Quantans Hill Wind Farm

Volume 1 -
EIAR Chapters 1-15

VATTENFALL

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PREFACE

An Environmental Impact Assessment Report (EIAR) has been prepared in support of an application submitted by Natural Power Consultants Limited (Natural Power) on behalf of the Applicant (Vattenfall Wind Power Ltd). The application seeks consent under Section 36 of the Electricity Act 1989 and the EIAR has been prepared in accordance with the Electricity Works (Environmental Impact Assessment) (Scotland) Amendment Regulations 2017. The application also seeks a direction under Section 57(2) of the Town and Country Planning (Scotland) Act 1997 as amended that planning permission for the development be deemed to be granted. This EIAR contains the information carried out for the Environmental Impact Assessment to develop a wind farm comprising of up to fourteen turbines and associated infrastructure (the Proposed Development). The Proposed Development is located in Dumfries and Galloway local authority areas.

The Electricity Works (Miscellaneous Temporary Modifications) (Coronavirus) (Scotland) Regulations 2020 ("the Temporary Regs") came into effect on 24 April 2020. These Regulations are temporary and were due to expire on 30 September 2020. However, these safeguards will now continue to be in place for the duration of the extension period, with the expiry date of the Scottish Acts by this Bill, to 30 September 2022.

Copies of the EIAR may also be obtained from Vattenfall Wind Power Ltd at a charge of £1,400 per hard copy. Copies of Non-Technical Summary and USB format of entire application are available free of charge upon request.

- **This is Volume 1 (Volume 1 of 4) of the EIAR.** This volume presents the 15 Chapters of the EIAR.
- Volume 2a of the EIAR presents the technical Figures associated with the EIAR Chapters except for Chapter 5 (Landscape & Visual Impact Assessment).
- Volume 2b of the EIAR presents the technical Figures associated with EIAR Chapter 5.
- Volume 2c of the EIAR presents the Visualisations produced for EIAR Chapters 5 and 9 (Landscape & Visual Impact Assessment and Cultural Heritage).
- Volume 3 of the EIAR presents the Technical Appendices associated with the EIAR Chapters.
- Volume 4 of the EIAR presents the Non-Technical Summary.

In addition to the EIAR, the application is also supplemented by accompanying documents including:

- Planning, Design & Access Statement,
- Pre-Application Consultation (PAC) Report.

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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

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Client Name	Vattenfall Wind Power Ltd

Issue	Date	Revision Details
A	24/09/2021	Client review
B	20/10/2021	Further review
C	10/12/2021	Released

Chapter 1

Introduction

Contents

Glossary

Term	Definition
Environmental Impact Assessment	Environmental Impact Assessment (EIA) is a means of carrying out, in a systematic way, an assessment of the likely significant environmental effects from a development.
Environmental Impact Assessment Regulations	The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (EIA Regulations)
Environmental Impact Assessment Report	A document reporting the findings of the EIA and produced in accordance with the EIA Regulations
The Proposed Development	The Quantans Hill Wind Farm development
The Proposed Development Area	The area within the “Site boundary” as illustrated on Figure 1.1 which the Proposed Development will be located

List of Abbreviations

Abbreviation	Description
Applicant	Vattenfall Wind Power Ltd, the Applicant
Natural Power	Natural Power Consultants Limited, the lead EIA Co-ordinator
ECU	Energy Consents Unit
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
LVIA	Landscape and Visual Impact Assessment
MW	Mega Watt

1.1 INTRODUCTION

1.1.1 This Environmental Impact Assessment Report (EIAR) has been prepared in support of an application submitted by Vattenfall Wind Power Ltd (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 Quantans Hill Wind Farm (the Proposed Development). The Applicant holds an electricity generation licence under section 6(1)(a) of the Electricity Act 1989.

1.1.2 The Proposed Development is located around Quantans Hill, in Dumfries and Galloway, northeast of the village of Carsphairn and east of the A713. It is situated on the predominantly southwest-facing slopes of hills at the southern base of Cairnsmore of Carsphairn (797m) such as Willieanna (431m) and Knockwhim (498m). The main tops situated within the Proposed Development area are Quantans Hill (338m) and Furmiston Craig (324m). The overall elevation range within the Proposed Development Area is from c.185m to 350m above sea level. The application site covers an area of approximately 1,800 hectares.

1.1.3 The Proposed Development is located to the north and east of the Water of Deugh, which is part of the Water of Ken/River Dee catchment. There are several tributaries of the Water of Deugh that rise within the Proposed Development including the Benloch Burn, which flows south-west, the Knockgray, Polhay/Marbrack and Furmiston Burns flowing generally south through the Proposed Development Area towards the Water of Deugh which is located just outside of the Proposed Development Area, to the south of the B729.

1.1.4 The Proposed Development is situated on land that is dominated by mixed livestock farming in unenclosed areas where sheep and cattle are allowed to wander and graze freely. Stocking levels and grazing management varies between the three landholdings that the Proposed Development is located within. The western area (Knockgray) is primarily used for year-round extensive sheep grazing, central area (Marbrack) is grazed by sheep year-round and cattle during the summer months and the eastern area (Furmiston) is grazed by sheep year-round.

1.1.5 The Proposed Development Area also contains several scattered areas of small spruce-dominated plantations used as shelter for stock, and a much older wood of mature conifer and broadleaved species at the eastern edge of the Proposed Development Area.

1.1.6 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 Dumfries & Galloway, 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 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: Site Selection and Design Evolution	Explains the site selection and the design evolution process that has resulted in the Proposed Development.
1	EIAR Chapter 3: Project Description	Provides a detailed description of the infrastructure associated with the Proposed Development.
1	EIAR Chapter 4: 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 Landscape and Visual Impacts of the Proposed Development including Residential Visual Amenity and Night-time effects.
1	EIAR Chapter 6: Ecology	Provides an assessment of the habitats and (non-avian) fauna present within the Proposed Development area and immediate surrounding environment.
1	EIAR Chapter 7: Ornithology	Provides an assessment of the potential effects upon avian species.
1	EIAR Chapter 8: Hydrology, Geology & Hydrogeology	Assesses the effects on the hydrological, geological and hydrogeological environment by the Proposed Development, including private water supplies and peat.
1	EIAR Chapter 9: Cultural Heritage	Provides an assessment of the potential effects of the Proposed Development upon cultural heritage assets.
1	EIAR Chapter 10: Noise	Provides an assessment of the potential noise effects of 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: 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 13: Other Effects	Provides an assessment of the potential effects upon aviation, Ministry of Defence (MoD) interests, communication operations and existing site infrastructure.
1	EIAR Chapter 14: Socioeconomics	Provides an assessment of the potential socioeconomic and tourism effects of the Proposed Development.
1	EIAR Chapter 15: Synergistic effects, Summary of Mitigation and Residual Effects	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.
2a	Figures	EIAR Figures except for LVIA
2b	Figures	LVIA Figures only
2c	Figures	LVIA and Cultural Heritage Visualisations

Volume	Heading	Description
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 A previous application for a 12 turbine development at Quantans Hill was made to the Scottish Government in January 2014 by E.ON Climate and Renewables UK Developments Limited, however the Applicant decided not to proceed with the application. This Proposed Development site boundary is larger than the previous development application but centres around the same area.

1.3.2 Figure 1.1 illustrates the site layout and location of the Proposed Development. It consists of up to 14 turbines and associated infrastructure. It is expected to have an operational period of up to 30-35 years. Figure 1.2 illustrates the site constraints associated with the Proposed Development.

1.3.3 The Proposed Development's generating capacity of renewable electricity will be between 86.8 to 92.4 MW subject to final wind turbine procurement, excluding battery storage. There is, potentially, up to 50MW of battery/energy storage capacity also proposed within the substation 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.

1.3.4 The Proposed Development may comprise of the following main elements:

- Up to 14 turbines
  - Turbine foundations
  - Crane pads
- Substations, control building and compound
- Potential for battery/energy storage infrastructure of up to 50MW
- 14.65km of new access tracks, with 31 watercourse crossings identified (watercourse crossings summarised in Appendix 8.1)
- Underground of electricity cables
- Anemometry mast
- Signage
- Temporary borrow pits
- Temporary construction and storage compounds, laydown areas and ancillary infrastructure
- Drainage and drainage attenuation measures (as required)

1.3.5 Habitat management will be undertaken within the Proposed Development Area. Whilst the land where turbines will be erected has been partially forested recently at the time of writing, further forest development has been consented and is expected to commence and as such forest felling and replanting may be undertaken to facilitate the Proposed Development. Both planting areas on or proposed on the Proposed Development Area comprise commercial forestry plantations.

1.3.6 Full details of the infrastructure associated with the Proposed Development is provided in EIAR Chapter 3. For the purpose of this EIA, turbines have been considered to be a maximum of up to 200m in height to blade tip.

1.3.7 A Scoping Report was submitted to the ECU on 26 June 2020. A copy of this can be found in Technical Appendix 1.1 of the EIAR. The full Scoping Opinion was received from the ECU on 14 October 2020 and is provided in Appendix 1.2 of the EIAR. It informs the scope of the EIA undertaken for the Proposed Development. The Scoping Opinion was used during the design evolution along with other assessments of the Proposed Development. As a result, the Proposed Development was amended reducing turbines from 21 to 14 and tip heights from 250m to 200m in height to blade tip. The ECU was informed of the changes from the original scoping layout via email and meetings.

1.4 THE APPLICANT

1.4.1 Vattenfall AB, the ultimate owner of Vattenfall Wind Power Ltd, is a leading European energy company with approximately 20,000 employees, owned by the Swedish state. For more than 100 years Vattenfall has powered industries, supplied energy to people's homes and modernised the way its customers live through innovation and cooperation.

1.4.2 Vattenfall has over 50 wind farms, onshore and offshore, across five countries and pioneered co-locating wind with solar and batteries. Vattenfall owns the largest onshore wind farm in England and Wales, Pen y Cymoedd, and in Scotland operates wind farms on the Isle of Skye and in Aberdeenshire. At a local level, Vattenfall developed the consented South Kyle wind farm, near Dalmellington, lying within both East Ayrshire and Dumfries and Galloway, which is currently under construction and due to begin commercial operation in Q1 2023.

1.4.3 Vattenfall aims to make fossil-free living possible within a generation and is leading the transition to a more sustainable energy system through growth in renewables and climate-smart energy solutions for its customers. Since 2008, Vattenfall has been in the UK investing over £3.5 billion in enough wind to power nearly a million British homes. The Applicant has the necessary knowledge and experience in renewable energy to develop the Proposed Development.

Table 1.1: Details of the Applicant

Applicant	
Vattenfall Wind Power Ltd	5th Floor 70, St Mary Axe, London, EC3A 8BE

1.5 EIA PROJECT TEAM

1.5.1 The Proposed Development has been designed by the Applicant in association with civil engineers RJ McLeod and Sweco and with input from its lead EIA consultants, Natural Power (Table 1.2) and the EIA chapter authors in an iterative way to minimise environmental effects as much as possible. 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 & Environment Department is accredited by the Institute of Environmental Management and Assessment. In addition, Natural Power also operates in formally accredited health and safety (IOSAS 18001), environmental (14001) and

quality (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, experienced consultant to co-ordinate and undertake EIA and to prepare the EIAR. Natural Power is headquartered approximately 16.1km 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. 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	
LVIA Review	
Natural Power Consultants Limited	The Green House, Forrest Estate, St John's Town of Dalry, DG7 3XS
Design	
Sweco UK Limited	Grove House, Mansion Gate Drive, Leeds, West Yorkshire, LS7 4DN
R.J McLeod	2411 London Road, Glasgow, G32 8XT
Cultural Heritage Assessment	
AOC Archaeology Group	Unit 7 St Margarets Business Centre, Moor Mead Road, Twickenham, TW1 1JS
Noise Assessment	
Hayes McKenzie Partnership Ltd	Unit 3, Oakridge Office Park, Whaddon, Salisbury, Wiltshire, SP5 3HT
Traffic and Transport Assessment	
Natural Power Consultants Limited	The Green House, Forrest Estate, St John's Town of Dalry, DG7 3XS
Aviation Assessment	
Aviatica	Aviatica, Reservoir House, Gladhouse, Midlothian, EH23 4TA
Forestry Assessment	
Neil McKay	Grange Farm, Tundergarth, Lockerbie, Scotland, DG11 2QG

Document history

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Client Details	
Contact	Matthew Bacon
Client Name	Vattenfall Wind Power Ltd

Issue	Date	Revision Details
B	07/10/2021	For client review
B4	28/10/2021	For legal review
C	08/12/2021	Final Draft
D	13/12/2021	Released
E	16/06/2022	Update and released

Chapter 2

Site Selection & Design Evolution

Contents

Glossary

Term	Definition
Environmental Impact Assessment	Environmental Impact Assessment (EIA) is a means of carrying out, in a systematic way, an assessment of the likely significant environmental effects from a development.
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Environmental Impact Assessment Report	A document reporting the findings of the EIA and produced in accordance with the EIA Regulations.
The Proposed Development	The Quantans Hill Wind Farm Project.
The Proposed Development Area	The area within the “Site boundary” as illustrated on Figure 1.1 in which the Proposed Development will be located.

Term	Definition
Developer	In the event of the Proposed Development being granted Section 36 Consent, this is the Company developing the Project.
Original Equipment Manufacturer	Producer of the plant/machinery

List of Abbreviations

Abbreviation	Description
Natural Power	Natural Power Consultants Limited
Applicant	Vattenfall Wind Power Ltd, the Applicant
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
AA	Appropriate Assessment
MW	Mega Watt
ECU	Energy Consents Unit
DGC	Dumfries & Galloway Council
LVIA	Landscape & Visual Impact Assessment
SM	Scheduled Monument
SAC	Special Area of Conservation
SNH	Scottish Natural Heritage (now NatureScot)
SSSI	Site of Special Scientific Interest
DGCAS	Dumfries and Galloway Council Archaeology Society
SPEN	Scottish Power Energy Network
PAN	Planning Advice Note
CFD	Computational Fluid Dynamics
RVAA	Residential Visual Amenity Assessment
SPA	Special Protection Areas
GWDTE	Groundwater Water Dependent Terrestrial Ecosystems
ECoW	Environmental Clerk of Works
SEPA	Scottish Environment Protection Agency
GIS	Geographic Information Systems
PAC	Pre-Application Consultation
T	Turbine

2.1 INTRODUCTION

2.1.1 The purpose of this Chapter is to identify the steps that have been considered in the site selection and design evolution of the proposed Quantans Hill Wind Farm (the Proposed Development). This Chapter demonstrates how the site design and the layout of the turbines evolved through the initial site selection process, identification of various constraints and site-specific factors, and highlights the key design criteria applied.

2.1.2 Planning Advice Note (PAN) 68: Design Statements explains the process of undertaking a design statement. Design and Access statements are a statutory requirement for all Major Developments in terms of Town and Country Planning legislation. Although not a statutory requirement for a Section 36 application, this Chapter nevertheless explains the design process which has been applied in arriving at the final layout. As a result, it also fulfils the requirement of Regulation 5(2)(d) of the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 to describe the alternatives considered.

2.1.3 As an electricity generation licence holder, it can be confirmed the Applicant has had regards to Schedule 9 duties and this is demonstrated through the appropriate design evolution principals set out in this Chapter. Mitigation of effects are set out in detail in the following chapters of the EIAR and collated and summarised in the concluding chapter.

2.2 THE SITE SELECTION PROCESS

2.2.1 The Applicant has a portfolio of sites across Scotland which it has investigated over time for wind energy potential. Some are not progressed whilst others make it all the way to application stage and are constructed following consent. Desk-based feasibility studies and site visits to the area in the vicinity of Quantans Hill were undertaken at an early stage. Results indicated that this site would be a technically and environmentally appropriate location to develop a wind farm. A scoping report was submitted to the Scottish Government in June 2020 by the Applicant. At this time, it was envisaged the wind farm would comprise of approximately 21 wind turbines up to 250 m in height to blade tip.

2.2.2 The overarching aim of the selection process was to have a layout that maximised the efficiency of the Proposed Development whilst limiting the potential environmental impacts. Factors influencing the suitability of the site included:

- Suitable wind speeds;
- Suitable separation distance from dwellings and settlements;
- Proximity to sensitive landscape and visual receptors;
- Reasonably close proximity to viable grid connection;
- Willing landowner(s);
- Potential to use existing infrastructure, as far as practical;
- A feasible route for transporting components to site by the public road network;
- Suitable land area to accommodate generating capacity and civil engineering requirements; and
- No significant environmental constraints preventing development.

2.2.3 The Proposed Development Area has also been assessed against several strategic constraints. Figure 1.1 of the EIAR illustrates the regional context of the Proposed Development.

2.2.4 Following the site selection, a feasibility assessment was carried out by the Applicant against the potential constraints detailed in this Chapter. The site feasibility assessment demonstrated the suitability of the site for wind farm development.

Policy Context

2.2.5 Scottish Planning Policy indicates that the Proposed Development is situated predominately within a Group 3 area; one with potential for wind farm development. Limited parts of the Proposed Development Area come under Group 2; areas of significant protection, due to high level mapping of carbon rich soils. A full review of legislation, national and local planning policy has been provided in Chapter 4: Climate Change, Legislative and Policy Context of the EIAR, and an assessment of such material is provided in the accompanying Planning, Design and Access Statement, as well as in the individual EIAR chapters. The iterative design process factored in such policy context, including, where practicable, avoiding Group 2 areas for example.

Wind Resource

2.2.6 Initial long-term wind resource estimates were derived from multiple sources including site measurements collected on the Proposed Development Area. An early estimate used within initial feasibility assessment of the long-term wind speeds across the Proposed Development Area is as follows:

2.2.7 Early indications for the Proposed Development are that the capacity factor may be ~ 40% for turbines up to 200 m to blade tip.

2.2.8 Although this value should be taken as indicative, they imply that the wind resource at the Proposed Development is comparatively good and has the potential to deliver an economically viable wind energy development.

2.2.9 Detailed assessments have been undertaken using state of the art Computational Fluid Dynamics (CFD) modelling in order to better understand the local wind regime. This has led to an improved understanding of the specific complex flow regime that results from the terrain and forestry surrounding the Proposed Development. The turbulence intensity, wind shear, inflow angle and veer across the site were assessed in order to inform the design process (along with all relevant physical, environmental and technical constraints). The process was undertaken iteratively in order to arrive at the appropriate number, size and location of turbines for the Proposed Development to minimise project risks (turbine performance / operational issues) and maximise project efficiency and energy yield output. A full anemometry monitoring campaign may be appropriate, using industry best practice monitoring techniques (combination of anemometer mast and LiDAR remote sensing) in order to capture detailed wind profiles and further refine the wind resource on site.

Grid Connection

2.2.10 Capacity in the network was acquired and a grid connection agreed with the network operator which led to progressing the project with Scoping in 2020. Capacity on the electricity grid for the Proposed Development has been secured.

2.2.11 The grid connection offer is, currently, connecting the project at the existing Holm Hill substation (also known as Kendoon North) approximately 6km west of the proposed development which National Grid indicate will be via an overhead line

2.2.12 Due to the changing nature of grid connections during planning, the method and exact route would be subject to a separate assessment undertaken by the network operator. It is anticipated that the connection would be subject to a separate application, prepared by the network operator, for consent under Section 37 of the Electricity Act 1989.

2.2.13 However, given the lack of nationally significant environmental designations and that the it is envisaged the overhead line route will follow (if not make use of) the proposed 132kV line that intersects[1] the Proposed Development Area it is considered the grid connection route to Holm Hill will be achievable without unacceptable environmental effects

2.2.14 The connection date is proposed in April 2027.

Access

2.2.1 An access study was carried out in 2020/21 to determine the feasibility of the proposed public access route from both the Port of Ayr and King George V Dock in Glasgow to the entrance of the Proposed Development Area using a candidate turbine with a c.85m blade length as a candidate model for the purposes of swept path analysis as the largest blade size under consideration therefore likely to present the 'worst case scenario' in terms of offsite access. The study assessed the delivery of wind turbine components and general construction traffic. The access study was used within the initial feasibility study of the Proposed Development and as a result deemed that the site had viable access from A713. As a potential alternative, the use of existing forestry roads and tracks built for other wind farms has also been identified and their use and upgrade will be further explored. The potential effects on transport and access are fully assessed in the EIAR and the results presented in Chapter 11: Traffic & Transport.

2.2.2 The Proposed Development's primary option for access to the Proposed Development Area is from the existing B729 road which leaves the A713, approximately 0.5km to the east of Carsphairn. These roads will be utilised and upgraded where necessary. In some cases, existing road improvements have been recently undertaken, or are proposed, for other developments including the South Kyle wind farm. A full assessment of the public road access is provided in Chapter 11: Traffic & Transport.

Land Use

2.2.3 The primary land use within the Proposed Development Area is sheep and cattle grazing, across large tracts of unenclosed moorland, marshy and semi-improved grassland and improved pasture fields at lower elevations. There are several small mixed woodland plantations scattered across the Proposed Development Area. The eastern edge of the Proposed Development Area borders an extensive area of commercial conifer plantation. The Proposed Development Area is intersected by a number of minor watercourses, many of which originate within the area, and flow into the Water of Deugh to the west and south. Detailed description of land use is included in Chapter 1: Introduction of the EIAR.

2.2.4 The land where the wind turbines will be developed is partially recently forested with further planting likely following recent grant of consent for another commercial forestry development.

2.2.5 Landowners have also been consulted during the EIA in particular with relation to establishing appropriate areas for habitat management.

2.2.6 Scottish Power Energy Networks (SPEN) have proposed an overhead transmission grid line which dissects the Proposed Development in order to serve the Lorg, Euchanhead, and Shepherd's Rig developments. The Applicant has consulted with SPEN throughout EIA to establish suitable locations and buffers for several turbines.

Proximity of Dwellings

2.2.7 The Proposed Development Area is rural and distant from large numbers of potential receptors. Twenty dwellings have been identified within 3 km of the Proposed Development as shown in Table 2.1.

[1] Public_Consultation_Leaflet.pdf (spenergynetworks.co.uk)

Table 2.1: Dwellings within 3 km of the nearest proposed turbine

Property	Distance to nearest turbine (km)	Turbine no.
Furmiston	0.7	14
Knockgray Cottage	0.9	10
Knockgray	0.7	10
Marbrack Cottage	0.8	11
Marbrack	0.8	11
Stables Cottage	1.0	10
Bridgend	1.6	4
Carsphairn	2.1	10
Liggat	1.6	10
Marbrae	1.1	10
Burnfoot	1.5	11
Old Burnfoot Cottage	1.5	11
Burniston	1.5	14
Kensglen	1.4	14
Nether Loskie	1.3	14
Marscalloch	1.6	14
Muirdrochwood	2.3	14
Smittons	3.0	13
Craigengillan	2.7	12
Moorbrock	2.6	3

Source: Appendix A5.5: Residential Visual Amenity Assessment

2.2.8 Potential effects on landscape and visual amenity, noise, and shadow flicker have been given consideration during the site design iterations to ensure minimised effects on nearby residents. A Residential Visual Amenity Assessment (RVAA) is detailed in Chapter 5: Landscape & Visual Assessment, a noise assessment is provided in Chapter 10: Noise. Shadow flicker is considered in Chapter 13: Other Effects of the EIAR.

Landscape and Visual

2.2.9 The effects on landscape and visual amenity were considered during the design development of the Proposed Development, as these were understood to be key to the progression of the project. Several sources of information were used at the time to inform the design process and are listed in Sections A5.2 and A5.4 of Appendix 5.1 of the EIAR.

2.2.10 Chartered Landscape Architects have worked closely with the project team from the outset, reviewing the siting and design of the wind turbines and associated infrastructure in order to minimise, as far as practical, the potential effects on landscape and visual amenity.

2.2.11 Consideration was also given to other wind farms that are operational, consented or currently in planning and the potential for cumulative effects.

Ecology and Ornithology

2.2.12 Desk-based studies indicated that there were no designated ecological or ornithological constraints such as Sites of Special Scientific Interest (SSSI), Special Protection Areas (SPA) or RAMSAR, within the Proposed Development Area. Baseline survey work indicated potential suitability for wind energy development, subject to further detailed assessment and survey data fed into the iterative design process. Potential effects upon ecology and ornithology are fully assessed in the EIA and the findings are presented in Chapter 6: Ecology and Chapter 7: Ornithology.

Hydrology, Geology and Hydrogeology

2.2.13 The general position of the Proposed Development Area is situated on the localised Water of Deugh hydrological networks and is part of the main Water of Ken and River Dee catchments. There are five main burns which supply these networks situated in and around the Proposed Development Area (Benloch Burn, Knockgray Burn, Furmiston Lane, Marbrack Burn and Polhay Burn).

2.2.14 As part of the hydrology assessment all watercourses shown on a 1:50,000 scale OS map were marked as a hard constraint from the outset and a 50 m buffer was applied to them to protect watercourses from disturbance and potential effects on water quality during construction and operation.

2.2.15 In the case of the Benloch Burn, which is identified as a drinking water protected area on account of the water abstraction owned by Scottish Water, a buffer distance of 100 m was applied to all watercourses and the site design has focused specifically on minimising construction activities in this catchment as far as possible.

2.2.16 Desk-based surveys indicated potential for carbon rich soils and deep peat which were corroborated through on-site hydrological and geotechnical surveys. The results of these surveys were used to avoid sensitive areas (where practical) through the design evolution. Ground Water Dependant Terrestrial Ecosystems (GWDTE) were also identified and avoided where possible. A detailed assessment of hydrological elements is provided in Chapter 8: Hydrology, Geology & Hydrogeology, with details on GWTDE presented in Chapter 6: Ecology.

2.2.17 The Applicant has sought to minimise the potential impacts on peat through an iterative design process, optimising the distribution and orientation of the proposed infrastructure following the completion of each phase of surveying.

2.2.18 Where the results of detailed design indicate that micro-siting within the allocated micro-siting distance could achieve a reduction in the requirement for peat excavation, this would be investigated by the Principal Contractor and where possible, implemented following approval with the Environmental Clerk of Works (ECoW), Dumfries & Galloway Council (DGC) and the Scottish Environment Protection Agency (SEPA).

2.2.19

Cultural Heritage

2.2.20 During feasibility studies it was noted that The Proposed Development lies within an area of known archaeological remains dating from the prehistoric period to the Second World War, including six Scheduled Monuments which lie within 2.5km; Craigengillan Cairn (SM2238); Stroanfreggan Craig Fort (SM1095), Cairn Avel (SM1006), the Braidenoch Hill Cross Slabs (SM1105), the Holm of Daltallochan, Stone Circle and Standing Stone (SM1029) and Cross Slab (SM1106). A selection of non-designated assets, a number of which are considered by DGCAS to be nationally important, are also located within the vicinity of the site and required consideration. A baseline survey was undertaken which identified cultural heritage assets in the Proposed Development Area. These were accounted for during the design evolution and direct effects thus avoided. A full cultural heritage assessment is provided in Chapter 9: Cultural Heritage.

Existing Infrastructure and Aviation

2.2.21 The presence of existing infrastructure such as service pipes and cables, TV transmission, mobile telephone networks and electromagnetic paths were considered. Geographic information systems (GIS) data used within the initial feasibility study indicated there was existing infrastructure within the Proposed Development Area. Full details are provided in Chapter 13: Other Effects

Public Right of Way and Core Paths

2.2.22 There is a Public Right of Way that traverses the site but does not appear to physically exist on site. Nonetheless, a safe passage across the site will be maintained and was given a 'topple height' distance buffer during the design process. A core path travels through the Proposed Development Area that needed to be accounted for in design. More details are provided in Chapter 13 – Other effects

2.3 DESIGN EVOLUTION

2.3.1 This section describes the design alternatives of the Proposed Development and discusses how the site design and layout continued to evolve throughout the EIA process. The layout of the Proposed Development was designed under the guidance, requirements and considerations of the Applicant, contributions from Natural Power and from other contributing specialist consultants such as cultural heritage, aviation and transport advisors. The site design process was also guided by the findings of the baseline surveys, by the opinions of the specialist consultants and by issues raised by statutory and non-statutory consultees in line with Scottish Planning Policy. Many of site constraints identified during the process and taken into account for the design evolution are illustrated in Figure 1.3.

2.3.2 The Applicant's aim throughout the design evolution has been to balance the need to decarbonise homes, businesses and transport with the aspirations of local communities, and to protect wildlife and natural habitats

2.3.3 Local feedback and detailed environmental studies throughout the EIA process have input into the design evolution and helped refine the project design.

Scoping (2020)

2.3.4 In 2020 a layout representing what was likely to provide the most benefit in terms of electricity generation, climate mitigation, net biodiversity gain, supply chain, and community benefit, and be the 'greatest extent' with regard to potential adverse environmental effects was prepared. This comprised the largest extent of land and the tallest and greatest number of turbines which was expected to be put forward an application for consent resulting in an initial proposal for 21 turbines at up to 250 m in tip height, see Diagram 2.1 below.

Source: Natural Power

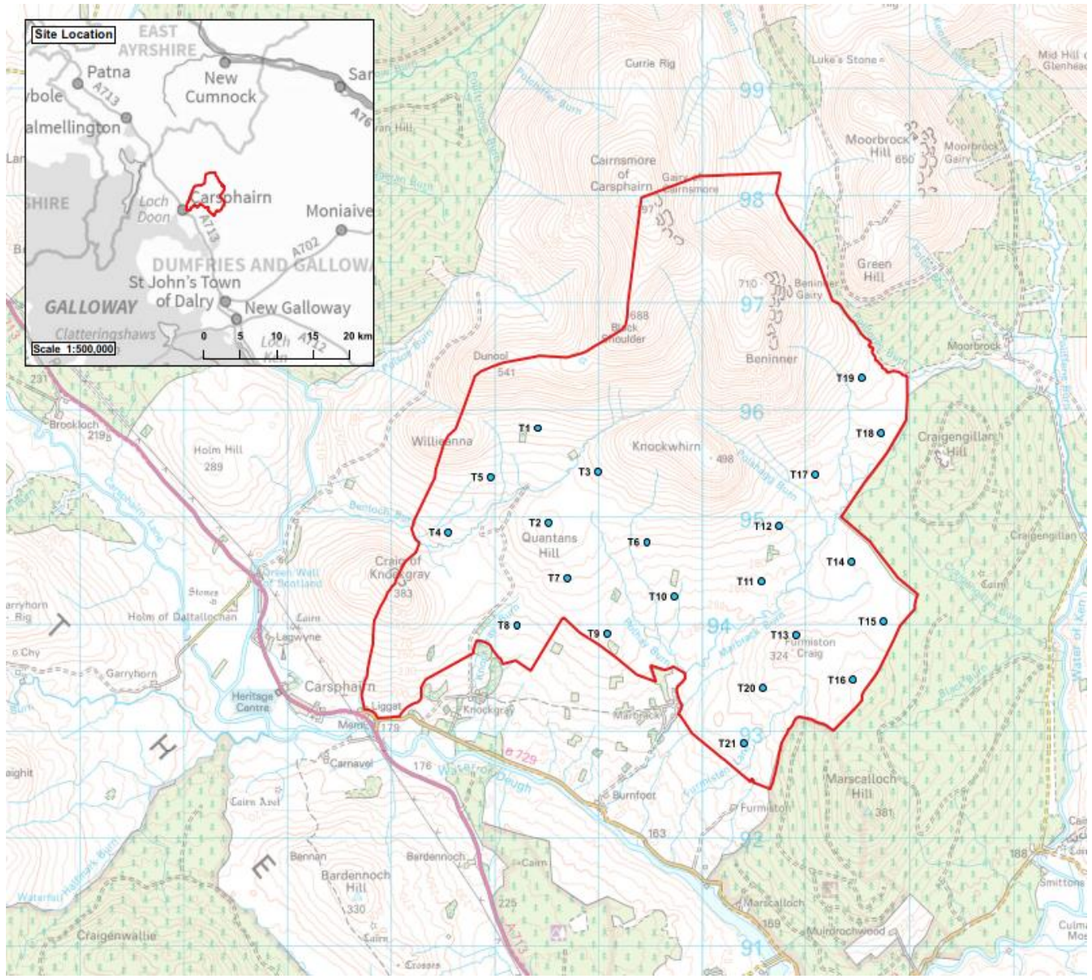

Diagram 2.1: Scoping (2020) (not to scale)

2.3.5 The layout was based predominately on desk-based reviews and baseline ecology and ornithology surveys. A Scoping Report was prepared and issued to consultees via the ECU for responses. Several representations in response to the consultation on the Scoping Report were received by the Applicant. This consultation helped identify and clarify key issues, promoted dialogue with both consultees and other stakeholders, and confirmed methods for survey, evaluation and assessment going forward. The consultee responses were reviewed in partnership with the specialist sub-consultants in order to make sure all relevant issues identified were assessed as part of the site survey work and were subsequently included in draft copies of relevant EIAR chapters.

Design Chill

2.3.6 A design chill was arrived at in the first quarter of 2021 between the Applicant and consultants from relevant departments of expertise including landscape, planning, ecology, ornithology, hydrology, wind, and construction design to amend the layout following responses from scoping and collection of more site data including phase 1 peat. The resultant layout from this workshop is presented in Diagram 2.2.

Source: Natural Power

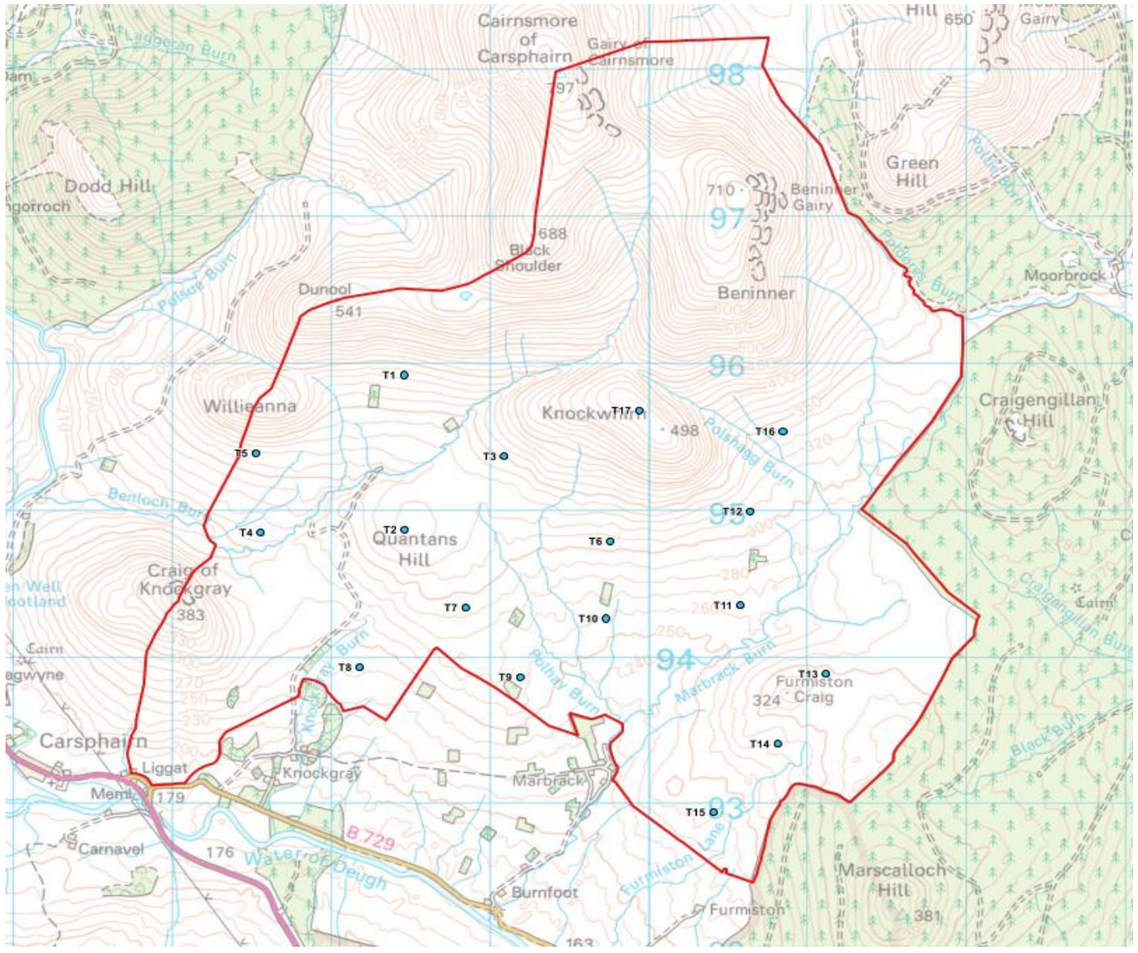

Diagram 2.2: Design Chill (not to scale)

2.3.7 Following scoping feedback from local residents and consultees, the overall scale of the project was significantly reduced:

- Turbine numbers were reduced from 21 to 17; and
- Turbine size, or tip height, has been reduced from 250m to up to 200m – 20% lower

2.3.8 This reduction in scale reduced the overall visual impact in the local area and has also allowed the Proposed Development to avoid encroaching into the more sensitive Upper Dale landscape character unit, although it has come at the cost of additional generation of renewable electricity through reducing access to faster and more consistent windspeeds and reducing the impacts of turbulence and other factors caused by wind passing over forestry and topographical features.

2.3.9 Following preliminary noise assessment, turbines (T) 19, 18, 15 and 16 were removed for cumulative noise reasons.

2.3.10 Turbine 14 was moved due to bog/peat/waders in the area to minimise the impact on these species.

2.3.11 Ground conditions, ornithology, ecology, LVIA, and wind yield were all residual risks to investigate further and amend the layout as required, including phase 2 peat surveys, and cultural heritage baseline survey.

2.3.12 T17 was highlighted as a potential issue due to its higher elevation in relation to the other turbines and was subsequently removed despite excellent wind yield, see Diagram 2.3.

Source: Natural Power

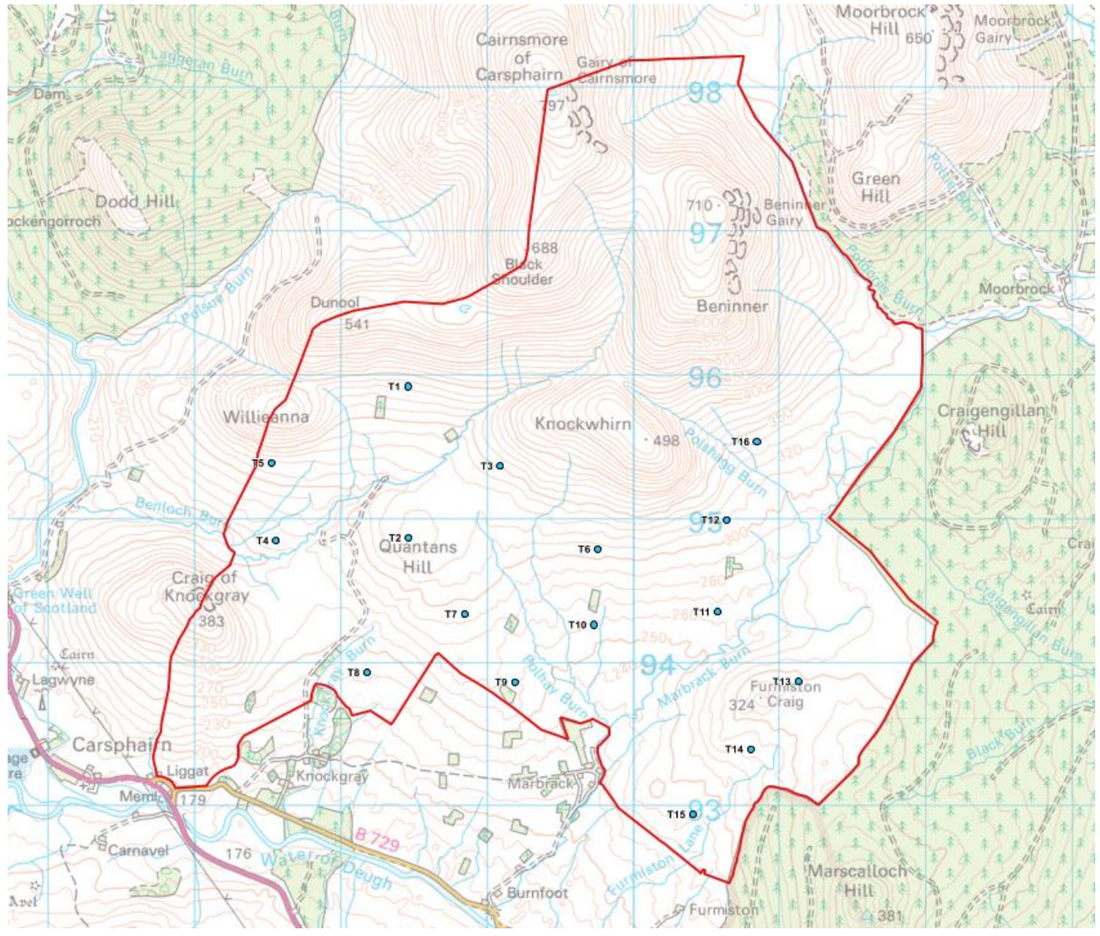

Diagram 2.3: Design Chill (not to scale)

Design Workshop

2.3.13 A design workshop was undertaken in March 2021 following completion of cultural heritage baseline surveys, noise modelling, hydrological surveys, and landscape and visual review. The resulting layout identified 14 turbines still at up to 200 m in tip height. Several turbines saw potential risks for GWDTE and were within potential watercourse buffers. Some slope and constructability concerns remained for T13. T1 and T16 were removed due to wind resource considerations at each location, with T1 also posing potential risks for the Benloch Burn catchment. Further landscape and visual analysis, wind yield analysis, hydrology surveys and phase 2 peat survey work were also required.

Source: Natural Power

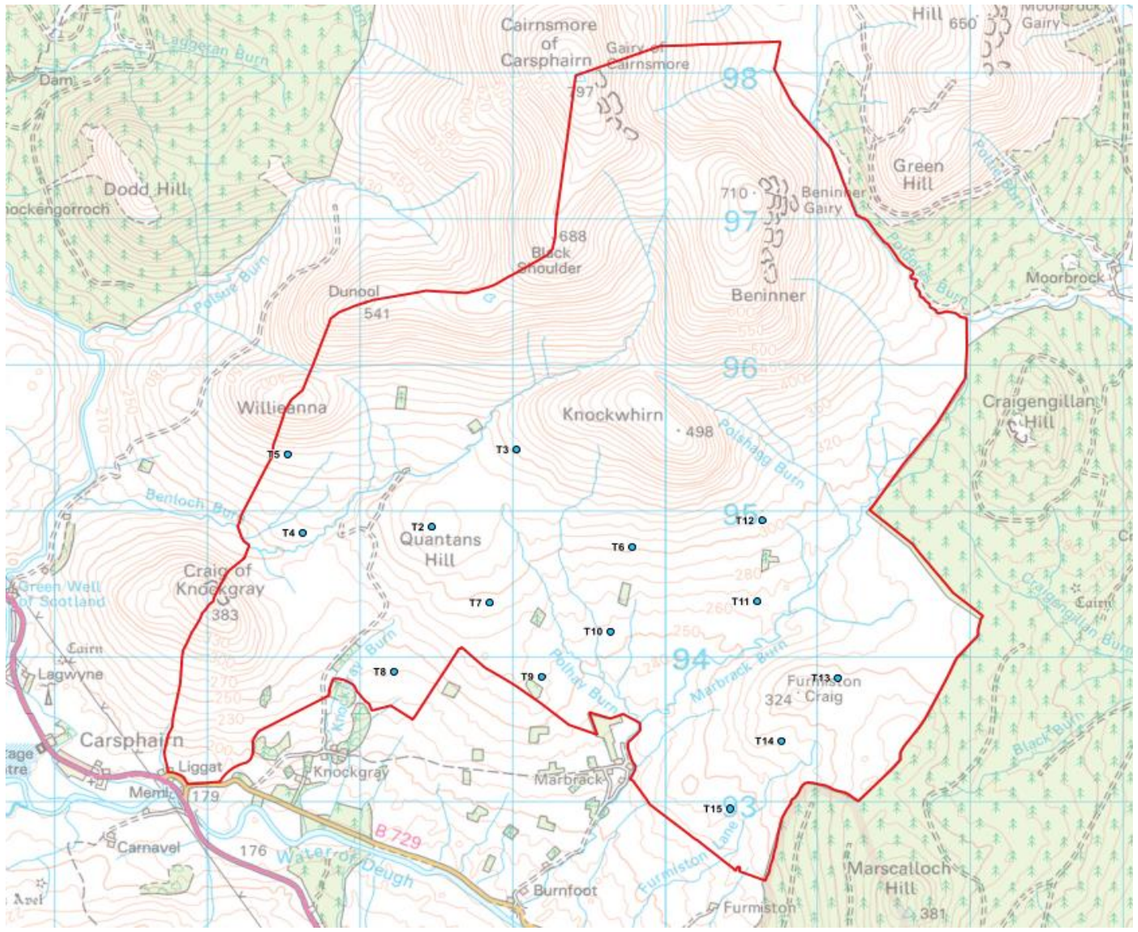

Diagram 2.4: Design Workshop (not to scale)

Turbine Design Freeze

2.3.14 Further refining of turbine locations was undertaken in a balancing act between competing LVIA and wind resource interests as well as ground conditions, particularly peat and GWDTE. T5, T9, T12, T13 and T14 were moved to improve turbine spacing and avoid surface site constraints.

2.3.15 Additional targeted peat surveys resulted in the repositioning of infrastructure to avoid peat are as follows:

- Repositioning of T13 to avoid a pocket of deeper peat to the southeast of the proposed location;
- Repositioning of T11 to avoid a pocket of deeper peat to the northeast of the proposed location;
- Repositioning of T12 to avoid a pocket of deeper peat to the east of the proposed location;
- And avoidance of an area of deep peat on the interfluve between the Benloch Burn and Knockgray Burn catchment, east of Craig of Knockgray.

2.3.16 The resultant layout is shown in Diagram 2.5. This design resulted in a 'frozen' turbine layout, i.e. one whereby the turbines would not be further moved such that assessments for landscape and visual impacts could be further progressed. This layout was also consulted upon with the public and full details of pre-application consultation process are provided in the PAC Report.

Source: Natural Power

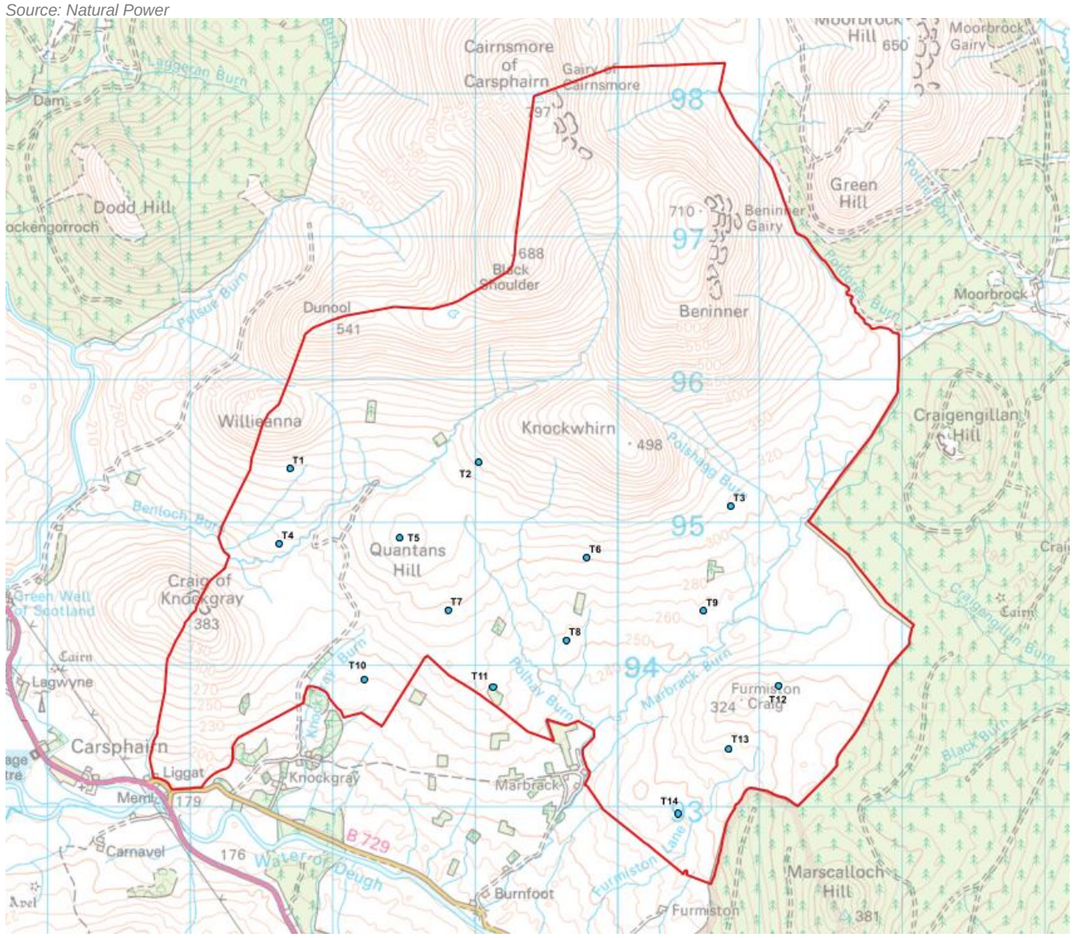

Diagram 2.5: Final Design Workshop – Turbine Design Freeze (not to scale)

Application Layout

2.3.17 Following turbine freeze, essential infrastructure for the Proposed Development was refined. Extensive work was carried out to minimise environmental impacts including the track layout to turbine foundations whilst keeping careful consideration to technical constraints regarding track width and slope.

Source: Natural Power

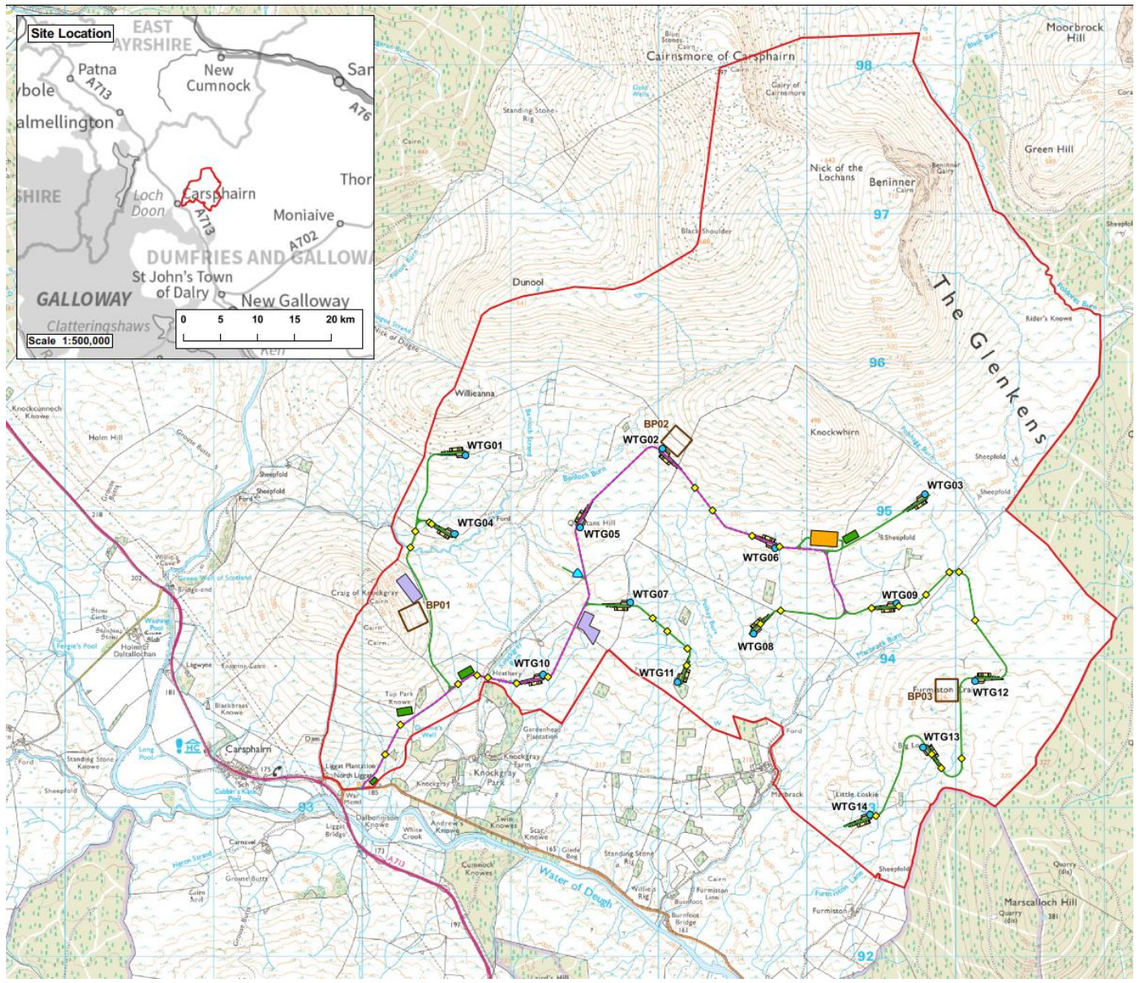

Diagram 2.6: Application layout (not to scale) See also Figure 1.1 in Volume 2a

2.3.18 Protection of watercourses and GWDTE were prioritised which required repositioning turbine locations and access tracks to limit infrastructure on water crossings and increase the buffer distances surrounding water courses. Due to the sensitivity surrounding the Benloch Burn water intake, the track to Turbines 1 and 4 was repositioned to approach from the southwest alongside the Craig of Knockgray rather than north from T2 removing risks to water intake.

2.3.19 On several occasions, access tracks were moved to avoid peat pockets reducing environmental impacts of construction on carbon rich soils. Furthermore, construction and infrastructure were avoided on very wet land to avoid risk of increased pollution runoff to the surrounding environment.

2.3.20 Temporary Construction Compounds were also included. Site tracks were included following Design Construction 2-D and 3-D design work. Proposed Borrow Pit Search Areas, including temporary tracks to access them, and existing Borrow Pits were included.

2.3.21 The final design iteration involved the substation location being moved to minimise visual impact to Marbrack cottage.

2.3.22 In order for the Applicant to continue to monitor wind conditions and turbine performance during the operational phase of the project, permanent anemometer masts and their tracks were added to the Proposed Development Area, taking account of the site constraints and preferential areas for recording wind data. The layout for the Proposed Development is presented to scale in Figure 1.1 (Chapter 1 'Site Layout and Location) and shown not to scale in Diagram 2.6. It is this final layout for which the resultant EIA has focussed on to determine potential effects of the Proposed Development, whilst also taking account of embedded mitigation, discussed in relevant EIAR Chapters.

2.4 SUMMARY

2.4.1 The design changes have resulted from two key elements of the EIA process:

- The Applicant listening to the feedback that is coming out of their ongoing consultations with both the local community and technical consultees; and
- The environmental surveys and baseline data collection that have been undertaken and the professional advice of consultants on the data's interpretation.

2.4.2 The Proposed Development has been located in a suitable area for wind farm development following a lengthy site selection and feasibility process. Through balancing the various site constraints with the scale of development required to be economically viable, the Applicant believes that the Proposed Development provides optimum use of the site with respect to the potential renewable electricity generating capacity balanced against the potential environmental and other effects.

VATTENFALL

Document history

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Client Details	
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A	27/09/2021	draft for client review
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C	14/12/2021	Released

Chapter 3

Project Description

Contents

Glossary

Term	Definition
Environmental Impact Assessment	Environmental Impact Assessment (EIA) is a means of carrying out, in a systematic way, an assessment of the likely significant environmental effects from a development.
Environmental Impact Assessment Regulations	The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (EIA Regulations).
Environmental Impact Assessment Report	A document reporting the findings of the EIA and produced in accordance with the EIA Regulations.
The Proposed Development	The Quantans Hill Wind Farm Project.
The Proposed Development Area	The area within the “Site boundary” as illustrated on Figure 1.1 in which the Proposed Development will be located.
Developer	In the event of the Proposed Development being granted Section 36 Consent, this is the Company developing the Project.
Original Equipment Manufacturer	Producer of the plant/machinery

List of Abbreviations

Abbreviation	Description
AOD	Above Ordnance Datum
Applicant	Vattenfall Wind Power Ltd, the Applicant
CEMP	Construction Environmental Management Plan
CMS	Construction Method Statement
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
SEPA	Scottish Environmental Protection Agency
ECoW	Environmental Clerk of Works
PMO	Planning Monitoring Officer
ACoW	Archaeological Clerk of Works
CAA	Civil Aviation Authority
SCADA	Supervisory Control and Data Acquisition
BESS	Battery energy storage structure
SF6	Sulphur hexafluoride
TC	Temporary Construction
SuDS	Sustainable Drainage System
COSHH	Control of Substances Hazardous to Health
HSE	Health and Safety Executive
O&M	Operations and Maintenance

3.1 INTRODUCTION

3.1.1 This chapter of the EIAR outlines the details of the Proposed Development as specified in the application, including indicative specifications of turbines, access tracks and electrical infrastructure. It also describes the general construction methodology, projected construction timescales and typical construction equipment likely to be used. Operational and decommissioning phases are also described within this chapter.

3.1.2 The construction methods detailed below build on best practice methodologies developed at other wind farms to comply with Health and Safety requirements for construction operations and follow relevant guidelines including but not limited to Construction (Design and Management) Regulations 2015, SEPA's Pollution Prevention Guidelines, and the joint publication of Good Practice during Wind Farm Construction.

3.2 SITE LOCATION AND DESCRIPTION

3.2.1 Figure 1.1 shows the location and layout of the Proposed Development. The Proposed Development is located around Quantans Hill, in Dumfries and Galloway, northeast of the village of Carsphairn and east of the A713. It is situated on the predominantly southwest-facing slopes of hills at the southern base of Cairnsmore of Carsphairn (797m) such as Willieanna (431m) and Knockwhim (498m). The main tops situated within the Proposed Development Area are Quantans Hill (338m) and Furmiston Craig (324m). The overall elevation range within the Proposed Development Area is from c.185m to 350m above sea level and covers an area of approximately 1,800 hectares.

3.2.2 The Proposed Development may include:

- Up to 14 wind turbines
- Turbine foundations
- External transformer housing
- Crane pads
- Substation, control building and compound
- Battery/energy storage infrastructure
- Upgraded and new access tracks, including a public footpath
- Underground/ overhead cables
- Anemometry mast
- Signage
- Temporary borrow pits
- Temporary batching plant area(s)
- Temporary construction and storage compounds, laydown areas and ancillary infrastructure
- Drainage and drainage attenuation measures (as required).

3.2.3 Habitat management would be undertaken in the Proposed Development Area. Some of the land where turbines would be erected has been recently planted with forestry and further forest development has been consented, although not yet commenced at the time of writing, and as such forest felling and replanting may be undertaken to facilitate the Proposed Development.

3.2.4 The Proposed Development is expected to operate for up to 35 years following which decommissioning of the turbines and other infrastructure would be undertaken as required.

3.2.5 After detailed design iterations it was considered that the Proposed Development provides a reasonable and proportionate balance between optimising efficient wind capture to ensure economic viability and a meaningful contribution towards renewable energy targets (in the context of "net zero") whilst for the most part safeguarding against potential adverse environmental effects. Chapter 2 provides further details of the process that resulted in the final project design and layout.

Site Layout

3.2.6 The Proposed Development's layout is presented in Figure 1.1. Micrositing allows the exact turbine location 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 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 turbines and associated infrastructure. Table 3.1 gives the centre point location and proposed maximum tip height for each of the proposed turbines.

Table 3.1: Turbine Locations

Turbine ID	Easting	Northing
1	258470.7	594885.6
2	259026.1	595416.1
3	257623.6	594845.1
4	257699.0	595372.0
5	259785.0	594748.5
6	258810.6	594380.3
7	258221.7	593893.2
8	259127.2	593842.3
9	259642.3	594169.2
10	260606.8	594374.4
11	260797.0	595109.0
12	261134.6	593850.7
13	260784.8	593403.9
14	260426.4	592953.0

Source: Natural Power

3.2.7 Indicative drawings for currently available technologies that suit site conditions are presented in Figure 3.1 – 3.10 of this EIAR. For the purpose of assessment, a maximum turbine height of up to 200 m to tip has been used. Where necessary for assessment purposes a maximum rotor blade diameter of up to 170 m has been used although the rotor length may be less depending on blade availability at the time of construction.

Public Road Access

3.2.8 The Proposed Development's primary option for abnormal load access to the Proposed Development Area is from the existing B729 road which leaves the A713, approximately 0.5km to the east of Carsphairn. These roads would be utilised and upgraded where necessary. An assessment of the public road access is provided in Chapter 11: Traffic & Transport.

Private Access

3.2.9 Upon leaving B729, the primary option for access to the Proposed Development is through new access tracks. As a result, a new site access junction would be required to facilitate construction traffic and component deliveries.

Assessment of utilising this route is provided in Chapter 11: Traffic & Transport and the potential environmental and forestry effects are also assessed in Chapters 6: Ecology, 8: Hydrology and 12: Forestry.

Felling

3.2.10 As noted earlier, the land where the wind turbines would be developed is partially newly forested with further planting possible. As a result, felling of immature commercial forestry would be required, which is likely to take place well in advance of prior planned felling dates. An updated forestry design plan including assessment of the felling and proposed arrangements are provided in Chapter 12: Forestry.

3.2.11 The wind farm felling programme 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. Typically, a minimum area of about 3.14 ha (equivalent to a 200 metre diameter circle) would be required to be felled for each turbine; a 30 m buffer around each item of infrastructure, in addition to the area required for the infrastructure; and a 100 m corridor for access roads. **NOTE:** Pre construction Geotechnical Investigation would require felling pre-commencement. This requirement is included in total felling allowance.

3.2.12 Much of the felled areas can be replanted upon completion of the construction, only leaving felled areas to allow the safe operation and maintenance of the Proposed Development for its lifetime.

3.2.13 Full details of the forestry felling, restocking and forest management practices are provided in Chapter 12: Forestry, of the EIAR.

3.3 CONSTRUCTION

Construction Method Statement

3.3.1 Prior to the commencement of construction, a CEMP/CMS 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 Chapter 8: Hydrology of the EIAR for more details of a draft CEMP). The CEMP/CMS would be secured by planning condition and ensure that construction activities are carried out safely, in accordance with best practice and the relevant guidelines[1], and to minimise environmental impact, in accordance with SEPA's pollution prevention guidance. The CEMP/CMS would cover the following topics:

- Site Health and Safety Plan
- Method Statements and Risk Assessments to include for environmental considerations e.g. sympathetic construction methodology with regard to weather and ground conditions.
- Location and Description of Project
- Consent and Regulation Approvals e.g. discharge of planning conditions
- Pre-construction Survey Work Undertaken
- Turbine Description/Specification
- Construction Schedule
- Public Highway Works
- Site Tracks
- Temporary Construction Compound
- Crane Pads
- Cable Trenches
- Foundation Works
- On-site Substation and Control Building
- Borrow Pits
- Monitoring - Ecological, Hydrological and Geotechnical and Archaeology
- Emergency Procedures

3.3.2 A Site Waste Management Plan would be drawn up as part of the CMS/CEMP prior to the commencement of construction.

3.3.3 Previous experience of agreeing the construction methodology during the post-consent/pre-construction stage has proved effective in securing accurate and realistic method statements. At this stage in the project, additional data would be available in the form of detailed site investigations. Furthermore, the civil engineering contractor and the turbine supply contractor would have been chosen, enabling more detailed preparation of individual method statements. During the preparation of the CMS/CEMP correspondence and meetings with NatureScot, SEPA, the planning authorities and other relevant consultees would be undertaken to review the working methods proposed and if necessary, incorporate changes. This iterative process of preparing the CMS/CEMP ensures that when construction commences there is a robust process for ensuring that the construction effects associated with the Proposed Development are effectively managed and mitigated against where reasonably practicable. This makes monitoring of the construction activities, either by the appointed site representative or by the various bodies associated with the preparation of the document more effective.

3.3.4 Each section of the CMS/CEMP would provide a detailed description of the tasks to be completed along with risk assessments, where necessary, covering items such as waste management, pollution prevention, control of waters, nuisance and material use.

3.3.5 A section of the CMS/CEMP (Peat Management Plan) regarding the handling and storage of peat would be prepared in accordance with recommendations from a suitably qualified geotechnical designer, ecologist and hydrologist following a detailed site investigation. Peat slide risk assessment works have been carried out to provide input to the layout design and the results show that, through geotechnical risk management, strict construction management and implementation of relevant control measures, the risk of peat failure across the site shall be reduced to negligible levels. Additional detailed ground investigation would be conducted prior to construction. In respect of matters regarding construction methodology and peat stability at the site, the following general recommendations would be adhered to and would form part of the overall CMS/CEMP documentation:

3.3.6 Environmental awareness training would be provided to all staff entering on to the site; this would include a basic environmental site induction covering the following measures:

- Avoid placing excavated material and local concentrated loads on peat slopes.
- Avoid uncontrolled concentrated water discharge onto peat slopes identified as being unsuitable for such discharge.
- Avoid unstable excavations. All excavations would be suitably supported to prevent collapse and development of tension cracks.
- Avoid placing fill and excavations in the vicinity of steeper slopes.
- During construction install and regularly monitor geotechnical instrumentation as appropriate, in areas of possible poor ground such as deeper peat deposits.
- Implement site reporting procedures to ensure that working practices are suitable for the encountered ground conditions. Ground conditions are to be assessed by a suitably experienced geotechnical engineer.
- Form a contingency plan to detail the level of response to observed poor ground conditions.

[1] Good Practice during Wind Farm Construction. (Version 4, 2019) Scottish Renewables, SNH, SEPA, FCS and HES. Available online from: https://www.nature.scot/guidance-good-practice-during-wind-farm-construction (last accessed 18/01/2021)

- Routinely inspect the wind farm site by maintenance personnel including an assessment of ground stability conditions.
- Carry out an annual inspection of the site following completion of works by suitably experienced and qualified geotechnical personnel.
- Maintain stored peat in a suitable condition to minimise the peat drying out.
- Minimise the need to handle stored peat so as to reduce any drying or changes to the peat.
- Re-use of peat (both acrotelmic and catotelmic) as close to extracted area as possible
- Maintain all surplus peat (both acrotelmic and catotelmic) on site

3.3.7 NatureScot's online carbon/peatland map indicates the Proposed Development Area has a range of Class 1 – Class 5 soils including priority peatland habitat[2]. The layout of the site infrastructure has taken peat into account and avoided areas of priority peatland habitat where practicably possible. Phase 1 and 2 peat surveys have been completed for the Proposed Development which indicate an average peat depth of 0.39 m. Further details are provided in Chapter 8: Hydrology. Construction procedures would follow best practice guidelines in order to ensure that areas of priority peatland habitat are protected.

3.3.8 Other sections relating to site-specific items including landslide hazard and the geotechnical risk register, identified during the pre-construction phase, would form part of the CMS/CEMP. It is intended that the CMS/CEMP would be an evolving document and staged completion of the document would be undertaken in line with the progression of construction. Updating of the document to reflect changes in the methods to be used would also be carried out, where necessary.

Wind Farm Construction and Reinstatement Techniques

3.3.9 Construction of the Proposed Development would begin within a defined time period following consent granted by the Scottish Government. The Applicant seeks a 5-year period for implementation of the consent. This is necessary to allow time for the discharge of conditions and procure the turbine equipment and associated infrastructure delivery.

3.3.10 This chapter summarises the construction phase and the general order of on-site activities is presented in Table 3.2. These items generally follow chronologically but some items would run concurrently.

Table 3.2: Construction Elements

Construction Elements
Forestry felling
Mobilisation of civil and electrical contractor
Site Investigation
Construction and upgrades to access and site tracks
Excavation and construction of turbine foundations
On-site cabling
Construction of the substation control building
Preparation of crane pads
Installation of turbine transformers
Mobilisation of turbine supply contractor
Turbine delivery
Turbine erection
Reinstatement around turbines
Turbine fit-out
Connection to substation and grid connection
Commissioning of wind farm
Reliability testing
Demobilisation

3.3.11 Table 3.2 represents a simplified process of the different construction elements. It should be noted that there would be a degree of overlap between individual elements. It should also be noted that these elements relate to permanent infrastructure. Some temporary works are also required during the construction phase, such as borrow pits, batching plant areas, temporary hardstanding areas for crane components, pads for supporting the rotors during construction in addition to the permanent crane pads or drainage measures in turbine excavations.

3.3.12 Technical Appendix 11.1 provides indicative details for associated construction traffic and abnormal indivisible loads. An indicative construction timetable is also provided based on an 18-month construction programme.

ECoW

3.3.13 A suitably qualified independent ECoW would be appointed to undertake pre-construction surveys, monitor the construction activities and report to both the Developer and LPA of any incidences. The ECoW would liaise closely with the Developer, providing expert advice to help rectify any potential environmental matters that arise during the construction phase.

PMO

3.3.14 A PMO would be appointed to undertake site surveys, monitor the construction activities, monitor compliance of development with the planning requirements of its consent during construction and report to both the Developer and LPA of any incidences. The PMO would liaise closely with the Developer, providing expertise to help rectify any potential planning issues that arise.

ACoW

3.3.15 An independent qualified ACoW would be appointed to undertake pre-construction archaeological surveys, monitor the construction activities in relation to any sites of Cultural Heritage significance and report to both the Developer and LPA of any findings or incidences. The ACoW would liaise closely with the Developer, providing expert advice to help mitigate any potential harm to Cultural Heritage sites that could arise during the construction phase.

3.4 INFRASTRUCTURE

3.4.1 As explained above, a CMS/CEMP would detail the final construction methods for infrastructure. Below is a high-level overview including reference to relevant diagrams submitted with the application. For the purposes of carrying out the assessments on construction activities in the EIAR, the reasonable worst-case scenario has been adopted.

Wind Turbines

3.4.2 The eventual turbines procured for construction and operation would be of a modern design with three blades mounted on a horizontal axis, attached to a nacelle. The nacelle would be mounted on a tubular tower which allows

[2] Available online: https://map.environment.gov.scot/Soil_maps/?layer=10 (last accessed 16/08/2021)

access to the nacelle. It is expected that the turbine cut-in wind speed would be around 3 m/s and would rotate clockwise. The specific turbine model has not yet been selected but to inform modelling and assessment a turbine with maximum 200 m tip height with up to 170 m rotor diameter and a hub height of around 115 m with up to 6.6 MW generating capacity has been assumed. An indicative drawing of the proposed turbine is presented in Figure 3.1.

3.4.3 Chapter 13: Infrastructure & Aviation provides details of a lighting scheme proposed for the turbines which has been consulted with the CAA.

Construction including External Transformers and Foundations

3.4.4 This section describes the construction of the wind turbines including external transformers, foundations and crane pads.

3.4.5 Wind turbine towers would likely be pre-fabricated off site in three sections and made from steel and the blades from fibreglass. It is proposed that the turbine tower, nacelle and blades be finished in a semi-matt, off-white/pale grey colour. In order to comply with Health and Safety requirements for the site it would be appropriate to apply identification numbers to the sides of the turbine towers. Numbers would be up to 1000 mm tall by 900 mm wide and would be positioned between 1.5 m and 3 m from ground level in order to be visible from the approaching access track. Details of these would be agreed as part of the CMS.

3.4.6 External transformer housing(s) would be situated adjacent to each of the turbine towers. The requirement for such structures, along with their dimensions, would vary based on the final turbine choice (some turbine types require two stacked transformer housings). The transformer is likely to be internal to the turbine structure however an indicative design for a typical external transformer housing is included in Figure 3.1.

3.4.7 The Applicant is aware of increasing options being brought forward by suppliers to replace SF6 as insulation in HV switchgear. It is the Applicant's ambition to adopt new insulation technologies for high voltage breakers to avoid the use of SF6.

3.4.8 Reinforced concrete foundations would be created in the ground on which the turbine towers would be bolted. An indicative drawing of a turbine foundation is presented in Figure 3.2. Depending on the height of the water table at the foundation location, a drainage system may be installed around the foundation to prevent the build-up of water pressure under the foundation. Alternatively, in locations that are particularly sensitive to hydrological disturbance, a submerged foundation design could be employed which would not require a drainage system around the foundation.

3.4.9 Cement entering a watercourse can have a detrimental effect by drawing oxygen from the water and increasing its alkalinity. If an on-site batching plant is required it would be situated away from water courses, either within a borrow pit or at another secure location which would be agreed in advance with SEPA and Scottish Water prior to construction. Please refer to proposed layout for proposed location(s) (an indicative diagram of a typical batching plant is shown in Figure 3.10). Particular care would be taken pouring concrete at turbine foundations in the vicinity of watercourses and in areas of deeper peat (see also Chapter 8: Hydrology). SEPA's Pollution Prevention Guidelines would be adhered to and in addition SEPA would be consulted during the preparation of the CMS to ensure that the appropriate measures are put in place. This may include construction of a settlement pit within the construction compound or elsewhere for treating rinse water from concrete lorries and measures to prevent water from entering excavations in the vicinity of watercourses.

Erection of Turbines including Crane Pads and Hardstandings

3.4.10 It is expected that two types of cranes are required for the erection of the turbines; 800/1000-tonne capacity cranes and 400/500-tonne capacity tailing cranes. The cranes would use the crane hard standing area as indicated in Figure 3.3. There would be permanent crane pads and temporary hardstanding areas to facilitate the cranes and construction plant. Their locations would be finalised following further site investigation, but would maximise use of the access tracks, where possible, to minimise the carbon footprint of the Proposed Development. The construction of the hardstanding areas would see topsoil/ peat removed and stored adjacent to the sites and remaining strata removed down to a suitable bearing stratum. Geotextile material would be laid down where necessary with crushed stone on top, to a depth of around 500 mm. The crushed stone would be sourced from the borrow pit search areas identified in Figure 1.1. Additional temporary hardstandings may be required at various stages during turbine construction and erection. This may include temporary hardstanding to facilitate the erection of crane components, lattice boom or turbine components e.g. rotor assembly.

3.4.11 Where reasonably practicable, the delivery of the turbine components would be scheduled, weather dependent, to allow for direct lift off the transport trailers. Otherwise, turbine components would be stored on, or adjacent to, the crane pad areas, or components may be delivered to the construction compound for internal distribution by a separate tractor unit. The tower sections would be erected, followed by the nacelle and hub. Following erection of the tower sections and the nacelle, the blades would either be lifted and attached individually to the hub in position, or the hub and blades would be raised together, as a unit, and attached to the nacelle. The cranes would then move to the next turbine location.

Operation

3.4.12 Once installed and fully commissioned, the wind turbines would operate automatically and can be controlled remotely or from the on-site Control Building. Regular visits would be made by technicians to infrastructure and turbines in four-wheel drive vehicles or similar. In addition, longer servicing visits would be required, typically every six months, along with reasonable unscheduled maintenance, as may be necessary. Occasional use of larger vehicles, such as cranes or lorries similar to those used during construction may be necessary, should there be a requirement for replacement of major turbine components.

3.4.13 Wind farm performance would be remotely monitored using the permanent anemometer mast, together with a Supervisory Control and Data Acquisition system (SCADA) that would monitor the individual turbines and the grid connection.

3.4.14 All turbine transformers would be sited on bunded foundations that are able to contain 110% of the oil contained within them. Any leaks from equipment within the nacelle would be contained within the turbine.

Permanent Anemometer Masts and Turbine Anemometry

3.4.15 Wind farm performance and weather conditions would be remotely monitored using a permanent anemometer mast. The mast would be approximately hub height (around 115m) of the wind turbines and likely be of a metal lattice structure secured to the ground through concrete foundation. Figure 3.7 presents an indicative drawing of such a mast.

3.4.16 A SCADA unit would monitor the individual turbines and allow remote technical control. In terms of additional anemometer requirements, each of the turbines would have an anemometer located on the nacelle in order to operate the turbines. Furthermore, ground based laser anemometer devices may be utilised during the operational phase. These would be approximately 2.5 m in height and require an area of up to 25 m^2 of relatively level ground per unit installed. These would likely be secured by means of a 2 m high palisade type fence for each unit and would be kitted with an energy supply.

Borrow Pits

3.4.17 On-site borrow pits may be used to provide most of the stone for use in the Proposed Development Area, subject to sufficient quality and quantity of stone being available at the identified borrow pit locations. The exception may be works to form the access track leading from existing tracks in to the development area and up to the first of the on-site borrow pits. Material for this section of track as well as improvements to the wider forestry access track network may be imported onto site from local quarry sources. Technical Appendix 11.1 provides more details including predicted material movements. From initial site assessments, the indicative locations of the borrow pit

search areas are shown on Figure 1.1. Final locations would be agreed as part of the CMS for the Proposed Development and subject to detailed ground investigations to confirm suitability of material. Should further stone be required, any further borrow pit locations would be subject to the successful outcome of a relevant Mineral Extraction Licence application which would be made to the relevant authority. The final reinstatement of these borrow pits would be agreed with the relevant local authority prior to reinstatement works commencing, but would likely include surplus arisings including peat.

Access Tracks

3.4.18 Approximately 14.65 km of new on-site tracks would link the proposed turbines and infrastructure to the existing private access track. The existing private access track, which has been used for commercial forestry would be used and upgraded where required. (see Figure 1.1).

3.4.19 The design philosophy behind the track layout has taken into account a number of factors including topography, ecological/environmental/archaeological constraints, hydrology, watercourse crossing, ground conditions and construction parameters and has been based on best practice methodology developed at other wind farm sites. It is proposed that existing tracks are used where possible in order to reduce the need for construction of new tracks, thus reducing the degree of disturbance to the local environment and promoting sustainable development. The proposed track layout has been designed following an onsite review and minimised the number of water crossings necessary and used as far as reasonably possible the existing infrastructure in place to minimise impacts on the environment.

3.4.20 The initial stripping of topsoil/peat for the new tracks and placement of stone material for construction of new tracks has the potential to release sediment into watercourses. Therefore, using methods consistent with industry best practice, sediment measures would be put in place ahead of the track construction activities. Sediment would be transported the furthest by existing surface water channels and manmade drainage systems, therefore proactive mitigation measures would require these to be identified prior to the track construction. Within the channels and drains and any necessary settlement ponds, silt traps would be constructed prior to track construction. The silt traps would likely be constructed using straw/hay bales or specialized siltation fencing, pinned into place, allowing water to either percolate through the bale or flow over. Where machinery is required for any of these up-front activities, they would have low pressure bearing tracks. Sediment transport mitigation drainage systems would be subject to regular maintenance during the lifetime of the Proposed Development. Chapter 8 of the EIAR provides an assessment of the potential effects on hydrology.

3.4.21 For construction of new sections of track, alternative methods would be utilised for different areas of the Proposed Development Area, depending on site specific conditions. For each method, the track running width (excluding drainage channels and cable trenches) would be approximately 5m wide, with the exact width depending on the local ground conditions. A wider track width of approximately 7m is also proposed as a main spine road to minimise interface issues throughout the construction and operational period of the windfarm. The spine road reduces collision risks and also has significant environmental benefits by preventing the continual braking and accelerating (and standing) of plant and vehicles associated with passing places. Track widths may also be wider for short sections such as lengths with passing places and at sharp bends and track junctions. It is expected that all new tracks would be excavated whereby overlying soil or peat material would be removed with a foundation formed on the underlying glacial till or the weathered rock horizon, as shown in Figure 3.5. Where peat depths are greater than 1m deep, it is generally more efficient to “float” the track over peat i.e. leave the peat in place. In this instance, geogrid(s) and rock from the borrow pits (at approximately 1m thick), are used to form the construction of the floating track.

3.4.22 In addition, there would be a requirement for drainage channels along one or both sides of each section of track depending on the ground conditions along each track segment (see Figure 3.5) to prevent the track itself acting as a watercourse. Tracks would be designed with a crossfall, towards the drainage ditches, to prevent build-up of water on the running surface. It is important that the water flowing along the drainage ditch is not able to build up enough volume and velocity to act as a major sediment transport route. To prevent this happening, cross drainage pipes would be placed under the road at regular intervals. This also helps minimise the effect the road construction would have on the hydrology in the adjacent area and prevent concentration of water flow higher in the catchments’ area than would necessarily occur. The drainage ditch would also be blocked just above the cross-drainage inlet, thus preventing water from simply flowing past the inlet. Using stone available onsite, a head wall would be constructed to prevent erosion around the inlet. A silt trap would also be constructed at the inlet to the cross drainage, to minimise sediment entering the pipes. The outlet of the cross drainage would allow the water to filter through the adjacent vegetation.

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

3.4.24 Tracks between turbines and the anemometry equipment are required during the operational period of the Proposed Development to allow for routine maintenance operations and the replacement of components.

3.4.25 Note: Two new additional footpaths may be constructed on site for additional recreational benefits to the local community (see figure 3.11 and 3.12 for corridor of potential routes which have been considered to avoid environmental constraints). As footpaths effects are minimal these have not been considered in assessment.

On-site cabling

3.4.26 The wind turbines envisaged for use on the Proposed Development would initially generate electricity at 690-1000 Volts. This typically needs to be converted to 33,000 Volts (33 kilovolts (kV)) via a transformer located within the turbine or immediately adjacent to the tower of each turbine. Typical specifications for possible external transformer housings are given in Figure 3.1. Any external transformer would be linked to the turbines through cable ducts in the turbine foundations. Underground cable routes between turbines and the substation compound would generally follow track routes. These would be placed approximately 2 m from the track verge and drainage ditches.

3.4.27 The transformers would be linked to the on-site electrical substation and metering/control building (Figure 3.4) typically via 33 kV underground cables placed in trenches. The route within the site would generally run adjacent to the route of on-site tracks where possible. The route would be marked above ground with clearly identified posts, spaced at suitable intervals along the length. This would be agreed as part of the CMS/ CEMP.

3.4.28 Cables would be laid from a drum attached to a suitable vehicle. Each cable would arrive as three insulated cores. These would be gathered in the trench and bound together along the entire length of the trench in a trefoil arrangement. Communication cables and earth tapes would also be laid in the same trench. The cables would be protected from mechanical damage by a sand bed and surround. Two layers of marker tape and/or tiles would be buried above the cables to prevent accidental excavation, and concrete marker posts would be placed at regular intervals to enable the cables to be located in the future.

3.4.29 Silt, scour and run-off would need to be managed as the cable trench can act as a preferential drainage channel. Backfilling of the trench should be carried out as soon as is reasonably practicable and the road drainage installed should be set up with suitable silt traps as the construction proceeds. In steep sections, impermeable plugs could be used in the cable trench to prevent the channel becoming a preferential drainage run, using locally won clay material if available.

3.4.30 In areas where the surrounding soils are very coarse gravel or peat, the cable trench footprint shall have a geo-textile wrap placed within it to prohibit fines migrating from the backfill into the surrounding sub-soils. These areas shall be identified on site during the commencement of the works. Where surplus mineral soil material is present, this shall be transported back to the borrow pit for use in the reinstatement and final profiling.

3.4.31 On-site cable trenches would be located to minimise the area of disturbance, up to 5 m beyond the edge of the site track in case of multiple circuits. Trench excavation, cable laying and backfill would be carried out in a continuous operation (minimising the length of trench open at any one time) and may occur subsequent to the construction of on-site tracks or after the erection of turbines. Prior to excavation, the topsoil/turfs would be stripped

and placed to the side in a temporary stockpile. A trench would then be dug with a small excavator or backhoe to approximately 1 m in depth and 1.5 m in width. Figure 3.6 gives an indicative outline of the cable trench. The final cable positions would be surveyed and supplied in 'as built' drawings for the Operations and Maintenance team.

3.4.32 Cable ploughing may be adopted if ground conditions permit. The final choice of method would depend on the appointed contractor and the results of further site investigation.

3.4.33 In all cases, the cables would be buried to a depth of approximately 1 m. Reinstatement would be carried out to relay the previously stripped top layer of peat turfs containing the seed bank, over the top of the cable trench. This reinstatement would be conducted following the backfilling of each cable trench section.

3.4.34 At track crossings and within concrete foundations, the cables would be laid within plastic ducts.

3.4.35 Existing watercourses should be monitored during the works, both to prevent water entering the excavation, and also for runoff and silt escaping and entering the watercourses. These may need temporary diversions/piping until the track is complete and the watercourses can be reinstated.

3.4.36 On decommissioning of the Proposed Development, on-site cabling would be left in-situ, unless ducted. Most modern cables are aluminium with a protective plastic coating and are relatively benign and inert; over time these would break down to clay. These can be electrically isolated and left in-situ, as is common practice.

Substation, Control Building, Energy Storage & Compound

3.4.37 The onsite substation and control building compound would accommodate metering equipment, switchgear, transformers, the central computer system, electrical control panels and include the potential for containers for battery storage. A spare parts store room and welfare facilities would also be located in the control building.

3.4.38 Figure 3.4 shows a typical compound and layout within a maximum footprint area of 100 m by 180 m assessed. This is indicative and the design and layout are subject to change.

3.4.39 **Note**: The BESS containers can be housed externally. The potential for up to 50MW is proposed so overall footprint is approx. 60 m by 40 m with 14 containers, 1 MV/LV transformer, 1 inverter, and one container to act as a control room.

3.4.40 Although it may not be permanently staffed, the building would be visited periodically by maintenance personnel.

3.4.41 The underground cables routed from the proposed turbines would be brought together via underground cables to an onsite substation, (an indicative diagram of underground cabling is shown in Figure 3.6). The electricity would be stepped up from 33 kV to 132 kV at the substation before being transformed to 400 kV as part of National Grid asset works and connected to the grid.

Grid Connection

3.4.42 The Applicant has consulted with the network operator and agreed upon a connection to link the Proposed Development with the National Grid. Electricity generated by the Proposed Development would be exported from the onsite substation.

3.4.43 The grid connection offer is, currently, connecting the project at the existing Holm Hill substation (also known as Kendoon North) approximately 6km west of the proposed development which National Grid indicate will be via an overhead line

3.4.44 Due to the changing nature of grid connections during planning, the method and exact route would be subject to a separate assessment undertaken by the network operator. It is anticipated that the connection would be subject to a separate application, prepared by the network operator, for consent under Section 37 of the Electricity Act 1989.

3.4.45 However, given the lack of nationally significant environmental designations and that the it is envisaged the overhead line route will follow (if not make use of) the proposed 132kV line that intersects[3,4] the Proposed Development Area it is considered the grid connection route to Holm Hill will be achievable without unacceptable environmental effects

Temporary Construction Compound and Facilities

Description

3.4.46 During the construction phase of the Proposed Development, temporary construction (TC) compound areas would be required. The construction compound would be built by carefully removing topsoil or peat turfs down to a firm substrate, laying down geotextile material and then constructing a working surface of stone extracted from the borrow pits. The topsoil/peat would be stored adjacent to the site for reinstatement or used elsewhere on the site. The temporary construction compounds would be reinstated with topsoil, at the batching plant, such that it can be re-used if needed during the operation phase for major maintenance or emergency works.

Construction

3.4.47 The dimensions of the compounds vary depending on whether it is the main or satellite compound. Currently, the areas are as follows: TC001 (1500m^2), TC002A/ 002B (5000m^2) and these would be surrounded by a fence. Due to the requirement under health and safety legislation, the Construction Design Management (CDM) Regulations for welfare facilities on site, and the exposed nature of the site, a number of cabins would be needed in the construction compound. These would have offices, canteens, drying-rooms, toilets and washing facilities. Smaller mobile, self-contained units are likely to be required as work progresses throughout the Proposed Development Area. These would be placed at suitable locations to tie in with the work interfaces as required. A typical layout of the compound area is presented in Figure 3.9.

3.4.48 The compound would be used, where necessary, for temporary storage of the various components and materials which are required for construction.

3.4.49 A settling pit/concrete washout bay and wheel wash may be included near the construction compound. When concrete lorries have deposited their loads, there is a requirement to wash out the inside of the concrete drum. This requires water that would then be washed out from the drum into a settlement pit. The size of this pit would depend upon the flow of concrete lorries up to the site (or within the site if an on-site batching plant is employed) but would be lined with an impermeable sheet and granular fill to assist in the settling process. The construction compound would be reinstated at the end of the wind farm construction period. The stored subsoil and the stored topsoil would be laid over the geomembrane separating it from the underlying stone surface and then regenerate naturally (or reseeded using a seed mix selected if required) or where possible, turfs would be reinstated. This process is regarded as more environmentally friendly whilst still meeting planning requirements.

Environmental Considerations

3.4.50 Fuel would be required for the vehicles, generators and other equipment on site. The storage facilities would typically be comprised of a bunded concrete area containing a lockable, bunded fuel tank and a lockable housing for the storage of construction chemicals. In addition, there would typically be a wheeled, double-skinned bowser for transport of fuel to tracked vehicles. All construction equipment would be inspected daily to check for spillages. Drip trays would be used when refuelling vehicles on the site. Emergency spill kits would be kept on site adjacent to the fuel storage area and with the mobile bowser. Site operatives would be briefed on the emergency procedures to be undertaken in the event of a large spillage. The principal contractor would have a 24-hour emergency response company on standby in the event of a spillage incident. Vehicles would be refuelled at their working location to prevent loss of time and use of fuel returning to any designated refuelling areas. All previous stated

[3] Public_Consultation_Leaflet.pdf (spenergynetworks.co.uk)

[4] Scottish Government - Energy Consents Unit - Application Details

measures would be used when refuelling vehicles and the bowser operator would be suitably trained to deal with any spillage.

3.4.51 Turfs would be regularly monitored to prevent excessive desiccation. The subsoil would be removed and stored separately from the topsoil (or peat turfs). Geotextile and stone would be laid down to an approximate depth of 300-500 mm.

3.4.52 The storage facilities would be self-contained and no discharge of drainage would be made to the surrounding land unless otherwise agreed with SEPA and the relevant local authority.

3.4.53 The settlement pit would be located away from watercourses with details included as part of the CMS following consultation with SEPA. Any drainage from these facilities would be collected and treated prior to discharge via the Sustainable Drainage System (SuDS). The washout bay would be maintained as necessary by replacing the granular fill with clean stone. At close of construction, all material within the washout bay would be removed from site and the area reinstated.

3.4.54 Diesel fuel would be stored on site for all construction vehicles. The storage tank would be placed within the construction compound and measures would be taken to mitigate the risk of leakage using either a double skinned tank, or the tank placed within a bund capable of containing 110% of the maximum stored volume as required by the SEPA guidelines.

3.4.55 In line with SEPA guidance, appropriately competent operatives would be used for handling, storing and arranging for the disposal of potentially polluting substances. Licensed waste disposal companies would be used to dispose of potentially polluting wastes.

Signage

3.4.56 There would be a requirement for the need 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 site. Signage would consist of non-illuminated post and panel sign locations and non-illuminated turbine identification signs with a maximum of 3 signs per post facing towards ~~at~~ the Proposed Development. Signs would also be placed on the turbines to help identify them as indicated in Figure 3.8.

3.4.57 The signage on site would comprise of two elements; directional signs and roundels displaying the site speed limit. Indicatively, the directional and speed roundel sign would measure 300 mm x 400 mm x 3 mm and 300 mm x 300 mm x 3 mm respectively, which would likely be mounted on a 2500 mm x 76 mm grey aluminium pole as shown on Figure 3.8. The poles would be set within a 460 mm deep concrete foundation as indicated in Figure 3.8. This would ensure the stability of the signs, in line with current guidance for such installations.

3.4.58 The sign fixtures allow back-to-back mounting and are used on sign locations where more than two signs are specified. The signs would be hard wearing using tamperproof fixtures, securing the signs in place. A high-quality typeface would be used to maximise readability. The signage would be uncluttered and designed to be legible from vehicle or from foot.

3.4.59 The exact number of signs required at any of the post locations would be decided post consent, following a full review of the health and safety requirements and would be confirmed in the CMS that would require to be approved by the planning authority prior to the commencement of development.

3.5 EMPLOYMENT DURING CONSTRUCTION

3.5.1 It is envisaged that the Proposed Development would be constructed employing a number of main contractors; probably one for the civil infrastructure works, one for the electrical works, and one for the supply, erection and commissioning of the wind turbines - all of whom would be coordinated and overseen by a project manager. In order to monitor the progression, site representatives would be employed full time to ensure the quality and health and safety aspects of the construction, and to ensure the development is carried out in accordance with the CMS methodologies. The site representatives would be individuals with previous experience of wind farm construction and would, as required, be supported on site by a suitably qualified ECoW. The site representatives would carry out daily checks on the site to monitor on-going activities, particularly when subcontractors are being used on site. In addition to this, and in conjunction with the ecologist, and hydrologist, environmental audits of the site operations would be undertaken on a regular basis accompanied by representatives of the relevant contractors. Where necessary, additional specialists may attend the site including geotechnical and archaeological representatives.

3.5.2 In line with guidance, appropriately competent operatives would be employed for handling, storing and arranging for the disposal of potentially polluting substances. Licensed waste disposal companies would be used to dispose of potentially polluting wastes.

3.5.3 During the construction period there would be construction operatives carrying out the works on site that have been described. There would be indirect local benefits arising from the construction phase, including use of hotels, Bed & Breakfasts and other accommodation, hire of local equipment and plant, temporary employment of local work force and potential contracting of local subcontractors (see Chapter 14 of the EIAR: Socioeconomics for more details). The construction mobilisation would likely be spread over a 15-month period for which such effects are assessed in Chapter 11 of the EIAR: Traffic & Transport.

3.6 SITE REINSTATEMENT

Access Tracks

3.6.1 During track excavation works, where possible the vegetated top layer of material, which holds the seedbank, would ~~will~~ be stripped and carefully set to the side of the worked area for re-use in the re-profiling and track verge reinstatement works. Where practical, if storage is required, the layers would be correctly stored in their respective soil/peat horizons, i.e. in the layers that they were stripped in, so when reinstated they can be put back in the correct order. If temporary storage of excavated materials is required, then such material would be stored safely and the method of storage would not lead to any areas of additional disturbance.

Cable Trenches

3.6.2 The reinstatement and storage of any excavated materials for the cable trenches would involve replacement of previously stripped soils, vegetated layers or turves. Timing of trench reinstatement works would also take into account adjacent construction activities which may disturb any reinstatement works already carried out. The amount of time between the excavation of the trench and subsequent reinstatement following cable laying would be minimised as much as practically possible. The reason for this is that the longer the stripped turves are stored for the more they would degrade and become unsuitable for successful reinstatement. The optimum scenario for the cable trench works would be to ensure that no cable trenches are excavated until the electrical contractor has their cables ready for installation on site.

Turbine Foundations

3.6.3 Reinstatement methods associated with turbine foundations would include where practical the storage of turves and topsoil around the perimeter of the foundation excavation. A plan showing where the material is to be stored would be created prior to the works commencing. In areas where storage of the turves or excavated material adjacent to the works is not possible, then the material would be taken to the nearest agreed storage areas as soon as possible.

Crane Hardstandings

3.6.4 Due to the requirement for crane hardstandings to remain in place, reinstatement of the crane pad would not take place. There would however be reinstatement of the area around the crane pad and any exposed batters using the stripping, storage and reinstatement methods described above.

Construction Compound

3.6.5 All temporary construction areas would be reinstated as quickly as possible following construction. Following removal of temporary site accommodation, storage, equipment and materials, all areas would then be reinstated. Suitable materials i.e. topsoil would be replaced over the area in appropriate horizons i.e. in the correct order. The material used for the reinstatement works (often that which was excavated for the temporary construction area), would be stored and managed adjacent to the temporary construction areas but away from watercourses and other sensitive receptors. It is highly probable that the temporary construction areas, such as the site compound would be required for the duration of the construction period and may be required at times during the operation and decommissioning phases. Therefore it is unlikely that any stripped turves would be suitable for reinstatement, as the vegetation would have decomposed if stored for any length of time. Vegetation would therefore be allowed to regenerate naturally.

Forestry Replanting

3.1.1 As noted, the land where the wind turbines would be developed is partially forested with further planting anticipated. Details of the proposed forestry arrangements are presented in Chapter 12 of the EIAR.

3.7 OPERATIONAL PHASE

Operation of the Proposed Wind Farm

3.7.1 The majority of the operation of the Proposed Development would be automatic. Each individual turbine would operate independently of the other turbines. Turbine operation would be managed by control and monitoring systems. These systems control the rotational speed of each individual turbine and ensure its continued safe operation. Should any malfunction in operation occur or should wind speeds exceed safe limits, then the braking system of the wind turbine would automatically be applied and each turbine would shut down to a safe condition.

3.7.2 If the cause of the shutdown is due to high wind speeds, then the turbine would automatically begin operation again once average wind speeds reduce to below 25 m/s. Under other causes of shutdown e.g. through malfunction, the turbine would remain shut down in a safe condition (e.g. with the rotor blades orientated 90 degrees to the wind direction) until manually restarted by a member of the Operations and Maintenance team, following satisfactory inspection and/or repair.

3.7.3 The lifetime of the project is envisaged to be up to 30-35 years from completion of commissioning to commencement of decommissioning. To ensure that turbines continue to operate with acceptable reliability (i.e. with each turbine capable of operating on average, between 95% and 98% of the time), regular pre-planned maintenance and servicing programmes are performed on each turbine. A typical maintenance programme is outlined below. Additionally, there may be a need to conduct irregular, ad hoc maintenance in the event of mechanical breakdowns.

3.7.4 Tracks giving access to turbines would be required during the operational period of the wind farm to allow for routine maintenance operations and occasional replacement of larger components.

Maintenance Programme

3.7.5 Maintenance regimes commonly begin shortly after commissioning with a 'post-construction' check on the torque levels of all bolts within the structure. This is normally performed 10 days after commissioning and again, 3 months after commissioning.

3.7.6 After this, servicing is performed annually throughout the lifetime of the turbine.

3.7.7 Routine oil sampling and testing of lubricant maintains awareness of the integrity and condition of these lubricants. This allows cost-effective oil changes to be performed as the oil quality degrades. Routine oil sampling and testing of transformer oils is also performed in order to maintain awareness of the integrity of the electrical properties of these oils.

3.7.8 Maintenance of the high-voltage switchgear would also be conducted routinely and annual checks would be performed.

3.7.9 In the case of major component maintenance being required, such as generator or blade replacement, large vehicles similar to those used during construction may need to return to site. These would be subject to similar conditions of planning as agreed for the initial construction period. From time to time, when such maintenance is being undertaken, it may be necessary to restrict access to areas close to the replacement turbine components in order to maintain the health and safety of visitors. In such cases, the areas affected would be clearly marked and fenced and alternative routes would be provided for any visitors seeking passage through the wind farm, where necessary.

3.7.10 All maintenance of any equipment item would be performed according to the Original Equipment Manufacturer's stated schedules, health and safety and Construction, Design and Management procedures.

3.7.11 All maintenance would also be undertaken according to the environmental procedures aforementioned in this chapter.

Storage and Use of Polluting Substances

3.7.12 Storage of polluting substances at the site during the operational period of the proposed wind farm would only take place where agreed with the relevant authorities in accordance with Control of Substances Hazardous to Health (COSHH) regulations. Generally, substances of this nature are transported in minimum quantities on an 'as required' basis.

Employment during the Operational Phase

3.7.13 It is envisaged that the turbines at the Proposed Development would be included within a wider portfolio of operational wind turbines and that persons and/or technicians would be on site as required. For the first few years of operation the turbines would be under warranty and maintenance would be performed by the turbine manufacturer. During annual servicing thereafter, the number of technicians on site would increase. The site would also support a site manager to be based in the local area. Other contract personnel would attend the site as required to maintain the civil and electrical infrastructure as well as carrying out duties in relation to ecological monitoring and reporting. Site personnel would make use of the onsite control building, which has been designed to include office space and welfare facilities. Chapter 14 of the EIAR assesses the socio-economic effects of the Proposed Development.

3.8 DECOMMISSIONING

3.8.1 At the expiry of the consent or the end of the Proposed Development's useful life, it is proposed that the turbines and transformers would be removed. The upper sections of the turbine foundations, to a depth of at least 1 m, would be removed and backfilled with appropriate material. Peat or topsoil would be replaced and the area reseeded. Tracks would be left and allowed to grass over, or would be covered with soil and reseeded. Cabling

would be left in-situ, unless ducted. At least six months prior to the decommissioning of the site, a Decommissioning Method Statement would be prepared, for agreement with the local authorities and relevant consultees.

3.9 WASTE MANAGEMENT

3.9.1 The Proposed Development would produce small amounts of general, municipal and hazardous waste during its construction, operation and decommissioning. Where waste is generated, the waste hierarchy would be applied:

Source: DEFRA Guidance on applying the Waste Hierarchy, 2011

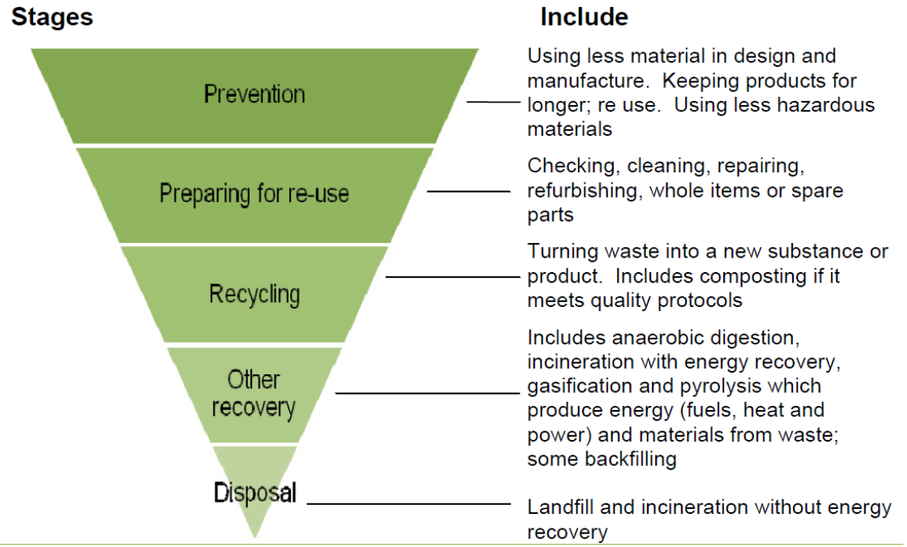

Table 3.3 Waste hierarchy

3.9.2 Waste materials generated during the construction phase include excavation waste such as vegetation, forestry residues, soil, stone, rock and similar materials. Excavated materials can be reused on site or elsewhere if it is deemed suitable for reuse. Excavated peat associated with development on peatland is not classed as waste if it is deemed suitable for a required and predetermined end use as part of construction works and reinstatement on a site. Other construction waste streams include municipal waste from welfare facilities, including food waste, paper, plastics, glass, cardboard, paper, and other typically domestic refuse. Industrial waste chemicals, fuel, oil and polluted water from plant, vehicle and wheel washes may also be generated as a result of the Proposed Development.

3.9.3 The operational phase of the Proposed Development is unlikely to generate significant amounts of waste except for minor quantities of material collected during routine maintenance inspections. Waste streams during this phase include municipal waste, waste chemicals, fuel and oil, sewage and polluted water from vehicle and wheel washes.

3.9.4 During the decommissioning phase of the Proposed Development wastes include demolition waste, turbine components, electrical cabling as well as municipal waste, waste chemicals, fuel and oil, sewage and polluted water. Wind turbines and electrical cables can be re-used subject to potential ready markets for the material.

3.9.5 Measures 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. Such measures would be detailed fully within the CMS, that would be subject to approval from the local authority.

3.9.6 Embedded mitigation to reduce the quantity of waste from the Proposed Development would include the design of the Proposed Development in such a way that new turbines can be accessed by existing access tracks wherever possible, minimising the need to construct additional access tracks and reducing the potential for waste. All construction and decommissioning activities would be planned effectively to ensure that any materials associated with these activities are predicted well in advance, reducing the chance of over-ordering of materials which would result in waste.

3.9.7 Materials would be reused on site or elsewhere and materials would be sent for recycling where recycling facilities are available. Other measures to ensure that waste materials sent to local waste management facilities sent to landfill are kept to a minimum include the nomination of an approved person(s) to be responsible for waste management on site; this would include the coordination of waste collection to suitable disposal and/or recycling facilities. In addition, a system to record and monitor waste would be implemented, keeping a record of re-use, recycling and disposal. It may also be possible to schedule certain activities that generate large volumes of waste to avoid overloading local infrastructure if other construction projects in the area are also producing large volumes.

3.9.8 The Applicant reports on emissions on SF6 at our operational sites as part of our Annual and Sustainability Report.[5]

3.9.9 Pollution prevention measures would also be put in place and these would be detailed fully within individual chapters of the EIAR and within the CMS. Pollution prevention measures include:

- Storage of waste materials within the construction compound only. If waste materials are generated outside the construction compound they would be taken to the compound on a daily basis.
- All waste products would be removed from site by registered waste carriers and taken to a waste management facility permitted to receive each specific waste type.
- Bonfires and the burning of waste products would be prohibited on site.
- Labelled, double skinned waste tanks would be utilised for the storage of waste oils onsite.
- The waste storage area would be isolated from surface drains and bunded to contain any spillages.
- A wastewater collection system would be used to prevent contamination of local water courses.

3.10 HEALTH AND SAFETY

Construction Phase

3.10.1 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

3.10.2 In awarding any civil, electrical or other contracts for the construction of the proposed wind farm 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 site.

3.10.3 Sweco UK Limited has been appointed 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 operation and maintenance

[5] vattenfall-annual-and-sustainability-report-2020.pdf

phase of the proposed wind farm. The Developer would be required to provide a timescale and start date for the project, 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 Developer would be on site 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 of any wind farm. The HSE can investigate safety aspects of the Project and visit site at any time if they have concerns.

Public Safety

3.10.4 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 site compound or immobilised to prevent unauthorised use. In addition, temporary construction safety signs would be placed at each possible entrance to the site and in areas where there may be further danger, e.g. around settling lagoons and borrow pits.

3.10.5 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.

Operational Phase

3.10.6 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 existing sites has shown that allowing the public to access an operating wind farm does not lead to a compromise with respect to safety issues.

3.10.7 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”.

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

3.10.9 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 development. Appropriate warning, directional and identification signs would be installed on the turbines, transformers and onsite electrical control building, and 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 site area, particularly on the public routes to inform members of the public that they are entering a wind farm area, 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.

3.10.10 No resulting safety risks are expected as a result of public access to the Proposed Development. Turbine models being considered for the site 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 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 turbine down.

3.10.11 Icing within Scotland is predicted to be light with the Icing Map of Europe (WECO, 2000) showing an annual average of only 2-7 icing days per year therefore the risk of ice throw from wind turbines is low. However, it is noted that the public right of way that traverses the Proposed Development Area requires mitigation measures in place to limit any risk of ice throw affecting members of the public. Wind turbines are fitted with vibration sensors which shut the wind turbines down should any imbalance that might be caused by icing be detected. Further mitigation measures include compulsory ice throw training for service crews, regular monitoring of ice risk conditions by the wind farm operator and public notices displayed at access points to the Proposed Development alerting the public and staff of ice throw that may occur under certain weather conditions. Further information is detailed in Chapter 13: Other Effects.

3.10.12 If the cause of the shutdown was high wind speeds then the 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 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 turbines to protect members of the public walking, cycling or riding past 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 turbines down under these conditions. The turbines are also equipped with lightning protection equipment so that strikes would be conducted from the nacelle down the tower into the earth.

3.10.13 The safety features and record of wind turbines are identified above, and it is concluded that the Proposed Development would not present a significant safety risk to the public.

3.11 CONCLUSION

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.

3.11.1 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 CMS, which would be submitted by the principle contractor for approval by the planning authority prior to the construction of the Proposed Development.

VATTENFALL

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Chapter 4

Climate Change, Legislative and Policy Context

Contents

Glossary

Term	Definition
Environmental Impact Assessment Report	A document reporting the findings of the EIA and produced in accordance with the EIA Regulations.
Environmental Impact Assessment	Environmental Impact Assessment (EIA) is a means of carrying out, in a systematic way, an assessment of the likely significant environmental effects from a development.
Environmental Impact Assessment Regulations	The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (EIA Regulations)
The Proposed Development	The Quantans Hill Wind Farm development
The Proposed Development Area	The area within the 'Site boundary' as illustrated on Figure 1.1 which the Proposed Development will be located

List of Abbreviations

List and describe your abbreviations here.

Abbreviation	Description
EIAR	Environmental Impact Assessment Report
Applicant	Vattenfall Wind Power Ltd, the Applicant
ECU	Energy Consents Unit
EIA	Environmental Impact Assessment
PDAS	Planning, Design and Access Statement
MW	Mega Watt
GW	Giga Watt
IPCC	Intergovernmental Panel on Climate Change
WG	Working Group
AR5	5th Assessment Report
SYR	Synthesis Report
UNFCCC	United Nations Framework Convention on Climate Change
CCC	Committee on Climate Change
GHG	Greenhouse Gas
NPF	National Planning Framework
CfD	Contracts for Difference
SEPA	Scottish Environment Protection Agency

Abbreviation	Description
OWPS	Onshore Wind Policy Statement
SES	Scottish Energy Strategy
PAN	Planning Circulars and Planning Advice Notes
SHEP	Scottish Historic Environment Policy
LPA	Local Planning Authority
LDP	Local Development Plans
DGC	Dumfries and Galloway Council
SPP	Scottish Planning Policy
SPG	Supplementary Guidance
DGWFLCS	Dumfries and Galloway Wind Farm Landscape Capacity Study
EU	European Union
AR4	Allocation Round 4

4.1 INTRODUCTION

4.1.1 This chapter of the Environmental Impact Assessment Report (EIAR) identifies and contextualises the policy and legislative framework relevant to the development of renewable energy in general and specifically with regard to onshore wind. It is recognised that current drivers to these policies have emerged from the pressing concerns regarding climate change and the resulting aims to reduce greenhouse gas emissions. Renewable energies, including wind powered generating stations, are acknowledged as a means to decrease greenhouse gas emissions through a reduced reliance upon fossil fuels.

4.1.2 The chapter also considers key policy documents, such as the Scottish Energy Strategy (2017), the draft Scottish Energy Strategy and Just Transition Plan (2022) and the associated Scottish Onshore Wind Energy Policy Statement (2022). Both underline the continuing importance of onshore wind in meeting renewable energy, decarbonisation and climate change targets, plus driving down the cost of power through efficiency measures, such as the use of taller wind turbines with larger generators.

4.1.3 This chapter identifies the relevant national and local planning policies against which the application for the Proposed Development is likely to be assessed.

4.1.4 The Planning, Design and Access Statement (PDAS) contains a brief description and detailed analysis of the Proposed Development, the rationale for the proposal, a summary of the findings of the EIAR and consideration of the application against key legislative requirements.

4.2 CLIMATE CHANGE (CONTEXT, POLICY AND LEGISLATION)

4.2.1 It is widely accepted that climate change is an international, pressing and real issue. The international Intergovernmental Panel on Climate Change (IPCC) has, to date, published three Working Group (WG) reports, which have been collated into a Synthesis Report (SYR)[1] and together, make up the Fifth Assessment Report (AR5). Headline statements from the report include:

"Human influence on the climate system is clear, and recent anthropogenic emissions of greenhouse gases are the highest in history. Recent climate changes have had widespread impacts on human and natural systems."

Continued emission of greenhouse gases will cause further warming and long-lasting changes in all components of the climate system, increasing the likelihood of severe, pervasive and irreversible impacts for people and ecosystems. Limiting climate change would require substantial and sustained reductions in greenhouse gas emissions which, together with adaptation, can limit climate change risks.

Adaptation and mitigation are complementary strategies for reducing and managing the risks of climate change. Substantial emissions reductions over the next few decades can reduce climate risks in the 21st century and beyond, increase prospects for effective adaptation, reduce the costs and challenges of mitigation in the longer term, and contribute to climate-resilient pathways for sustainable development.

Many adaptation and mitigation options can help address climate change, but no single option is sufficient by itself. Effective implementation depends on policies and cooperation at all scales, and can be enhanced through integrated responses that link adaptation and mitigation with other societal objectives."

4.2.2 The Sixth Assessment Report AR6 is currently in the Scoping Stage and is due to be published in 2022[2].

International Policy Framework on Climate Change

4.2.3 The United Nations Framework Convention on Climate Change (UNFCCC) has had a prominent role in establishing international policy on climate change. In particular, its principal review mechanism 'The Kyoto Protocol' was adopted by the Annex I participating countries of the UN in 1997 and commits the industrialised countries to legally binding targets to limit or reduce their greenhouse gas emissions.

4.2.4 The **Paris Agreement** (**Paris climate accord** or **Paris climate agreement)** is an agreement within the UNFCCC dealing with greenhouse gas emissions, mitigation adaption and finance with countries submitting plans for climate action in the year 2020. The Paris Agreement aims to respond to the global climate change threat by keeping a global temperature rise this century well below 2 degrees Celsius above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5[3] degrees Celsius. Under the Paris Agreement, the UK is required to produce plans and regularly report its own contribution towards mitigation. There is no mechanism to force a country to set a specific target by a specific date, but each target should go beyond previously set targets.

4.2.5 2021 saw the 26th annual summit (**COP26**) which took place in the UK. COP26 finalised the Paris agreement with nearly 200 countries agreeing to the '**Glasgow Climate Pact'**, which resolved a number of important outstanding elements of the Paris Agreement. The final COP26 agreements followed two years of negotiation and campaigning undertaken by the UK Presidency to secure action from all the 200 countries – the main outcomes is work focussed on making short term reduction of emissions to limit temperature rises to 1.5C, organising both public and private finance, and supporting communities to adapt to climate impacts[4].

The United Nations Emissions Gap Report 2020

4.2.6 The United Nations Emissions Gap Report[4] is the eleventh in a series of reports detailing progress with regard to greenhouse gas reduction and highlighting ways to further decrease their creation.

4.2.7 This latest report underlies that renewable energy deployment and energy efficiency are key to energy transition and driving down greenhouse gas emissions. It states that enhanced action by G20 members of the UN, such as renewable energy development, will be essential for global mitigation to succeed.

Climate Change Act 2008 as amended

4.2.8 The Climate Change Act 2008 received Royal Assent in the UK on 26 November 2008 and introduced legally binding targets on the Secretary of State to reduce the UK's net greenhouse gas emissions by at least 80% below 1990 levels by 2050. It was revised in 2019 through **The Climate Change Act 2008 (2050 Target Amendment) Order 2019** to increase this target to 100%.

4.2.9 The Climate Change Act 2008 established a series of measures to achieve these targets including the introduction of carbon budgeting, a carbon trading scheme and the creation of a new Committee on Climate Change ("CCC").

Climate Change (Scotland) Act 2009 as amended

4.2.10 The Climate Change (Scotland) Act 2009 aimed to establish a framework to drive greater efforts at reducing Kyoto Protocol greenhouse gas emissions in Scotland.

4.2.11 The Act was amended by Climate Change (Emissions Reduction Targets) (Scotland) Act 2019, which created new mandatory climate change targets to achieve a reduction in Scotland's greenhouse emissions to 100% below 1990 levels by 2045.

[1] Available at: https://www.ipcc.ch/report/ar5/syr/ (accessed 24/08/2021)

[2] Available at: AR6 Synthesis Report: Climate Change 2022 — IPCC (accessed 24/08/2021)

[3] Available at: https://www.ipcc.ch/sr15/ (accessed 24/08/2021)

[4] Available at: COP26 Negotiations Explained.docx (ukcop26.org) (accessed 01/12/2021)

[4] Available at: https://www.unenvironment.org/emissions-gap-report-2020 - UN Emissions Gap Report (accessed 01/09/2021)

4.2.12 An interim target[5] has been set for 75% reduction in emissions by 2030 relative to 1990 baseline levels of carbon dioxide, methane and nitrous oxide and 1995 levels of hydrofluorocarbons, perfluorocarbons, sulphur hexafluoride and nitrogen trifluoride.

4.2.13 Further interim targets are also set for further reductions of at least 56% by 2020 and 90% by 2040 relative to the 1990/95 baseline resulting in a near doubling of response in the decade from 2020 to 2030.

Climate Change Plan 2018

4.2.1 The Climate Change Plan 2018 sets out Scotland's strategy to meet emission reduction targets between 2018 and 2032, taking a visionary approach. It is published under the Climate Change (Scotland) Act 2009 as amended.

4.2.2 The plan sets out the emissions reductions pathway towards 2032 with the target of reducing emissions by 66% against the 1990s levels. It is acknowledged that "this will be an enormous transformational change" (page 22). This target has since been updated in December 2020 to 75% reduction in emissions by 2030 and to reach net-zero by 2045 as stated in the Climate Change Plan 2018-2032: Securing a Green Recovery on a Path to Net Zero[6].

Net Zero - The UK's Contribution to Stopping Global Warming 2019

4.2.3 The Climate Change Committee (CCC)[7] published its landmark report entitled 'Net Zero – UK's Contribution to Stopping Global Warming' in May 2019. The report responds to requests from the Scottish and Welsh Governments of the UK, asking the CCC to reassess the UK's long-term carbon emissions targets.

4.2.4 The Foreword of the report (page 8) sets out that the CCC has "reviewed the latest scientific evidence on climate change, including last year's IPCC special report on global warming of 1.5^0C and considered the appropriate role of the UK in the global challenge to limit future temperature increases". It adds, "Net Zero is a more fundamental aim than previous targets. By reducing emissions produced in the UK to zero, we also end our contribution to rising global temperatures".

4.2.5 The report makes recommendations regarding the UK economy including:

- UK overall: a new tougher emissions target of net zero[8] greenhouse gases (GHG) by 2050, ending the UK's contribution to global warming within 30 years. This would replace the previous target of an 80% reduction by 2050 from a 1990 baseline (acted upon by The Climate Change Act 2008 (2050 Target Amendment) Order 2019);
- **Scotland: a target of net-zero GHG economy by 2045**, reflecting Scotland's greater relative capacity to remove emissions than the UK as a whole (acted upon by the Climate Change (Emissions Reduction Targets) (Scotland) Act 2019).

4.2.6 The Technical Annex to the CCC Net Zero report specifically addresses integrating variable renewables into the UK electricity system. The Annex makes it clear that renewable electricity, such as large-scale onshore wind, is now the cheapest form of electricity generation in the UK and can be deployed at scale to meet UK electricity demands.

Energy White Paper – Powering our Net Zero Future

4.2.7 The UK government published the Energy White Paper – Powering our Net Zero Future in 2020[9] . A key focus of this publication is the need to achieve targets instead of setting goals for action.

4.2.8 A main route for achieving this objective is the further deployment of renewable energy generation, including onshore wind, such as this project to ensure the country is on the path to a low cost, clean electricity system by 2050.

4.2.9 Onshore wind will be a key building block of the future generation and to meet net zero emission targets, there will need to be sustained growth in the capacity of these sectors over the next decade.

Climate Emergency

4.2.10 Scottish First Minister Nicola Sturgeon declared a "Climate Emergency" in her speech to the SNP Conference in April 2019, stating:

4.2.11 *"As First Minister of Scotland, I am declaring that there is a climate emergency. And Scotland will live up to our responsibility to tackle it."* Referring to the soon to be published CCC advice, Ms Sturgeon added *"if that advice says we can go further or go faster, we will do so".*

4.2.12 Furthermore, Climate Change Secretary Roseanna Cunningham made a statement on 14 May 2019 to the Scottish Parliament on the 'Global Climate Emergency', again, with reference to the recent CCC Net Zero Report:

4.2.13 "*We acted immediately with amendments to our Climate Change Bill to set a 2045 target for net zero emissions - as we said we would do. If agreed by Parliament, these will be the most stringent legislative targets anywhere in the world and Scotland's contribution to climate change will end, definitively, within a generation.*

4.2.14 The Minister also highlighted the important role of the planning system stating:

4.2.15 "*And subject to the passage of the Planning Bill at Stage 3, the next National Planning Framework and review of Scottish Planning Policy will include considerable focus on how the planning system can support our climate change goals*".

CCC Annual Report 2020

4.2.16 CCC's 2020 report to Parliament which assessed progress in reducing UK emissions over the past year. The report includes new advice to the UK Government on securing a green and resilient recovery following the COVID-19 pandemic. It recommends that Ministers seize the opportunity to turn the COVID-19 crisis into a defining moment in the fight against climate change.

4.2.17 The document is an update on the progress of reducing emissions within the UK over the past year and also provides advice on a green recovery following the COVID-19 crisis. It highlights that net zero emissions and improved climate resilience are integral to the COVID-19 recovery. Climate investments will also assist in job creation and encourage economic recovery.

4.2.18 In the report, CCC has assessed an array of measures and collated the most up to date evidence on the role of climate policies within the economic recovery. Within the report five investment priorities are recommended:

- Low-carbon retrofits and buildings that are fit for the future.

[5] Available at: Climate change: Reducing greenhouse gas emissions - gov.scot (www.gov.scot)

[6] Available at https://www.gov.scot/publications/securing-green-recovery-path-net-zero-update-climate-change-plan-20182032/ (accessed 01/09/2021)

[7] The CCC is an independent, statutory body established under the Climate Change Act 2008. Its purpose is to advise the UK Government and Devolved Administrations on emissions targets and report to Parliament on progress made in reducing greenhouse gas emissions and preparing for climate change.

[8] A net zero target would require 100% reduction in greenhouse gas emissions. It is referred to as 'net' as the expectation is that it would be met with some remaining sources of emissions which would need to be offset by removals of CO_2 from the atmosphere.

[9] Available at https://www.gov.uk/government/publications/energy-white-paper-powering-our-net-zero-future (accessed 01/09/2021)

- Tree planting, peatland restoration and green infrastructure.
- Energy networks must be strengthened.
- Infrastructure to make it easy for people to walk, cycle and work remotely.
- Moving towards a circular economy.

4.2.19 Combined with these investment priorities the following opportunities have been identified to support the transition and recovery by investing in the UK's workforce and in lower-carbon behaviours and innovation:

- Reskilling and retraining programmes.
- Leading a move towards positive behaviours.
- Targeted science and innovation funding.

4.2.20 The UK hosted the G7 summit in June 2021. A key outcome from the summit included new commitments towards climate action. The UK is set to host the COP26 summit in November 2021 which will be another opportunity to demonstrate the UK's climate leadership and provide clear milestones for the next steps in the UK's emission targets climate adaptations.

Reducing emissions in Scotland Progress Report to Parliament, Committee on Climate Change, October 2020

4.2.21 This report provides a useful benchmark of Scotland's progress towards meeting climate change targets. Whilst noting that good progress was made during the 2010s towards reducing emissions, this was largely through the increase in renewable energy generation alongside the closure of Scotland's last coal fired power station in 2016. The challenge ahead will be focussed on accelerating the decarbonisation of other sectors primarily through further electrification. The paper recognises on page 11 how the Scottish Government has taken important steps to '*embed Net Zero as a core Government policy, framing major fiscal and Parliamentary events around climate action*[10].

4.2.22 The document also highlights that net zero emissions and improved climate resilience are integral to the COVID-19 recovery noting that the Scottish Government must take actions to improve resilience by integrating adaption into all government policy.

Protecting Scotland, Renewing Scotland: The Government's Programme for Scotland 2020-2021

4.2.23 The Scottish Government published its strategy Protecting Scotland, Renewing Scotland[11] in September 2020, which sets out actions and a recovery plan for 2020 and beyond in response to COVID-19.

4.2.24 In the introduction delivered by First Minister Nicola Sturgeon it states that "*We must use this moment to make significant advances to deliver the fairer, greener, more prosperous Scotland we all want to see*". She continues saying "*Central to that recovery is a new national mission to help create new jobs, good jobs and green jobs".* The First Minister also highlighted the importance of a green recovery stating: "*Even before the pandemic, we knew we had significant work to do in order to improve the state of nature and meet our statutory commitment to be a net zero society by 2045. The impacts of the crisis have reinforced the need for that, but also the opportunities it presents".*

4.2.25 As a result of this, the Scottish Government has committed to dedicating £100m over the next five years to a green job fund. The funds will be invested into business and organisations, which support the prospects of greener job creation across Scotland.

4.2.26 This will place a green recovery at the forefront of Scottish Government policy and will offer many businesses a chance to diversify and innovate. It also provides an opportunity for people to retrain and upskill in new high growth areas.

4.2.27 Furthermore, the First Minister states in her introduction to the strategy that: "*We will immediately put a clear new focus on our updated Climate Change Plan, ensuring it reflects our new starting point and the central importance of a green recovery to Scotland's progress, and the Infrastructure Investment plan will reflect our commitment to tackling climate change. We will ensure our rural economy and Scotland's rich natural resources and biodiversity are central to our economic, environmental, and social wellbeing".*

4.2.28 Additional commitments include securing 8 and 12 GW of installed onshore wind by 2030, subject to consultation. Furthermore, the publication of a new Onshore Wind Policy Statement is proposed in 2022 detailing the vital role that this technology will play in the delivery of net zero targets.

Renewable energy in the UK market

4.2.29 Following the announcement of the closure of the Renewables Obligation scheme to onshore wind in 2015 it has broadly been accepted that there must be a change in approach to deliver onshore wind farm developments in a manner that is efficient and economically viable. In 2020, a new announcement[12] was released for onshore wind to be re-introduced to the Contracts for Difference (CfD) electricity auction in late 2021. The draft budget for Allocation Round 4 (AR4) has since been released in September 2021[13] confirming £265 million will be distributed across 3 pots with onshore wind representing pot 1. Final budget parameters for AR4 will be announced in late November 2021. Given the level of competition, projects need to be designed on a worst-case scenario i.e. to generate 'subsidy free' with net payback to the billpayer under the CfD mechanism.

4.2.30 Technological change and the removal of subsidy has led to the development of new larger wind turbines with larger rotor diameters, taller tip heights and higher capacity generators. These turbines increase efficiency and maximise the use of the available wind resource, and also reduce the turbine numbers per unit area of land. This movement towards larger turbines is now reflected in more recent renewable energy policy, such as in the Scottish Energy Strategy, as discussed in section 4.4.2 below but this change was not anticipated in older guidance, for example that of NatureScot and local authorities.

4.3 RELEVANT SCOTTISH RENEWABLE ENERGY POLICIES

4.3.1 In the past, renewable energy had been guided in Scotland by the 2020 Route Map for Renewable Energy in Scotland and the Renewables Action Plan (2009) as well as the UK policies and guidance mentioned above. Following this, after being on course to meet the ambitious targets it presented, the Scottish Energy Strategy was produced in 2017 to guide the future development of energy in Scotland. This strategy was accompanied by the 2017 Onshore Wind Policy Statement.

[10] Available at: https://www.theccc.org.uk/wp-content/uploads/2020/10/Reducing-emissions-in-Scotland-Progress-Report-to-Parliament-FINAL.pdf (last accessed 24/08/2021)

[11] Available at: https://www.gov.scot/publications/protecting-scotland-renewing-scotland-governments-programme-scotland-2020-2021/ (last accessed 24/08/2021)

[12] Available at: UK's fourth CfD renewable energy auction in late 2021 to aim for 12 GW | S&P Global Platts (last accessed 24/08/2021)

[13] Available at: Draft budget of £265 million announced for Allocation Round 4 | Contracts for difference CfD (cfdallocationround.uk)

Scottish Energy Strategy

4.3.2 The Scottish Energy Strategy[14] was published in December 2017. The Strategy introduced new targets for the energy system by 2030, additional to those of the 2020 Route Map for Renewable Energy in Scotland and the Renewables Action Plan.

4.3.3 It is estimated that 17 GW of installed renewable capacity will be required by 2030 for these targets to be met. The installed capacity of renewables in Scotland was 9.5 GW in June 2017. It is therefore considered that the ambitious but achievable target set in strategy of **generating 50% of Scotland's energy demand for heat, transport and electricity by renewable resources by 2030** can be met. This represents a notable increase in the targets which underpinned the Scottish Planning Policy (SPP) in 2014, a point which is discussed further in section 12.6 of this chapter.

4.3.4 Scotland's Energy Strategy Position Statement[15] was published in March 2021 and provides an overview of the short to medium term priorities for ensuring a green recovery, aligned with the net zero target.

4.3.5 This energy strategy has been under review and in January 2023, a draft Energy Strategy combined with a Just Transition Plan was published for consultation and sets out a plan for renewables in Scotland to be accelerated as fossil fuel resources decline. Some of the key policies and proposed targets are outlined in section 4.3.14 - 4.3.20 below.

A 2050 Vision

4.3.6 The Scottish Energy Strategy (2017) outlines a vision for energy production in Scotland for 2050. The vision is centred on achieving a strong, low-carbon economy in which renewable energy in Scotland (which contributed 42% to the UK's low carbon sector in 2015) play an important part.

4.3.7 It sets new targets to produce the equivalent of 50% of Scotland's heat, transport and electricity consumption by renewable sources by 2030, with the ambition of a system wide approach towards energy production and to increase the productivity of energy use across the Scottish economy by 30%.

4.3.8 The strategy recognises Scotland's potential with the renewable energy industry rapidly growing in the country. Scotland is a substantial contributor to both UK and EU energy systems. It has great potential to help meet both national and local energy targets. Page 43 states:

"*Our energy and climate change goals mean that onshore wind must continue to play a vital role in Scotland's future – helping to decarbonise our electricity, heat and transport systems, boosting our economy, and meeting local and national demand.*"

Scotland's Changing Energy System

4.3.9 The Scottish Energy Strategy identifies an ongoing trend in Scotland's energy system towards rapid growth in harnessing the country's renewables resources, making for a largely decarbonised electricity supply.

4.3.10 Building on this success, it is the aspiration to continue this change in the energy system and begin to tackle decarbonising the heat and transport sectors to meet the Country's updated energy and climate change targets. Renewables have an important role to play in this in a shift away from the use of and reliance on fossil fuels in energy production, as well as energy efficiency. This is essential in helping the Scottish Government meet the set energy and climate change targets and become an energy leader.

Renewables and Scotland's Economy

4.3.11 The Scottish Energy Strategy recognises that the renewables industry has been a key economic driver within Scotland's Economy. In 2015, an estimated 58,500 jobs were supported by Scotland's low carbon and renewable energy sector and supply chain. Moreover, Scotland is now a key contributor to innovations in renewable energy technology.

4.3.12 The strategy concludes that onshore wind is a key component in Scotland's industrial opportunities. In 2015, it was estimated that the sector supported 7,500 jobs in Scotland, generating more than a £3 billion turnover.

4.3.13 See chapter 14: Socioeconomics, Tourism and Recreation for details of Proposed Development's economic benefits.

Scotland's Draft Energy Strategy and Just Transition Plan

4.3.14 On January 10th 2023, a route map to secure Scotland's fastest possible fair and just transition away from fossil fuels was published for consultation[16]. The draft 'Energy Strategy and Just Transition Plan' sets out a plan for Scotland's renewables revolution to be accelerated as North Sea basin resources decline.

4.3.15 This would result in a net jobs gain across the energy production sector, with the potential to increase renewable energy exports and reduce exposure to future global energy market fluctuations.

4.3.16 Key policy proposals published for consultation include:

- substantially increasing the current level of 13.4 Gigawatts (GW) of renewable electricity generation capacity, with an additional 20 GW by 2030, which could produce the equivalent of nearly 50% of current demand
- an ambition for 5 GW of renewable and low-carbon hydrogen power by 2030, and 25 GW by 2045
- increasing contributions of solar, hydro power and marine energy to the energy mix
- generation of surplus electricity enabling export of electricity and renewable hydrogen to support decarbonisation across Europe
- setting out final policy positions on fossil fuel energy, including consulting on a presumption against new exploration for North Sea oil and gas
- accelerated decarbonisation of domestic industry, transport and heat in buildings
- increasing access to affordable energy by urging the UK Government to take stronger, more targeted action for fair energy market reform
- maximising household, business and community benefit from energy projects, including through shared ownership of renewables

4.3.17 Published as part of the draft Energy Strategy is a Just Transition Plan for the energy sector. This details the support being provided to grow Scotland's highly skilled energy workforce, increase jobs in energy generation and the supply chain, while enabling communities and businesses, particularly in the North East, to prosper.

4.3.18 Analysis shows the number of low carbon production jobs is estimated to rise from 19,000 in 2019 to 77,000 by 2050 as the result of a just energy transition, meaning there will be more jobs in energy production in 2050 than there are now.

4.3.19 The Strategy also sets out recommended actions for the UK Government to take in reserved policy areas, including powers relating to energy security, market mechanisms, network investment and market regulation.

[14] Available at: http://www.gov.scot/Resource/0052/00529523.pdf (accessed 24/08/2021)

[15] Available at Energy strategy: position statement - gov.scot (www.gov.scot) (accessed 01/09/2021)

[16] Draft Energy Strategy and Just Transition Plan - gov.scot (www.gov.scot)

4.3.20 Scottish Ministers have invited the UK Government to join an Energy Transition delivery group to drive forward the vision set out in the Strategy.

Scottish Onshore Wind Policy Statement 2022

4.3.21 The Scottish Onshore Wind Policy Statement published 2017 was reassessed and underwent consultation to update with a draft published in November 2021. Following consultation, the final OWPS 2022 was published in December 2022[17].

4.3.22 The OWPS refers to the Climate Change Plan Update and RenewableUK 'Onshore Wind Industry Prospectus' which sets out the need for Scotland to develop an additional 12GW of onshore wind capacity.

4.3.23 The Climate Change Committee (CCC) developed four exploratory scenarios for emissions to 2050. These estimate that, in every scenario, the UK will require a total of 25-30 GW of installed onshore wind capacity by 2050 to meet government targets - which would mean doubling the current UK installed capacity.

4.3.24 In line with this commitment, and reflecting the natural life cycles of existing windfarms, The OWPS sets a new ambition for the deployment of onshore wind in Scotland:

A minimum installed capacity of 20 GW of onshore wind in Scotland by 2030.

4.3.25 This ambition will help support the rapid decarbonisation of the energy system, and the sectors which depend upon it, as well as aligning with a just transition to net zero whilst other technologies reach maturity.

4.3.26 Meeting climate targets will require a rapid transformation across all sectors of our economy and society. This means ensuring the right development happens in the right place. Meeting the ambition of a minimum installed capacity of 20 GW of onshore wind in Scotland by 2030 will require taller and more efficient turbines.

4.3.27 Having set out the ambition the focus of the policy is how to overcome barriers to the delivery of the outcome and achieving those ambitions.

4.3.28 In August 2021, the Scottish Government and the Scottish Green Party Parliamentary Group created a shared draft policy programme[18] – the Bute House Agreement – that would see the parties working together to achieve objectives relating to the climate emergency over the next 5 years. It details commitments to investing at least £1.8 billion over this period in energy efficiency and renewable heating and creating a bigger focus on green jobs.

4.4 PLANNING FRAMEWORK

4.4.1 The section below briefly describes relevant national and local planning policies, with further detail provided in the PDAS accompanying the application for consent. The Electricity Act 1989 and The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 are also considered due to their relevance to the consent of the Proposed Development.

4.4.2 The statutory provisions in section 25 of the Town and Country Planning (Scotland) Act 1997 (the 1997 Act), which establish that the status of the development plan when making decisions in relation to applications for planning permissions, do not apply to Section 36 determinations and the related grant of any deemed planning permission. Consequently, there is no requirement for the determination to be made in accordance with the development plan unless material considerations indicate otherwise.

4.4.3 However, it is acknowledged that as the application seeks approval for a form of development, the relevant provisions of the development plan are appropriate considerations in relation to the Section 36 determination process.

4.4.4 It is for the decision maker to determine the weight afforded to each relevant consideration, which would inevitably include the relevant provisions of the development plan. The requirements of paragraphs 32 and 33 of the SPP will also be considered in relation to the development plan and give presumption in favour of development that contributes to sustainable development.

The Electricity Act 1989

4.4.5 As the Proposed Development will generate over 50 MW of electricity, it will require consent from the Scottish Ministers under Section 36 of The Electricity Act 1989. Importantly, there is no 'primacy' of the Development Plan in decisions-making on applications made under the 1989 Act, as would be the case for an application under the Town and Country Planning (Scotland) Act 1997, as amended. Rather, weight can be attributed by the decision-maker to all relevant considerations including the various levels of national and local energy and planning related policy and guidance as deemed appropriate, as well as any socio-economic benefits of the Proposed Development.

4.4.6 As set out in the case of *William Grant & Sons Distillers Limited v Scottish Ministers* [2012] CSOH 98, Section 25 of the 1997 Act sets a requirement to have regard to the Development Plan in making decisions on planning applications, however deemed planning permission directions under Section 57(2) are not bound by the same rule. Although the consenting authority in this instance is Scottish Ministers, Schedule 8 of the Act requires the relevant local planning authorities are consulted on planning matters; in this case Dumfries and Galloway Council.

4.4.7 The requirements of Schedule 9 of the 1989 Act, which is concerned with the preservation of amenity and fisheries, are applied to applications for consent under Section 36 of the Electricity Act 1989. Pursuant of Schedule 9 of the Act, the Applicant shall have regard to the desirability of preserving natural beauty, conserving flora and fauna and geological or physiographical features of special interest and of protecting sites, buildings and objects of architectural, historical or archaeological interest, and shall do, within reason, what it reasonably can to mitigate any effect the Proposed Development might have on these features. The Applicant has considered the provisions of Schedule 9 duties and considered them in the development of the project and Chapter 2: Site Selection & Design Evolution provides detail on the appropriate design principals applied. Mitigation of effects are set out in detail in the following chapters of the EIAR. In considering the Proposed Development, the Scottish Ministers shall have regard to the desirability of these matters and the extent to which the Applicant has complied with its duty to mitigate effects, where reasonably possible.

4.4.8 These matters have been addressed in this EIAR and assessments of these features have been undertaken and are described along with a summary of the proposed mitigation measures in the relevant chapters of the EIAR to mitigate potential environmental effects upon these assets.

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

4.4.9 Regulation 3 of the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 states that Scottish Ministers must not:-

(a) grant an Electricity Act consent for EIA development; or

(b) direct that planning permission is deemed to be granted under section 57(2) or (2ZA) of the 1997 Act in respect of EIA development,

unless an environmental impact assessment has been carried out in respect of that development and in carrying out such assessment the Scottish Ministers must take the environmental information into account.

4.4.10 Such EIA has been completed following liaison with consultees, extensive survey work and design iterations.

[17] Onshore wind: policy statement 2022 - gov.scot (www.gov.scot)

[18] Available at: Agreement with Scottish Green Party - gov.scot (www.gov.scot)

The Planning Acts

4.4.11 The request that planning permission be deemed to be granted is governed by Section 57 (2) of the Town and Country Planning (Scotland) Act 1997, which provides 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 operation or change of use to which the consent relates."

4.4.12 The Planning etc. (Scotland) Act 2006 introduced additional processes in relation to the scale of development proposals. Although not required as a Section 36 application, given the scale of the Proposed Development, the Applicant has followed good practice in submitting a Planning, Design and Access Statement and a Pre-Application Consultation Report.

4.4.13 The most recent amendment to the 1997 Act comes in the form of the Planning (Scotland) Act 2019. Although the principal elements of this have yet to be implemented, most notably through a revised version of the National Planning Framework (NPF)/Scottish Planning Policy which will have Development Plan status in decision making (rather than a material consideration). The 2019 Act makes it clear under the 'Purpose of Planning' in Section 1 that contributing to sustainable development is considered to be in the long-term public interest. It also recognises under the requirements for the new NPF in Section 3 that regard is to be had to achieving Climate Change targets.

4.5 NATIONAL PLANNING POLICY AND ADVICE

National Planning Framework

4.5.1 The Planning etc. (Scotland) Act 2006 amended the 1997 Act to put NPF on a statutory footing. The third edition, NPF3, was published in June 2014[19]. It sets out a strategy for Scotland's development over the next 20 to 30 years, providing a national context for development plans and planning decisions, to inform wider programmes of government, public agencies and local authorities.

4.5.2 NPF3 confirms the importance of renewable energy to Scotland's energy mix and highlights upgrades to the electricity transmission system infrastructure that are needed to facilitate this development. The vision for Scotland portrayed in NPF3 is that of a successful, sustainable place, a low carbon place, a natural resilient place and a connected place. These visions put emphasis on the aspirations of Scotland being a leader in low-carbon energy generation, both onshore and offshore, to create a more energy efficient economy with fewer greenhouse gas emissions. The target is to generate the equivalent of Scotland's gross annual electricity consumption from renewable sources by 2020. The 2015 target of 50% was exceeded and recent data has stated that renewable electricity generation has risen from 90% in 2019 and is now equivalent to approximately 97% of Scotland's gross electricity consumption in 2020[20].

4.5.3 NPF is a relevant consideration and assessment of the Proposed Development against NPF3 is provided in the supporting Planning, Design and Access Statement to this application.

4.5.4 The energy sector is a key focus in Scotland's Economic Development Strategy, with recognition given to the importance of emerging renewable energy technologies. NPF3 states in paragraph 3.6 that the renewables industry currently supports around 11,000 jobs in Scotland and paragraph 3.9 states the Government's intention to maintain this:

"Security of supplies and addressing fuel poverty remain key objectives. We want to continue to capitalise on our wind resource, and for Scotland to be a world leader in offshore renewable energy. In time, we expect the pace of onshore wind energy development to be overtaken by a growing focus on our significant marine energy opportunities, including wind, wave and tidal energy".

4.5.5 NPF3 takes a stronger, more prescriptive stance regarding spatial development of onshore wind, stating in paragraph 3.23 that:

"Onshore wind will continue to make a significant contribution to diversification of energy supplies. We do not wish to see wind farm development in our National Parks and National Scenic Areas. Scottish Planning Policy sets out the required approach to spatial frameworks which will guide new wind energy development to appropriate locations, taking into account important features including wild land."

4.5.6 NPF3 also states the importance of community ownership in renewable energy and aims to deliver 500 MW of renewable energy in community and local ownership by 2020 and increase benefits in commercial scale developments.

4.5.7 Preparation of NPF4 was delayed by the impacts of COVID-19 and was not approved at the time this document was drafted. NPF4 was initially laid before the Scottish Parliament in November 2021 and has subsequently been the subject of consultation and Parliamentary Committee scrutiny. A revised version of NPF4 2022, which reflects the Scottish Government's consideration of the responses received as part of the consultation, was laid before the Scottish Parliament on 8 November 2022 for approval.

4.5.8 NPF4 2022, received final approval from the Scottish Parliament on 11 January 2023 and awaits adoption by the Scottish Ministers. Regulations have now been laid before the Parliament enabling the Scottish Ministers to adopt the plan, and this is likely to happen in February 2023. NPF4 will replace Scottish Planning Policy (SPP) 2014 and NPF3 and will become the national element of the statutory development plan for all parts of Scotland. .

Scottish Planning Policy

4.5.9 The latest Scottish Planning Policy (SPP)[21] was published in June 2014 and is a statement of Scottish Ministers' priorities. It will be a relevant consideration in the determination of this application albeit there is now a policy lag between the 2014 SPP and the more recent Scottish Energy Strategy and Onshore Wind Policy Statement (OWPS), which in turn pre-date the declaration of climate emergency and statutory Net Zero targets. A draft Scottish OWPS is currently being drafted and undergoing consultation for publication in 2022.

4.5.10 A revised version of the Scottish Planning Policy was published in 2020 but has since been removed following a legal challenge in the Court of Session in August 2021[22].

4.5.11 SPP currently highlights that the planning system is essential to achieving the Scottish Government's central purposes of increasing sustainable economic growth. With reference to Paragraph 18 of the SPP it is detailed that The Climate Change (Scotland) Act 2009 sets a target of reducing greenhouse gas emissions by at least 80% by 2050, with an interim target of reducing emissions by at least 42% by 2020. Annual greenhouse gas emission targets are set in secondary legislation. Section 44 of the Act places a duty on every public body to act:

- in the way best calculated to contribute to the delivery of emissions targets in the Act;
- in the way best calculated to help deliver the Scottish Government's climate change adaptation programme; and

[19] Available at: http://www.gov.scot/Resource/0045/00453683.pdf (last accessed 24/08/2021).

[20] Available at: https://www.scottishrenewables.com/our-industry/statistics (last accessed 24/08/2021)

[21] Available at: http://www.scotland.gov.uk/Publications/2014/06/5823 (accessed 24/08/2021)

[22] Available at https://www.gov.scot/publications/scottish-planning-policy/ (accessed 01/09/2021)

- in a way that it considers is most sustainable.

4.5.12 This need to tackle climate change is recognised as a principal challenge of sustainable economic growth, albeit it must be noted that targets have increased substantially since SPP was published in 2014. There is in consequence a notable shift in position and context between the SPP and more recent SES and OWPS in terms of the extent to which onshore is expected and needs to contribute towards these increased targets.

4.5.13 The SPP also introduces a presumption in favour of development that contributes to sustainable development, and sets out in paragraph 33 the weight which should be given to this where Development Plans have become outdated.

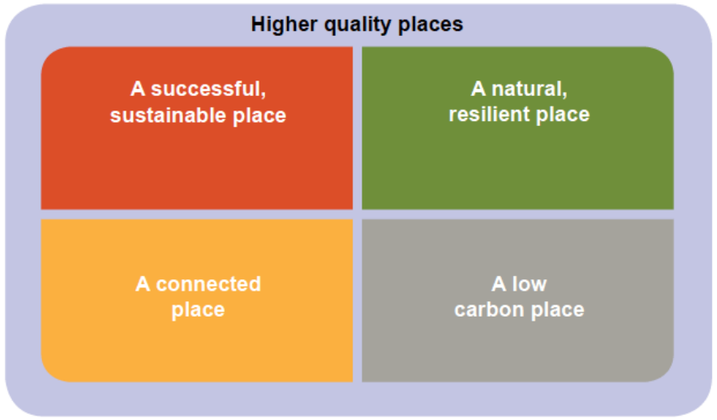
4.5.14 Under the SPP, to achieve the "right development in the right place" development plans, policies and decisions that consider onshore wind should amongst other things:

- Give due weight to net economic benefit and respond to economic issues, challenges and opportunities, as outlined in local economic strategies;
- Support the delivery of energy infrastructure;
- Support climate change mitigation and adaption;
- Have regard to the principles for sustainable land use set out in the Land Use Strategy[23] and
- Avoid over-development and protect the amenity of new and existing development.

Other principles relevant to the determination of applications include the protection and enhancement of the cultural and natural environment, including biodiversity and landscape; to maintain, enhance and promote access to open space and recreation opportunities; and to take into account the implications of development for water, air and soil quality.

4.5.15 The SPP states that the planning system should "*take every opportunity to create high quality places by taking a design-led approach*". The SPP aims to achieve this through the use of a "*holistic approach that responds to and enhances the existing place while balancing the costs and benefits of potential opportunities over the long term*".

4.5.16 This means considering the relationships between:



4.5.17 This resulting outcomes from this approach are detailed in sections 4.4.31 – 4.4.41 below.

[23] Available at: Getting the best from our land - A land use strategy for Scotland (webarchive.org.uk) (accessed 24/08/2021).

A Successful, Sustainable Place

4.5.18 The SPP recognises the importance of supporting sustainable economic growth and regeneration, setting out the role that the Scottish Government expects the planning system to play in the sustainable economic growth of Scotland.

Rural Development

4.5.19 The overall approach advocated in the SPP is that of a proactive stance to development in rural areas. The Planning System should:

- *"In all rural and island areas promote a pattern of development that is appropriate to the character of the particular rural area and the challenges it faces"; and*
- *"Encourage rural development that supports prosperous and sustainable communities and businesses whilst protecting and enhancing environmental quality".*

A Low-carbon Place

4.5.20 Planning Authorities should support the development of renewable energy technologies, guide development to appropriate locations and provide clarity on the issues that will be taken into account when specific proposals are assessed. The development plans should be supportive of all scales of energy development to ensure that an area's renewable energy potential is realised and to make clear the factors that will be taken into account in decision making.

4.5.21 The energy and climate change policies referred to above are discussed within the SPP as part of the planning system. The SPP states that the planning system should:

"*Support the transformational change to a low carbon economy, consistent with national objectives and targets.*

Support the development of a diverse range of electricity generation from renewable energy technologies – including the expansion of renewable energy generation capacity."

4.5.22 Within 'A Low Carbon Place', a sub-section relating to onshore wind specifies that:

"*Planning authorities should set out in the development plan a spatial framework identifying those areas that are likely to be most appropriate for onshore wind farms as a guide for developers and communities*".

4.5.23 A spatial framework provided within the SPP which should be followed "*in order to deliver consistency nationally*". The SPP spatial framework is made up of three groups.

4.5.24 Group 1 are areas where wind farms will not be acceptable, these areas are made up of National Parks and National Scenic Areas.

4.5.25 Group 2 are areas of significant protection where wind farms may be appropriate in some circumstances. Consideration will be required where Proposed Developments are to be located within these areas to "*demonstrate that any significant effects on the qualities of these areas can be substantially overcome by siting, design or other mitigation*". Group 2 areas include 'National and International designations', i.e. World Heritage Sites, Natura 2000 and Ramsar sites, National Nature Reserves, Sites of Special Scientific Interest, sites identified in the Inventory of Gardens and Designed Landscapes, and Sites in the Inventory of Historic Battlefields; 'Other nationally important mapped environmental interests', i.e. areas of wild land and carbon rich soils, deep peat and priority peatland habitat; and 'Community separation for consideration of visual impact, i.e.' an area not exceeding 2 km around cities, towns and villages identified on the local development plan with an identified settlement envelope or edge.

4.5.26 Group 3 are areas with potential for wind farm development which includes all areas beyond Groups 1 and 2. Within these areas "*wind farms are likely to be acceptable, subject to detailed consideration against identified policy criteria*".

4.5.27 Following the above criteria, the Proposed Development is situated predominately within a Group 3 area. According to the NatureScot Carbon and Peatland Map[24], the site is covered in soils ranging from Class 1 to 5 which includes carbon rich soils, deep peat and priority peatland habitat and therefore some parts of the Proposed Development Area come under Group 2. Assessment of peat and carbon is provided in this EIAR, particularly Chapter 8.

4.5.28 The 2014 SPP[25] has included locally designated landscape sites as potential areas for wind energy (Group 3).

National Planning Framework 4 (NPF4)

4.5.29 NPF4 has been subject to consultation and committee scrutiny over the last year and was first laid before the Scottish Parliament in November 2021. On 8th November 2022 the revised NPF4 was laid before Parliament for approval. It is accompanied by an Explanatory Report which explains how the Scottish Government has considered responses to the initial draft NPF4 received during the preceding period of Parliamentary scrutiny and consultation, in line with its statutory duty. There is no statutory requirement to consult further, and the Scottish Government has confirmed that no further consultation will take place. NPF4 was approved on 11th January 2023 and it is expected that NPF4 will be adopted prior to the consideration of the application for the proposed development.

4.5.30 NPF4 will form part of the statutory Development Plan on adoption and publication (assuming the Scottish Minsters commence the necessary provisions in the Planning Act). Until then, the Revised NPF4 is a material consideration in development management decision making.

4.5.31 Section 13 of the 2019 Act amends Section 24 of the 1997 Act regarding the meaning of 'development plan', such that for the purposes of the 1997 Act, the development plan for an area is taken as consisting of the provisions of:

- The National Planning Framework;
- Any Strategic Development Plan; and
- Any Local Development Plan.

4.5.32 NPF4 introduces centralised development management policies which are to be applied Scotland wide, and also provides guidance to Planning Authorities with regard to the content and preparation of LDPs.

4.5.33 Annex A adds that NPF4 is required by law to contribute to six outcomes. These relate to meeting housing needs, health and wellbeing, population of rural areas, addressing equality and also "*meeting any targets relating to the reduction of emissions of greenhouses gases, and, securing positive effects for biodiversity*".

4.5.34 The spatial strategy is to support the delivery of:

- 'Sustainable Places': "where we reduce emissions, restore and better connect biodiversity";
- 'Liveable Places': "where we can all live better, healthier lives"; and
- 'Productive places': "where we have a greener, fairer and more inclusive wellbeing economy".

4.5.35 Page 6 of NPF4 addresses the delivery of sustainable places. Reference is made to the consequences of Scotland's changing climate, and it states, *inter alia*:

"*Scotland's Climate Change Plan, backed by legislation, has set our approach to achieving net zero emissions by 2045, and we must make significant progress towards this by 2030…..Scotland's Energy Strategy will set a new agenda for the energy sector in anticipation of continuing innovation and investment."*

4.5.36 Part 2 of NPF4 (page 36) addresses national planning policy by topic under the three themes of sustainable, liveable and productive places.

4.5.37 NPF4 continues the approach set out in NPF3 of identifying **national developments**. Proposed National Development 3 is entitled "*Strategic Renewable Electricity Generation and Transmission Infrastructure*"

4.5.38 Annex B of NPF 4, Page 103, provides the Statement of Need for National Development 3 and it states:

"*This national development supports renewable electricity generation, repowering, and expansion of the electricity grid.*

A large and rapid increase in electricity generation from renewable sources will be essential for Scotland to meet its net zero emissions targets. Certain types of renewable electricity generation will also be required, which will include energy storage technology and capacity, to provide the vital services, including flexible response, that a zero carbon network will require. Generation is for domestic consumption as well as for export to the UK and beyond, with new capacity helping to decarbonise heat, transport and industrial energy demand. This has the potential to support jobs and business investment, with wider economic benefits.

The electricity transmission grid will need substantial reinforcement including the addition of new infrastructure to connect and transmit the output from new on and offshore capacity to consumers in Scotland, the rest of the UK and beyond. Delivery of this national development will be informed by market, policy and regulatory developments and decisions."

4.5.39 The location for ND3 is set out as being all of Scotland and in terms of need it is described as:

"Additional electricity generation from renewables and electricity transmission capacity of scale is fundamental to achieving a net zero economy and supports improved network resilience in rural and island areas."

4.5.40 Reference is made to the designation and classes of development which would qualify as NAD3, and it states in this regard:

"A development contributing to 'Strategic Renewable Electricity Generation and Transmission' in the location described, within one or more of the Classes of Development described below and that is of a scale or type that would otherwise have been classified as 'major' by 'The Town and Country Planning (Hierarchy of Developments) (Scotland) Regulations 2009', is designated a national development:

(a) on and off shore electricity generation, including electricity storage, from renewables exceeding 50 megawatts capacity;

(b) new and/or replacement upgraded on and offshore high voltage electricity transmission lines, cables and interconnectors of 132kv or more; and

(c) new and/or upgraded Infrastructure directly supporting on and offshore high voltage electricity lines, cables and interconnectors including converter stations, switching stations and substations."

4.5.41 The Proposed Development would therefore have national development status as per these provisions of NPF4.

4.5.42 Annex A of NPF4 sets out the way in which the document is to be used. In terms development management and the application of the **national levels policies** in the consideration of applications, NPF4 states:

"*The policy sections are for use in the determination of planning applications. The policies should be read as a whole. Planning decisions must be made in accordance with the development plan, unless material considerations indicate otherwise. It is for the decision maker to determine what weight to attach to policies on a case by case basis. Where a policy states that development will be supported, it is in principle, and it is for the decision maker to take into account all other relevant policies*".

[24] Available at: https://map.environment.gov.scot/Soil_maps/?layer=10 (last accessed 24/08/2021)

[25] Available at: http://www.scotland.gov.uk/Publications/2013/04/1027 (accessed 24/08/2021).

4.5.43 In terms of 'sustainable places' policies which are relevant to the proposed development include the following:

- Policy 1: Tackling the Climate and Nature Crisis;
- Policy 3: Biodiversity;
- Policy 4: Natural Places;
- Policy 5: Soils;
- Policy 6: Forestry, Woodland and Trees;
- Policy 7: Historic Assets and Places; and
- Policy 11: Energy.

4.5.44 For the consideration of onshore wind energy development, Policy 11 is the lead policy against which the Proposed Development falls to be considered.

4.5.45 Policy 11 states:

a*) Development proposals for all forms of renewable, low-carbon and zero emissions technologies will be supported. These include:*

i. wind farms including repowering, extending, expanding and extending the life of existing wind farms;

ii. enabling works, such as grid transmission and distribution infrastructure;

iii. energy storage, such as battery storage and pumped storage hydro;

b) Development proposals for wind farms in National Parks and National Scenic Areas will not be supported.

c) Development proposals will only be supported where they maximise net economic impact, including local and community socio-economic benefits such as employment, associated business and supply chain opportunities.

d) Development proposals that impact on international or national designations will be assessed in relation to Policy 4.

e) In addition, project design and mitigation will demonstrate how the following impacts are addressed:

i. impacts on communities and individual dwellings, including, residential amenity, visual impact, noise and shadow flicker;

ii. significant landscape and visual impacts, recognising that such impacts are to be expected for some forms of renewable energy. Where impacts are localised and/or appropriate design mitigation has been applied, they will generally be considered to be acceptable;

iii. public access, including impact on long distance walking and cycling routes and scenic routes;

iv. impacts on aviation and defence interests including seismological recording;

v. impacts on telecommunications and broadcasting installations, particularly ensuring that transmission links are not compromised;

vi. impacts on road traffic and on adjacent trunk roads, including during construction;

vii. impacts on historic environment;

viii. effects on hydrology, the water environment and flood risk;

ix. biodiversity including impacts on birds;

x. impacts on trees, woods and forests;

xi. proposals for the decommissioning of developments, including ancillary infrastructure, and site restoration;

xii. the quality of site restoration plans including the measures in place to safeguard or guarantee availability of finances to effectively implement those plans; and

xiii. cumulative impacts.

In considering these impacts, significant weight will be placed on the contribution of the proposal to renewable energy generation targets and on greenhouse gas emissions reduction targets.

4.5.46 The remaining polices are all relevant to the consideration of the Proposed Development but as set out in Annex A of NPF 4 the weight to be attached policies in a matter for the decision maker.

4.5.47 The current National Planning Framework (NPF3) and Scottish Planning Policy (published in 2014) will remain in place until NPF4 is adopted.

Planning Circulars and Advice Notes

4.5.48 Planning Circulars and Planning Advice Notes (PAN) have been considered during the evolution of the Proposed Development as good practice.

4.5.49 Planning Circular 1 2017 - The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017 has been considered to ensure the EIAR produced for the Proposed Development is proportionate and fit for purpose as per this Circular although it must be noted that the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 apply to the Proposed Development which are complied with.

4.5.50 Specific Advice Sheet: Onshore Wind Turbines[26] has replaced PAN 45 - Renewable Energy. It acts as a web-based, and regularly updated, source of specific advice for the development of onshore wind farms and also recognises substantial growth and increasing diversity in project scale.

4.5.51 Table 4.1 below presents other relevant PAN.

Table 4.1: Planning Advice Notes

Other Relevant PAN	Details
PAN 51 – Planning, Environmental Protection and Regulation[27]	Published in October 2006 and supports existing policy on the role of the planning system in relation to the environmental protection regimes.
PAN 60 – Planning for Natural Heritage[28]	Provides advice on how development and the planning system can contribute to the conservation, enhancement, enjoyment and understanding of Scotland's natural environment and encourage developers and planning authorities to be positive and creative in addressing natural heritage issues.
PAN 68 – Design Statements[29]	Published in August 2003 and explains the design statement process.

[26] Available at: https://www.gov.scot/Resource/0044/00440315.pdf (webarchive.org.uk) (accessed 24/08/2021).

[27] Available at: http://www.gov.scot/Publications/2006/10/20095106/0 (accessed 24/08/2021)

[28] Available at: Planning Advice Note 60 (webarchive.org.uk) (accessed 24/08/2021)

[29] Available at http://www.gov.scot/Publications/2003/08/18013/25389 (accessed 24/08/2021)

Other Relevant PAN	Details
PAN 73 – Rural Diversification[30]	Defines diversification as helping to broaden the economic activity of rural areas, providing opportunity and creating a more balanced and stable economy. It details how planners can support rural diversification by addressing issues of accessibility, infrastructure, scale and design.
PAN 75 – Planning for Transport[31]	Published in August 2005 and aims to provide guidance for improving transport integration with new developments.
PAN 3/2010 – Community Engagement[32]	Published in August 2010. It provides guidance for interacting with the public appropriately and early in the planning process.
PAN 1/2011 – Planning and Noise[33]	Published in March 2011. It includes information about noise from wind turbines and links to web-based planning advice specifically for Onshore Wind Turbines. This document provides advice on 'The Assessment and Rating of Noise from Wind Farms' (ETSU-R-97) published by the former Department of Trade and Industry and the findings of the Salford University report into Aerodynamic Modulation of Wind Turbine Noise.
PAN 2/2011 – Planning and Archaeology[34]	Replaces PAN 42 and sits alongside SPP, Scottish Historic Environment Policy (SHEP) and the Managing Change in the Historic Environment Guidance Notes. PAN 2/2011 includes advice on the handling of archaeological matters within the planning process. For monuments scheduled under the Ancient Monuments and Archaeological Areas Act 1979 there are specific controls for works set out by SHEP and managed by Historic Environment Scotland.

4.6 DEVELOPMENT PLANS AND OTHER LOCAL POLICY

4.6.1 As noted previously, the Proposed Development is within one Local Planning Authority (LPA); Dumfries and Galloway Council (DGC), therefore, its Local Development Plan (LDP) should be considered.

4.6.2 Assessment of the Proposed Development against the LDP is provided in the Planning, Design and Access Statement which accompanies the application.

4.6.3 The Assessment shows that the Proposed Development is well aligned with the strategic elements of the development plan in the local authority area. This strategic element in itself aligns with the general requirements of national planning energy and climate change policy. At a more detailed level the Proposed Development aligns well with the general balancing requirements of the development plan in terms of environmental effects. As the approach taken in the guidance of the local authority represents an additional constraint that does not facilitate and support sustainable development, this guidance can be given limited weight in the decision-making process. Instead, weight should be given to the alignment of the Proposed Development and the Development Plan more generally with national and strategic policy and legislation, the actual suitability of the site for wind farm development, the design response and the detailed findings of the EIAR. Taken together and having regard to the need to apply the planning balance, it is the Applicant's view that the Proposed Development is sufficiently supported by the development plans of the local authority to warrant a positive response.

Dumfries and Galloway Local Development Plan 2 (LDP2) 2019

4.6.4 The Dumfries and Galloway Local Development Plan[35] (LDP2) was adopted on 3 October 2019. The LDP provides a planning framework for the future use and development of land within Dumfries and Galloway, creating a backdrop to guide the location of development over the next ten years alongside setting out development opportunities and ways to enhance the urban and rural environment. The overarching principle of the LDP is that:

"*all development proposals should support sustainable development, including the reduction of carbon and other greenhouse gas emissions".*

4.6.5 The LDP recognises that climate change is a pressing issue globally and outlines polices specific to renewable energy developments. The LDP provides a spatial framework for development of wind energy and two policies directly relevant to the Proposed Development; Policies IN1 and IN2. As noted earlier, the Proposed Development is located primarily within the Group 3 area with potential for wind farm development albeit with pockets of NatureScot mapped carbon rich soils/peatland, which are categorised as Group 2.

4.6.6 Policy IN1 – 'Renewable Energy', the policy states that the Council will support development proposals for all renewable energy generation and/or storage which are located, sited and designed appropriately.

4.6.7 The acceptability of the proposal will be "*determined through an assessment of the details of the proposal including its benefits and the extent to which its environmental and cumulative impacts can be satisfactorily addressed*".

4.6.8 The key DGC policy of relevance to the Proposed Development is Policy IN2: Wind Energy. This policy indicates support for development where it can be accommodated without unacceptable significant adverse effects and cross references other relevant polices.

4.6.9 Policy IN2 – Wind Energy, is split into two parts. Part 1 states that the acceptability of any proposed wind energy development will be assessed against a defined list of criteria.

4.6.10 The LDP seeks to develop its renewables sector to help support growth in the Dumfries and Galloway area, aligning its renewable energy policy with the SPP. The LDP also recognises the importance of the renewable energy sector and its contribution to the economy.

4.6.11 Part 2 of policy IN2 - Wind Energy states that wind energy developments will be supported when sited and designed appropriately. Wind farm developments should also take into account the spatial framework provided within the LDP, which outlines appropriate locations.

4.6.12 The LDP contains other policies relevant to the Proposed Development which have the overarching aim to encourage prosperous and sustainable communities and businesses, balance with protecting and improving the quality of the environment. These are listed below:

- OP1 – Development Considerations
- OP2 – Design Quality and Placemaking
- OP3 – Developer Contributions
- ED9 – Tourism

[30] Available at: http://www.gov.scot/Publications/2005/02/20638/51727 (accessed 24/08/2021)

[31] Available at: http://www.gov.scot/Publications/2005/08/16154453/44538 (accessed 24/08/2021)

[32] Available at: http://www.gov.scot/Publications/2010/08/30094454/0 (accessed 24/08/2021)

[33] Available at: http://www.gov.scot/Publications/2011/02/28153945/0 (accessed 24/08/2021)

[34] Available at: https://www.gov.scot/Resource/Doc/355385/0120020.pdf (webarchive.org.uk) (accessed 24/08/2021).

[35] Available at https://dumgal.gov.uk (accessed 21/03/2019).

- HE4 – Archaeologically Sensitive Areas
- HE6 – Gardens and Designated Landscapes
- NE2 - Regional Scenic Areas
- NE6 - Forestry and Woodland
- NE7 – Trees and Development
- IN11 – Telecommunications
- T1 – Transport Infrastructure

Dumfries and Galloway Supplementary Guidance: Wind Energy Development February 2020

4.6.13 The SPG is intended to help guide developers to appropriate areas for development and provide additional information for planners to assess a wind farm proposal. It provides further detail in support of the development management considerations in Policy IN2: Wind Energy, which the Proposed Development will be assessed against.

Dumfries and Galloway Wind Farm Landscape Capacity Study

4.6.14 The Dumfries and Galloway Wind Farm Landscape Capacity Study (DGWFLCS) is used to inform decision making and is referred to as Appendix C of Part 1 Wind Energy Development: Development Management Considerations Supplementary Guidance. The document seeks to set out the key characteristic and sensitivities to wind farm development within the Dumfries and Galloway administrative area. The document was updated in February 2020 prior to NatureScot releasing updated guidance on landscape sensitivity assessment in Scotland (NatureScot, July 2020[36].

4.6.15 The potential landscape and visual effects of the Proposed Development are assessed in EIAR Chapter 5: Landscape and Visual Impact Assessment. The outcome of these assessments are deemed acceptable.

4.6.16 The assessment has identified that the significant landscape and visual effects of the proposed development would be relatively contained within the surrounding landscape of Upper Glenkens. Significant landscape character effects have been assessed to occur within the upland areas of the Galloway Hills, Southern Uplands and from the northern reaches of Upper Glenkens. Due to this containment by the surrounding uplands, landscape effects would be restricted to the landscape within 12 km of the Proposed Development where the perceptual change to key characteristics would be experienced. This would affect a small part of the overall 45 km study area where fifty-four LCTs would receive a non-significant or no change to their key characteristics as a result of the Proposed Development.

4.6.17 The majority of significant visual effects are identified as typically occurring within approximately 12 km from the nearest proposed turbine. This includes a small number of residential receptors, nearby route receptors and surrounding hill tops to the north, and south west along the Rhinns of Kells.

Dumfries and Galloway Climate Emergency

4.6.18 In June 2019 Dumfries and Galloway Council declared its own climate emergency and has embarked on baseline studies to inform future policy within the area. The Climate Emergency Declaration[37] is a 12-point plan which aims to set the target of emitting net zero carbon in the region by 2025. It covers, amongst other things:

- creating a new and specific council priority, a review of policy and practice across the council and embedding climate change in all policy and practice risk assessments
- understanding the impacts of climate change locally and consider adaptations for people and the environment
- using innovations and technology to reduce our impact and bring about economic development
- creation of new climate change working groups, appointment of a climate change officer and an environmental champion
- communications and cooperation with the public and other organisations on these issues
- production of a climate change Strategic Action Plan

4.6.19 Their Carbon Neutral Strategic Plan (November 2021)[38] sets out the commitments to reduce carbon emissions including to:

- Lead on the transition to cleaner and greener technologies.

4.6.20 Aside from contributing to the Scottish renewable energy target, local renewable energy generation would contribute to the carbon neutral target in Dumfries and Galloway in two different ways:

- When local renewable generation sites connect to the grid, they contribute to the continuing decarbonisation of the national electricity grid. This will be reflected in the Dumfries and Galloway carbon footprint via a lower electricity emission factor.
- Where renewable generation sites directly supply local buildings, buildings using this zero-carbon electricity will reduce the carbon footprint associated with electricity use.

Carbon Payback

4.6.21 A carbon balance assessment report has been produced and SEPA's Carbon Calculator completed, to determine the carbon payback time for the Proposed Development (see EIAR Technical Appendix 4 for full details). 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 1.7 years, if it replaced the fossil fuel electricity generation method. Following the expected **up to 35 years generation of carbon-free renewable electricity**, it is calculated that the Proposed Development will result in up to **3,743,124 tonnes of CO_2 emission savings** when replacing fossil fuel electricity generation. As the negative payback period represents approximately 6% of the operational period and the positive contribution 94% it is possible to conclude that the positive contribution is statistically significant. The Proposed Development therefore illustrates a significantly positive net impact in terms of its contribution towards the reduction of greenhouse gas emissions from energy production.

The Applicant's Policies

4.6.22 The Applicant's corporate strategy is to power climate smarter living and to ensure its customers can live free from fossil fuels within a generation. In order to deliver on this strategy, the Applicant has a number of key policies in place:

4.6.22.1 The Applicant has set a goal for net zero emissions from its own operations and those of its customers and suppliers by 2040. This means reducing emissions intensity in the company's operations (Scope 1+2) by more than 77% by 2030 compared to 2017 and reduce absolute emissions from use of sold

[36] Landscape Sensitivity Assessment – Guidance for Scotland, Consultation draft (NatureScot, July 2020)

[37] Available at: Climate Emergency (dumgal.gov.uk) (accessed 07/12/2021)

[38] Available at: 0090-21-Carbon-Neutral-Strategic-Plan.pdf (dumgal.gov.uk)

products (Scope 3) by 33% by 2030 compared to 2017. This is aligned with the Paris Agreement to limit the rise in global temperatures to 1.5°C and has been certified by the Science Based Targets Initiative.[39]

4.6.22.2 The Applicant is also making significant investments in renewable energy across Northern Europe. At the time of writing, SEK 23 billion (approx.. £1.94 billion) was planned for development construction of new wind farms and SEK 2 billion (£170 million) will be invested in solar and heat energy solutions.

4.6.22.3 Ambitious new targets were set in October 2021 to improve the Applicant's environmental impact through ensuring resources are handled responsibly and production is carried out in a sustainable way, including: an immediate decision to ban decommissioned wind turbine blades from landfill disposal from owned wind farms and committing to re-use, recycle or recover 100% of decommissioned blades; a 50% recycling rate of wind turbine blades by 2025; and a 100% recycling rate of wind turbine blades by 2030. In addition, increased research on the use of recycled composite material in new products and material recycling of composite waste will be carried out. Support will be required from policies and governmental incentives to achieve these targets and to aid the push for business towards a sustainable end of life solution for wind turbine blades.[40]

4.6.22.4 The Applicant's latest Environmental Action Plan also sets a target by 2030 to be a recognised leader in biodiversity management. A core component of this work is to adopt a Net Positive Impact approach, meaning the Developer will go beyond a 'no net loss' approach and implement biodiversity enhancing measures.

4.6.22.5 The Applicant also reports on SF6 use within its business, a gas used in high voltage electrical equipment with a very high global warming potential and is exploring options to reduce and phase out SF6 use for new equipment procurement.[41]

4.6.22.6 The Applicant has also launched an initiative to reduce carbon emissions from the goods and services it buys by 50% by 2030, using its buying power to push for wider emissions reductions in the broader supply chain.[42]

4.6.23 The Applicant is certified by independent sustainability ratings agency EcoVadis, which gave the Developer a platinum rating, the highest score possible placing it within the top 1% of all rated companies, in February 2021.[43]

4.7 SUMMARY

4.7.1 This chapter, alongside the PDAS accompanying this application, highlights the key policies at international, national and local level that relate to renewable energy, which apply to the Proposed Development.

4.7.2 The chapter sets out the significant and growing body of policy and legislation which exists around the pressing need to address climate change and of the role of renewable energy generation in helping both Scottish and UK governments to meet their respective net zero targets. This includes but is not limited to the Scottish Energy Strategy (2017) and the associated Scottish Onshore Wind Energy Policy Statement (2017). Whilst these have yet to be formally incorporated into National Planning policy in the form of the NPF4, there is a clear direction of travel from the Scottish Government in the draft copy of NPF4 which states such policy/guidance is to be developed. In the meantime, whilst there is an associated lag in the corresponding policy produced at regional and local level, more recent national policy will be considered.

4.7.3 The Proposed Development's potential to generate between 86.8 to 92.4MW of renewable energy, subject to final wind turbine procurement, aligns with energy policies to contribute to the shift from the reliance on fossil fuels to renewable energy production. It will help to support many climate action plans, emission reduction targets and contribute towards future electricity demands in the UK by creating enough electricity to power at least 80,000 homes every year.

4.7.4 The Proposed Development Area has evolved through extensive survey work, liaison with consultees and design iterations to produce the most suitable layout for achieving maximum wind efficiency. Consideration has been given to SPP and DGC SPG throughout the planning process whilst limiting both visual and environmental impacts and achieving energy requirements. The use of larger wind turbines will increase the efficiency of energy production which is vital for helping Scotland meet their renewable energy targets.

4.7.5 The creation of new jobs and business opportunities in Scotland is anticipated throughout the lifetime of the Proposed Development. This will cover a range of disciplines including civil and electrical engineering, environmental studies, plant and equipment hire through to communications, security, and cleaning.

4.7.6 The carbon balance assessment which appends this chapter demonstrates the carbon payback time and carbon emissions savings associated with the Proposed Development. Set against fossil fuel electricity generation, the Proposed Development will **payback its carbon within 1.7 years** and save up to **3,743,124 tonnes** of **CO_2 emissions.** The negative payback period therefore represents approximately 6% of the operational period, with the Proposed Development providing a positive contribution over the remaining 94% of its operation (28.2 years). The Proposed Development therefore illustrates a significantly positive net impact in terms of reducing of greenhouse gas emissions from energy production and providing between 86.8 to 95.2MW, the equivalent of powering at least 80,000 homes every year[44].

4.7.7 (H) In addition, a habitat Management Plan has been produced (shown in Technical Appendix 6.6) which details enhancement measures intended to offset the direct and indirect effects on sensitive habitats and species that may be produced from the Proposed Development. Furthermore, the measures have the potential to result in a net positive effect over a long-term period. More detail on the Habitat Management Plan is included in Chapter 6: Ecology.

[39] Available at: https://group.vattenfall.com/press-and-media/pressreleases/2021/vattenfall-increases-its-emission-reduction-targets--now-in-line-with-1.5-degrees-celsius-scenario (accessed 21/10/2021)

[40] Available at: https://group.vattenfall.com/press-and-media/pressreleases/2021/vattenfall-commits-to-landfill-ban-and-to-recycle-all-wind-turbine-blades-by-2030 (accessed 21/10/2021)

[41] Available at: https://group.vattenfall.com/siteassets/corporate/investors/annual-reports/2020/vattenfall-annual-and-sustainability-report2020_.pdf (accessed 21/10/2021)

[42] Available at : https://group.vattenfall.com/press-and-media/newsroom/2021/vattenfall-to-cut-supply-chain-emissions-by-half (accessed 2/12/2021).

[43] Available at: https://group.vattenfall.com/press-and-media/pressreleases/2021/vattenfall-receives-platinum---highest-score-possible-for-its-sustainability-performance (accessed 21/10/2021)

[44] Statistics Explained - RenewableUK

VATTENFALL

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Chapter 5

Landscape & Visual Impact Assessment

Contents

Glossary

Term	Definition
Baseline studies	*'Work done to determine and describe the environmental conditions against which future changes can be measured or predicted and assessed.'**
Characteristics	*'Elements or combinations of elements, which make a contribution to distinctive landscape character.'**
Compensation	*'Measures devised to offset or compensate for residual adverse effects which cannot be prevented/avoided or further reduced.'**
Corbett	
Cumulative Landscape & Visual Impact Assessment (CLVIA)	To identify, predict and evaluate potential key effects arising from the addition of the Proposed Development to a theoretical baseline which includes the existing baseline situation of operational wind farms, those under construction, consented schemes, and additionally wind farms currently being considered within the planning system that may or may not be present in the landscape in the future.
Direct effect	*'An effect that is directly attributable to the proposed development.'**
Donald	
'Do nothing' situation	*'Continued change or evolution in the landscape in the absence of the proposed development.'**
Enhancement	'*Proposals that seek to improve the landscape resource and the visual amenity of the proposed development site and its wider setting, over and above its baseline condition.'**
Environmental Impact Assessment (EIA)	*'The process of gathering environmental information; describing a development; identifying and describing the likely significant environmental effects of the project; defining ways of preventing/avoiding, reducing, or offsetting or compensating for any adverse effects; consulting the general public and specific bodies with responsibilities for the environment; and presenting the results to the competent authority to inform the decision on whether the project should proceed.'**
Environmental Impact Assessment Report (EIAR)	A document reporting the findings of the EIA and produced in accordance with the EIA Regulations.
Geographical Information System (GIS)	*'A system that captures, stores, analyses, manages and presents data linked to location. It links spatial information to a digital database.'**
Indirect effects	*'Indirect effects that result indirectly from the proposed project as a consequence of the direct effects., often occurring away from the site, or as a result of a sequence of interrelationships or a complex pathway. They may be separated by distance or in time from the source of the effects.'**
Iterative design process	*'The process by which project design is amended and improved by successive stages of refinement which respond to growing understanding of environmental issues'**
Key characteristics	*'Those combinations of elements which are particularly important to the current character of the landscape and help to give an area its particularly distinctive sense of place'**
Landcover	*'The surface cover of the land usually expressed in terms of vegetation cover or lack of it. Related to but not the same as land use.'**
Land Use	*'What land is used for, based on broad categories of functional land cover, such as urban and industrial use and the different types of agriculture and forestry.'**
Landform	*'The shape and form of the land surface which has resulted from combinations of geology, geomorphology, slope, elevation and physical processes.'**
Landscape	*'An area, as perceived by people, the character of which is the result of the action and interaction of natural and/or human factors.'**
Landscape & Visual Impact Assessment (LVIA)	*'A tool used to identify and assess the likely significance of the effects of change resulting from development both on the landscape as an environmental resource in its own right and on people's views and visual amenity.'**
Landscape character	*'A distinct, recognisable and consistent pattern of elements in the landscape that makes one landscape different from another, rather than better or worse.'**

Term	Definition
Landscape Character Areas (LCAs)	*'A distinct, recognisable and consistent pattern of elements in the landscape that makes one landscape different from another, rather than better or worse.'**
Landscape Character Assessment (LCA)	*'The process of identifying and describing variation in the character of the landscape, and using this information to assist in managing change in the landscape. It seeks to identify and explain the unique combination of elements and features that make landscape distinctive. The process results in the production of a Landscape Character Assessment.'**
Landscape Character Types	*'These are distinct types of landscape that are relatively homogeneous in character. They are generic in nature in that they may occur in different areas in different parts of the country, but wherever they occur they share broadly similar combinations of geology, topography, drainage patterns, vegetation and historical land use and settlement pattern, and perceptual and aesthetic attributes.'**
Landscape effects	*'Effects on the landscape as a resource in its own right.'**
Landscape quality (condition)	*'A measure of the physical state of the landscape. It may include the extent to which typical character is represented in individual areas, the intactness of the landscape and the condition of individual elements.'**
Landscape receptors	*'Defined aspects of the landscape resource that have the potential to be affected by a proposal'**
Landscape value	*'The relative value that is attached to different landscapes by society. A landscape may be valued by different stakeholders for a whole variety of reasons.'**
Magnitude (of effect)	*'A term that combines judgements about the size and scale of the effect, the extent of the area over which it occurs, whether it is reversible or irreversible and whether it is reversible or irreversible and whether it is short or long term in duration.'**
Panorama	*'An image covering a horizontal field of view wider than a single 50mm frame. Wirelines and photomontages may also be produced as panoramas.'***
Perception	*'Combines the sensory (that we receive through our senses) with the cognitive (our knowledge and understanding gained from many sources an experiences).'**
Photomontage	*'A visualisation which superimposes an image of a proposed development upon a photograph or series of photographs'**
Protected and designated landscapes	*'Areas of landscape identified as being of importance at international, national or local levels, either defined by statute or identified in development plans or other documents.'**
Receptors	*'See Landscape receptors and Visual receptors.'**
Scoping	*'The process of identifying the issues to be addressed by an EIA. It is a method of ensuring that an EIA focuses on the important issues and avoids those that are considered to be less significant.'**
Sensitivity	*'A term applied to specific receptors, combining judgements of the susceptibility of the receptor to the specific type of change or development proposed and the value related to that receptor.'**
Significance	*'A measure of the importance or gravity of the environmental effect, defined by significance criteria specific to environmental topic'**
Susceptibility	*'The ability of a defined landscape or visual receptor to accommodate the specific proposed development without undue negative consequences.'**
The Applicant	Vattenfall Wind Power Ltd
The Proposed Development	The Quantans Hill Wind Farm Project
The Proposed Development Area	The area within the "Site boundary" as illustrated on Figure 1.1 in which the Proposed Development will be located.
Developer	In the event of the Proposed Development being granted Section 36 Consent, this is the Company developing the Project.
Tranquillity	*'A state of calm and quietude associated with peace, considered to be a significant asset of landscape.'**
Visual amenity	*'The overall pleasantness of the views people enjoy of their surroundings, which provides an attractive visual setting or backdrop for the enjoyment of activities of the people living, working, recreating, visiting or travelling through an area.'**
Visual effects	*'Effects on specific views and on the general visual amenity experienced by people.'**
Visual receptors	*Individuals and/or defined groups of people who have the potential to be affected by a proposal.'**
Visualisation	*'A computer simulation, photomontage or other technique illustrating the predicted appearance of a development.'**
Wirelines	*These are also known as wireframes and computer generated line drawings. These are line diagrams that are based on DTM data and illustrate the three-dimensional shape of the landscape in combination with additional elements such as the components of a proposed wind farm.'***
Zone of Theoretical Visibility (ZTV)	*'A map, usually digitally produced, showing areas of land within which, a development is theoretically visible.'**

*Taken from *Guidelines for Landscape and Visual Impact Assessment, Third Edition*. 2013.

** Taken from *Visual Representation of Wind Farms, Guidance.* 2017

List of Abbreviations

Abbreviation	Description
AGL	Above Ground Level
CMLI	Chartered Member of the Landscape Institute
CLVIA	Cumulative Landscape & Visual Impact Assessment
DSLR	Digital Single Lens Reflex
DTM	Digital Terrain Model
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
ELC	European Landscape Convention
EOS	Electro-Optical System
GLVIA3	Guidelines for Landscape and Visual Impact Assessment, Third Edition
HES	Historic Environment Scotland
km	Kilometre
LCA	Landscape Character Area
LCT	Landscape Character Type
LVIA	Landscape & Visual Impact Assessment
m	Metre
OS	Ordnance Survey
PLI	Public Local Inquiry
SNH	Scottish Natural Heritage (now NatureScot)
ZTV	Zone of Theoretical Visibility

5.1 INTRODUCTION

5.1.1 This Chapter of the EIAR provides a summary of the Landscape and Visual Impact Assessment (LVIA) of the proposed Quantans Hill Wind Farm (herein referred to as the Proposed Development) on the landscape resource and visual amenity within an identified study area. This assessment has been undertaken in accordance with the *Guidelines for Landscape and Visual Impact Assessment, Third Edition 2013* (GLVIA3) (Landscape Institute and the Institute of Environmental Assessment) as detailed in Volume 3: Appendix 5.1.

5.1.2 The landscape and visual aspects of the proposed site have fed into the design evolution of the Proposed Development as described in Chapter 2: Site Selection and Design Evolution. The scenario taken forward and assessed in this LVIA comprises 14 turbines up to 200 m to tip height. A full description of the Proposed Development is provided in Chapter 3: Project Description.

5.1.3 This Chapter of the EIAR should be read in conjunction with the following chapters:

- Chapter 2: Site Selection and Design Evolution;
- Chapter 3: Project Description;
- Chapter 4: Climate Change, Legislative and Policy Context;
- Chapter 6: Ecology;
- Chapter 8: Hydrology, Geology & Hydrogeology;
- Chapter 9: Cultural Heritage;
- Chapter 12: Socioeconomics; and
- Chapter 13: Other Issues.

5.1.4 This Chapter is also supported by the following Technical Appendices (see Volume 3), Figures and Visualisations.

- Appendix 5.1: LVIA Methodology;
- Appendix 5.2: Cumulative Sites;
- Appendix 5.3: Landscape Character Review;
- Appendix 5.4: Protected & Designated Landscapes Review;
- Appendix 5.5: Residential Visual Amenity Assessment;
- Volume 2B: LVIA Figures; and
- Volume 2C: Visualisations.

5.2 STATEMENT OF COMPETENCE

5.2.1 The LVIA has been undertaken by Chartered Members of the Landscape Institute (CMLI) from Natural Power experienced in undertaking LVIAs of wind farms throughout the United Kingdom and Ireland. This has included siting, feasibility and capacity studies, wind farm layout design, assessment, and preparation of material for Public Local Inquiries (PLI).

5.2.2 LVIA involves a combination of quantitative and subjective assessment and in accordance with GLVIA3, professional judgement is applied to the assessment of effects and a reasoned justification presented in respect of the findings.

5.2.3 Photography has been undertaken by a professional photographer experienced in undertaking specialist day and night-time viewpoint photography to NatureScot and Landscape Institute standards for LVIAs and to support evidence at PLI.

5.2.4 Visualisations and supporting LVIA figures have been produced by Natural Power experienced in the provision of GIS mapping, visualisation, and analytical services to all stages of the renewable energy project life cycle.

5.3 PROPOSED DEVELOPMENT

5.3.1 The Proposed Development is described in Chapter 3: Project Description and the elements likely to lead to landscape and visual effects summarised below:

- Construction Phase;
- Operational Phase; and
- Decommissioning Phase.

5.3.2 The following project components are proposed in within the Proposed Development Area (see Volume 2a: Figure 1.1):

- 14 x turbines;
- 14 x turbine foundations;
- 14 external transformer housings;
- 14 x crane pad hardstanding and temporary infrastructure area;
- Substation, Control Building, and Compound;
- Battery/energy storage infrastructure;
- 1 x permanent anemometry mast;
- Upgraded and new access tracks, including a public footpath;
- Onsite cabling;
- Temporary borrow pits;
- Temporary batching plant(s);
- Temporary construction and storage compounds, laydown areas and ancillary infrastructure; and
- Drainage and drainage attenuation measures (as required).

5.3.3 In order to produce Zone of Theoretical Visibility (ZTV) mapping and visualisations, a candidate turbine was assumed with a 115 m hub height and 170 m rotor diameter. Ancillary development will include the utilisation where possible of existing access tracks with additional lengths of track required connecting the proposed turbine locations.

5.4 SCOPE OF ASSESSMENT

Study Area

5.4.1 NatureScot guidance advises an initial study area of 45 km for wind turbines exceeding 150 m in tip height. This has been offset from the outermost turbines of the Proposed Development (see Volume 2b: Figures 5.2a – 5.2b).

Cumulative Study Area

5.4.2 For the cumulative assessment, an initial study area of 60 km is identified in accordance with the relevant guidance (SNH, 2012) (see Volume 2b: Figure 5.9). Following a review, this has been refined to 45 km from the outermost turbines and data collected for sites that are consented and submitted applications which would likely be experienced in conjunction with the Proposed Development (see Volume 2b: Figure 5.10).

5.4.3 It should be noted that the study areas applied in this LVIA have been determined as areas where all potential significant landscape and visual effects are likely to occur and is not the limit of potential visibility of the Proposed Development. Operational wind farms have been included as baseline.

5.5 METHODOLOGY

5.5.1 A detailed description of the LVIA and Cumulative LVIA (CLVIA) process and methodology is included in Volume 3: Appendix 5.1.

Identification of Landscape and Visual Receptors

5.5.2 Once the study area has been defined, the next step is to establish how the Proposed Development may give rise to landscape and visual effects. This is established through an understanding of the project components proposed, their layout and evolution through construction, operational and decommissioning phases. This forms the basis of the assessment and aids the identification of the landscape and visual baseline likely to be affected, referred to as landscape and visual receptors.

5.5.3 These were identified through analysis of Zone of Theoretical Visibility (ZTV) mapping (described in Volume 3: Appendix 5.1), desk-study and field work. ZTVs have been generated to aid the understanding of the extent of theoretical visibility of the Proposed Development. ZTVs have been used through the different stages of the Proposed Development from the initial feasibility study, through the evolution of the layout design, and have informed the extent of the study area and identification of landscape and visual receptors that are likely to be affected. As a precautionary approach, potential effects on landscape character and visual amenity are considered in this LVIA to be adverse

Landscape Effects

5.5.4 Assessing the significance of landscape effects on the landscape resource requires the identification of the landscape receptors, the consideration of the nature of the landscape receptors (sensitivity) and the nature of the change (magnitude) on those receptors due to the Proposed Development.

Landscape Baseline

5.5.5 Landscape is defined by the relationship between people and place and how different components of the natural environment such as geology, soils, climate, flora, and fauna; interact and are perceived alongside cultural and social components of historical and cultural land use, settlement, enclosure, and other human interventions.

5.5.6 Designated landscapes at national and local level are also included as broad scale landscape receptors and include the special qualities which contributed to their reasons for designation.

5.5.7 The landscape baseline has been identified through review of publicly available sources from NatureScot, Dumfries and Galloway Council (DGC), and Historic Environment Scotland (HES). Sources are detailed under the Section 5.8 Landscape Baseline.

Sensitivity of Landscape Receptors

5.5.8 GLVIA3 states that sensitivity of the landscape should be defined by analysing the susceptibility of the landscape receptor to the proposed change (the Proposed Development) and the value of the landscape receptor. These are described in detail in Volume 3: Appendix 5.1.

5.5.9 Both landscape value and susceptibility are identified as Very High, High, Medium, Low, and Very Low. So, where susceptibility to landscape change may be high but value is considered to be low, overall landscape sensitivity to wind farm development would generally be expected to be medium. However, in some cases, landscapes generally attributed the highest value such as international or national landscape designations do not necessarily have a high susceptibility to all types of change. Professional judgement is used to evaluate this complex relationship between value and susceptibility to determine the overall sensitivity of the landscape receptor to the proposed development. Overall sensitivity of a visual receptor is identified as Very High, High, Medium, Low and Very Low A Full justification for the assessment of the sensitivity of a particular receptor is included in the LVIA. Table 5.1 is used as a guide only.

Table 5.1: Levels of sensitivity on landscape receptors defined by value and susceptibility

Landscape Susceptibility	Landscape Value				
	Very High	High	Medium	Low	Very Low
Very High	Very High				
High		High			
Medium			Medium		
Low				Low	
Very Low					Very Low

Landscape Magnitude of Effect

5.5.10 Judgements of magnitude of effect are assessed in terms of the size and scale, geographical extent, duration, and reversibility of the change likely to result from the Proposed Development.

5.5.11 The relationship between all three of the above factors is assessed to determine the overall nature of the change resulting from the introduction of the proposed development. This results in four levels of magnitude. Substantial, Moderate, Slight and Negligible which is outlined in Table 5.2.

Table 5.2: Levels of Landscape Magnitude of Effect

Level of Landscape Magnitude	Definition of Landscape Magnitude
Substantial	Total loss or major alteration to key elements, features, or perceptual characteristics of the baseline landscape over a large area including the possible introduction of major new and uncharacteristic elements. The post development character and composition of the baseline landscape resource will be fundamentally changed for some distance from the site. Changes would also be deemed permanent and irreversible.
Moderate	Partial loss or alteration to one or more key elements, features, or perceptual characteristics of the baseline landscape over a moderate area, including the possible introduction of moderate new and uncharacteristic elements. The post development character and composition of the baseline landscape resource will be partially, but noticeably changed at a medium distance from the site, including the immediate setting and the landscape character area in which it lies. Changes would be long term, between 10 and 25 years but theoretically reversible.
Slight	Minor loss of or alteration to one or more key elements, features, or perceptual characteristics of the baseline landscape over a small area, including the possible introduction of minor new and uncharacteristic elements. The post development character and composition of the baseline landscape resource will be noticeably changed but the underlying character of the baseline landscape will be similar to the pre-development character. The change would occur only within the site itself or within the immediate vicinity of the development proposal. Changes would be wholly or partially reversible and would be medium term, lasting for up to ten years.
Negligible	Very limited or imperceptible loss or alteration to one or more key elements, features, or perceptual characteristics of the baseline landscape over a negligible area, including negligible effects from the introduction of minor new and uncharacteristic elements. Change to the landscape character will be barely discernible with very limited influence on the landscape character within the site or immediate

Level of Landscape Magnitude	Definition of Landscape Magnitude
	vicinity of the development proposal. Changes would be reversible, deemed temporary and would last between 0 and 5 years.

5.5.12 The determination of the magnitude of effect on the designated landscape resource additionally considers the distance from the site at its closest point, potential changes to principal views from within and towards the designated landscape and potential effects on the integrity of the designated landscape, including the extent to which it could affect the policy reasons for designation.

Visual Effects

5.5.13 Assessing the significance of visual effects of the Proposed Development requires several steps including identifying the sensitivity of the visual receptor, identifying the magnitude or scale of the change to the receptors view, prior to forming a judgement with respect to the significance of the effect in the context of the Electricity Works (Environmental Impact Assessment (Scotland) Regulations 2017.

Visual Baseline

5.5.14 Visual amenity relates to people's views from static locations or when moving through the landscape and are usually grouped by what they are doing such as residents, road users, recreational users, visitors, and workers etc. They include people living and working in the area, people travelling through the area on foot, road, rail or other forms of transport, people visiting promoted tourist attractions and landscapes, and people pursuing other recreational activities.

5.5.15 The following have been considered in the visual baseline:

- Residential properties within 2 km of the Proposed Development;
- Settlements;
- Roads including A, B, and minor roads;
- Walking routes including the Southern Upland Way, Scottish Hill Tracks, and Public Rights of Way/Core Paths within 5 km of the Proposed Development;
- Hill tops; and
- Promoted visitor attractions.

Viewpoints

5.5.16 A selection of viewpoints has been chosen in consultation with the Energy Consents Unit (ECU) and NatureScot to represent the views experienced towards the Proposed Development within the study area by various groups of people. Selected viewpoints include representative, specific, and illustrative views from publicly accessible locations. No feedback on viewpoints was provided by DGC.

5.5.17 Viewpoints are selected to take account of the viewing experience (such as static views from settlements and sequential views from routes), cumulative views of other developments and as far as possible are representative of the range of key visual receptors and view types (including panoramas, vistas, glimpsed views), as well as being located at varying distances, elevations, and orientations from the Proposed Development.

Sensitivity of Visual Receptors

5.5.18 The sensitivity or nature of visual receptors is defined by the professional judgement of the interaction between the value of the view experienced by the visual receptor and the susceptibility of the visual receptor (or viewer not the view) to the particular form of change likely to result from the Proposed Development.

5.5.19 The sensitivity of visual receptors is defined by the relationship between the value of views and the susceptibility of different types of viewer to the proposed change. Both value and susceptibility are identified as Very High, High, Medium, Low and Very Low. In general terms, where the value of the view is high and the susceptibility of the viewer to change is low, the overall sensitivity of the visual receptor would be expected to be medium. However, this is not formulaic and can be a complex relationship with different combinations possible. Professional judgement is used to evaluate this complex relationship between value and susceptibility to determine the overall sensitivity of the visual receptor to the Proposed Development. Overall sensitivity of a visual receptor is identified as Very High, High, Medium, Low and Very Low, Table 5.3 is used as a guide only.

Table 5.3: Levels of sensitivity on visual receptors defined by value and susceptibility

Visual Susceptibility ↑ / Visual Value →	Very High	High	Medium	Low	Very Low
Very High	Very High				
High		High			
Medium			Medium		
Low				Low	
Very Low					Very Low

Visual Magnitude of Effect

5.5.20 The nature or magnitude of the effect on visual receptors considers the size and scale, geographical extent, duration, and reversibility of the change likely to result from the Proposed Development.

5.5.21 The worst-case scenario is considered during the assessment of the nature (magnitude) of all visual effects. All changes to views are considered as they would occur in winter conditions with minimal screening by vegetation and deciduous trees. ZTVs and wireframes are similarly displayed on the basis of bare ground and therefore demonstrate the maximum extent of visibility possible, in the absence of buildings or vegetation.

5.5.22 The relationship between all three of the above factors is assessed to determine the overall nature of the visual change resulting from the introduction of the Proposed Development. This results in four levels of magnitude: Substantial, Moderate, Slight and Negligible, which is outlined in Table 6.4.

5.5.23 In general, a major visual change in terms of size and scale, seen from many locations with long term reversible or permanent, irreversible effects would result in an overall substantial magnitude of visual change. However, this is a complex relationship between the different factors of magnitude, and various combinations are possible. Each effect is judged on its own merit and the following table is used as a guide only.

Table 5.4: Levels of visual magnitude of potential effect defined by size and scale, geographical extent and duration and reversibility

Level of Visual Magnitude	Definition of Visual Magnitude
Substantial	Major visual change which causes a complete or substantial change in the view as a result of loss of important features or the addition of significant new ones, to the extent that the composition of the view is substantially altered. The change is experienced from many locations across the study area, from the majority of a linear route or from most areas within a specific location and/or by a large

Level of Visual Magnitude	Definition of Visual Magnitude
	number of viewers. Changes would last for 30 years or more and are deemed permanent or irreversible.
Moderate	Moderate visual change which causes a noticeable change in the view as a result of the loss of features or the addition of new ones, to the extent that the composition of the view is altered to a moderate degree. The change is experienced from a moderate number of locations across the study area, from a moderate part of a linear route or from a moderate proportion of an area within a specific location and/or by a moderate number of viewers. Changes would be long term, between 10 and 30 years but theoretically reversible.
Slight	Minor visual change which causes a perceptible change in the view as a result of the loss of features or the addition of new ones, to the extent that this partially alters the composition of the view. The change is experienced from a small number of locations across the study area, from only limited sections of a linear route or from a small proportion of an area within a specific location and/or by a small number of viewers. Changes would be wholly or partially reversible and would be medium term, lasting for up to 10 years.
Negligible	Negligible visual change which causes a barely perceptible change in the view as a result of the loss of features or the addition of new ones, to the extent that this barely alters the composition of the view. The change is either not visible or seen by viewers from only one or two locations across the study area, from very limited sections of a linear route or from hardly any locations within a specific area and/or by only a very small number of viewers. Changes would be reversible, deemed temporary and would last between 0 and 5 years.

Judging the Levels of Significance of Effects

5.5.24 An overall judgement is made on the nature of the receptor and the likely change resulting from the Proposed Development. This judgement is based on evaluations of the individual aspects of value, susceptibility, size and scale, geographical extent, duration, and reversibility. The table below illustrates the four main levels of visual effect that are used in this LVIA; Major, Moderate, Minor and Negligible. Three intermediate combinations are also used for determining landscape effects; Major/moderate, Moderate/minor, and Minor/negligible. The table is not a prescriptive tool, and the evaluation of potential effects makes allowance for the use of professional judgement and experience.

5.5.25 Landscape Institute advice, contained in GLVIA3 statement of clarification 1/13 (June 2013), states that following the determination of magnitude and sensitivity, '*the assessor should then establish (and it is for the assessor to decide and explain) the degree or level of change that is considered to be significant*'. In accordance with this advice, this LVIA establishes at what level in the assessor's opinion, 'significant' effects arise.

5.5.26 Those effects considered to be **Major** and **Major/moderate** effects and some **Moderate** effects by virtue of the more sensitive receptors and the greater magnitude of effects, are considered to be **Significant Effects**. Moderate, Moderate/minor, Minor, Minor/negligible and Negligible effects are considered to be Not Significant Effects.

Table 5.5: Levels of landscape and visual effects and overall significance

Nature of Effect (Magnitude) ↑	Nature of Receptor (Sensitivity) ←		
	High	Medium	Low
Substantial	**Major**		
Moderate		**Moderate**	
Slight			**Minor**
Negligible			**Negligible**

Cumulative Effects

5.5.27 The aim of the CLVIA is to identify, predict and evaluate potential key effects arising from the addition of the Proposed Development (Scawd Law Wind Farm) to a theoretical landscape baseline which includes the existing baseline situation of operational wind farms and those under construction and additionally includes wind farms currently being considered within the planning system, and that may or may not be present in the landscape in the future.

5.5.28 The methodology for CLVIA follows good practice guidance as set out in the GLVIA3 and *Assessing the Cumulative Effects of Onshore Wind Energy Developments* (SNH, 2012).

Cumulative Approach

5.5.29 SNH guidance defines cumulative effects as '*the additional changes caused by a proposed development in conjunction with other similar developments or as the combined effect of a set of developments, taken together.*' This highlights the two possible ways of reporting cumulative effects. The first is to consider only the additional effect that would occur in the cumulative baseline, meaning those effects over and above the effects identified in the LVIA assessment. The second is to redo the LVIA assessment but using the theoretical cumulative baseline, so a combined effect is determined.

5.5.30 This CLVIA takes the first approach resulting in a stand-alone assessment which identifies the effects of introducing the proposed development into the cumulative baseline. It is clearly set out whether the effect has increased or decreased relative to the LVIA assessment or whether the effects will be the same as in the LVIA assessment.

Cumulative Baseline

5.5.31 An initial cumulative search area of 60km from the proposed scheme was delineated and a list was prepared including all operational, those schemes under construction, consented schemes, those schemes in the planning system as valid applications (see Volume 2b: Figure 5.10). Recently withdrawn sites have not been included and those sites registered with a Pre-Application Notice (PAN), are not finalised applications and have therefore not been included as a valid application but have been included as a pre-application/scoping scheme.

5.5.32 Using this initial Search Area list of developments, an initial cumulative desktop and site assessment was carried out by a CMLI to identify a suitable cumulative baseline (or Cumulative Study Area). In accordance with SNH guidance (2012), the initial Search Area list was therefore refined to establish which developments were of most relevance to the cumulative assessment for the proposal. As the guidance states '*the key principle for all cumulative impact assessments is to focus on the likely significant effects and in particular those which are likely to influence the outcome of the consenting process*'. (Para 33 SNH 2012).

5.5.33 The Cumulative Study Area or cumulative baseline for windfarms was therefore defined to include those developments it was considered required further cumulative assessment. These included all operational, consented, and valid planning applications within an approximate 45 km radius from the proposed site.

5.5.34 The cumulative baseline is divided into different scenarios which reflect which groups of wind farm developments are assumed to be present in the landscape. The existing scenario of operational wind farms and those under construction is assessed in the LVIA and is referred to as Scenario 1. The CLVIA considers the following scenarios;

- **Scenario 2**: considers the addition of the proposed development in the context of operational wind farms, those under construction and additionally those developments currently consented. This represents the likely future scenario; and

- **Scenario 3**: the addition of the proposed development in the context of operational, under construction, consented, undetermined planning applications and wind farm developments currently at appeal i.e., a less certain future scenario.

Cumulative Sensitivity

5.5.35 The susceptibility of receptors may be affected by the presence of other wind energy developments. Some viewers may consider that susceptibility is reduced because other wind farms are 'already there', but for others it may be that sensitivity is increased because more development would be 'too much'. However, to retain a consistent and objective approach, the susceptibility of receptors used for the cumulative assessment is taken to be the same as that identified in the LVIA. The value of the receptor would also remain the same in the cumulative assessment and therefore the overall sensitivity of the receptor is considered to be the same as judged in the LVIA.

Cumulative Magnitude of Effect

5.5.36 An overall judgement is made on the nature of the receptor and the likely change resulting from the addition of the proposed development. This judgement is based on evaluations of the individual aspects of value and susceptibility of the receptor as identified in the LVIA and the size and scale, geographical extent, duration, and reversibility of the cumulative change.

5.5.37 Four main levels of cumulative magnitude of change are used in this CLVIA; Substantial, Moderate, Slight and Negligible. Three intermediate combinations are also used; Major/moderate, Moderate/minor, and Minor/negligible. The evaluation of potential effects makes allowance for the use of professional judgement and experience.

Cumulative Landscape Magnitude of Effect

5.5.38 There are varying degrees of cumulative landscape effect. These are as follows;

- Multiple wind farms are seen as separate isolated features within the landscape character type, too infrequent and of insufficient significance to be perceived as a characteristic of the area;
- Multiple wind farms are seen as a key characteristic of the landscape, but not of sufficient dominance to be a defining characteristic of the area;
- Multiple windfarms appear as a dominant characteristic of the area, seeming to define the character type as a 'wind farm landscape character area and
- Wind farms cross different character types, reducing the distinction between the different types.

Cumulative Visual Magnitude of Effect

5.5.39 With particular regard to visual cumulative effects, the following factors are also considered in determining the magnitude of cumulative visual change from each visual receptor:

- The number of turbine developments visible;
- The prominence of the developments likely to be seen;
- The amount of available view affected;
- The arrangement of turbine developments e.g., developments seen in one direction or in only part of the view, or seen in all directions;
- The relationship of the scale of the turbine developments including size and number of turbines which may also be expressed as the horizontal and vertical angle occupied by turbines;
- The position of the turbine developments in the view e.g., on the skyline, against the backdrop of land;
- The distances from the viewer and between developments;
- The landscape setting, context, and separation (or coalescence) of turbine developments; and
- Potential screening by landcover such as vegetation and local variations in topography.

Overall Significance of Cumulative Effects

5.5.40 An overall judgement is made on the nature of the receptor and the likely change resulting from the addition of the proposed development. This judgement is based on evaluations of the individual aspects of value and susceptibility of the receptor as identified in the LVIA and the size and scale, geographical extent, duration, and reversibility of the cumulative change. Four main levels of cumulative visual effect are used in this CLVIA; Major, Moderate, Minor and Negligible. Three intermediate combinations are also used; Major/moderate, Moderate/minor, and Minor/negligible. The evaluation of potential effects makes allowance for the use of professional judgement and experience.

5.6 CONSULTATION

5.6.1 An initial scoping request was submitted to the Energy Consents Unit (ECU) on the 26th of June 2020. This contained questions pertaining to the overall methodology of the LVIA and the landscape, visual and cumulative receptors to be assessed. A Scoping Opinion was issued by the ECU on the 14th of October 2020 which included a response to the LVIA questions from relevant consultees as summarised below in Table 5.6, along with details of how these have been addressed in the LVIA.

Table 5.6: Summary of Consultation and LVIA Response to Scoping

Consultee	Comment	LVIA Response
Scottish Government	*It is recommended by the Scottish Ministers that with regards to impacts of night time aviation lighting the Applicant should discuss and agree with Dumfries & Galloway Council and NatureScot the range (in kilometres from the proposed Development) for night time assessments of the impacts of night-time aviation lighting and receptors therein to be assessed. As well as the scope, methodology, findings and recommendations of such assessments, full details of all mitigation of aviation lighting impacts subsequently identified should be provided in the EIA Report.*	The potential effects from aviation lighting have been considered for both landscape and visual amenity and assessed in this chapter. A reduced lighting scheme has been proposed consisting of medium intensity steady red lights fitted to Turbines 1, 3, 10, 12 and 14 as detailed in Chapter 13: Other Issues and supporting Technical Appendix 13.2.
	It is also recommended by the Scottish Ministers that the Impacts of night time aviation lighting on the Galloway Forest Dark Sky Park and the Merrick Wild Land Area be fully assessed and the outcome and findings of which, along with appropriate visualisations, be presented in the EIA report. The Applicant should discuss and agree the finalised content and style of the visualisations with NatureScot.	A night-time aviation lighting ZTV for the reduced lighting scheme was produced and indicated that theoretical visibility would be very limited within The Merrick Wild Land Area and from the core area of the Galloway International Dark Skies Park (see Section 5.8 and Volume 2b: Figure 5.6b).
	Viewpoints & Visualisations *It is recommended by the Scottish Ministers that the final list of viewpoints and visualisations should be agreed following discussion between the Applicant, Dumfries & Galloway Council, Historic Environment Scotland, Mountaineering Scotland and NatureScot,*	NatureScot and Mountaineering Scotland stated in their scoping response that they were content with the viewpoints proposed. Cultural heritage viewpoints were agreed separately with Historic Environment Scotland and are assessed in Chapter 9: Cultural Heritage. DGC

Consultee	Comment	LVIA Response
		provided no response on viewpoint locations.
	Cumulative assessment – other Developments *It is recommended by the Scottish Ministers that the assessment range (in kilometres) and other Developments to be included in cumulative assessments should be discussed and agreed with Dumfries & Galloway Council.*	Cumulative sites were identified within a 60 and 45 km study areas and a detailed assessment of sites undertaken.
Dumfries & Galloway Council	***Landscape and Visual Impacts*** *7.1 As noted above, the internal consultation response from the Council's landscape architect is still outstanding. Due to ongoing pressures on landscape resources and workload, landscape advice is prioritised in the order in which work is submitted to the Council, however the full consultation response will be provided in due course.*	No further responses from DGC were received.
	Landscape and visual impact forms one of the development management considerations within LDP2 Policy IN2. In particular: • *the extent to which the proposal addresses the guidance contained within the Dumfries & Galloway Windfarm Landscape Capacity Study (DGWLCS);* • *the extent to which the landscape is capable of accommodating the development* • *without significant detrimental impact on landscape character or visual amenity.* • *that the design and scale of the proposal is appropriate to the scale and* • *character of its setting, respecting the main features of the site and the wider environment and that it fully addresses the potential for mitigation.*	Policy and legislation are addressed in Chapter 4: Climate Change, Legislative and Policy Context and noted in Section 5.7 of this Chapter.
	7.3 IN2 also sets out that for all wind farm proposals, the extent of any detrimental landscape or visual impact from two or more wind energy developments (i.e. cumulative impact), and the potential for mitigation, also requires to be assessed. *The Supplementary Guidance (SG) Wind Energy Development: Development Management Considerations corresponds with, and gives more detail on how cumulative impacts on landscape and visual amenity are assessed at Part B. In addition, the DGWLCS (as Appendix C to the SG) assesses the individual landscape area to accommodate wind energy development. It includes an appraisal of the cumulative landscape and visual effects of existing and consented wind energy developments, and an assessment of where ultimate landscape capacity is close to be being reached.*	Noted.
	7.4 In terms of the DGWLCS, the proposed turbines are located within the Carsphairn unit of the Southern Uplands Landscape Character Type (LCT19); at a height to blade tip of 200 to 250 metres, they fall into the "Very Large" typology of wind turbine.	Noted.
	7.5 The Carsphairn unit (LCT19), is described as "These uplands have a generally consistent and homogenous character within Dumfries and Galloway, forming high hills with an often-dramatic sculptural landform. While the expansive scale of these uplands could relate to larger typologies, their distinctive landform, where hills are pronounced and often form steep, rugged edges to adjacent dales and upland glens, is a key constraint to development. The sparsely settled nature and simple land cover pattern reduces sensitivity although, conversely, these uplands are particularly valuable because of their openness and absence of built development and large-scale forestry."	Noted.
	7.6 The DGWLCS gives this LCT an overall High sensitivity to Large typology turbine types (>150m), for both landscape and visual sensitivity. Sensitivity in terms of landscape values are considered to be High-Medium for all typology turbines due to the Regional Scenic Areas that cover much of this character type.	Noted
	7.7 Key cumulative effects that could occur if additional development were located in the Carsphairn Uplands include: *"The operational Windy Standard wind farm and its consented extension extend into the Carsphairn unit in the Southern Uplands with Forest (19a). Other than this, none of these character areas accommodates operational, under-constructed or consented wind farms although a number of developments lie close-by these uplands. Other wind farms are/will also be visible from the landmark hill of Cairnsmore of Carsphairn within this character area including Whiteside, Afton and Hare Hill. Any additional wind farm development in this and the adjacent Southern Uplands with Forest (19a) could have significant cumulative effects on this landmark hill".*	All of the sites mentioned are addressed in the cumulative landscape and visual assessment as well as recently consented (Scenario 2) and submitted sites (Scenario 3).
	7.8The key constraints to wind farm development within this LCT generally are: • *An often-dramatic landform where high and shapely peaks, steep scarp slopes, crags and deeply incised valleys are interspersed with smoother rolling upland plateaux;* • *The backdrop and distinctive skyline provided by these uplands to adjoining settled areas such as*	Constraints identified for the Carsphairn and Glenkens area are noted.

Consultee	Comment	LVIA Response
	the upland glens of Moffat and Langholm, plus the broader dales of Nithsdale, the Glenkens and Annandale which have increased visibility; • *Extensive forestry within adjacent upland areas in Dumfries and Galloway which increases the value of these open, less modified hills and increases the sense of naturalness experienced;* • *The important contribution that these sculptural and open uplands make to wider scenic quality, particularly forming dramatic backdrops to well-settled dales, as recognised in the RSA designations that cover the majority of these uplands.*	
	7.9 The DGWLS lists the opportunities as: • *Lower, less complex hill slopes where the small typology (turbines*	
	7.10 The DGWLCS guidance for development within this landscape states that: "There is no scope for the larger development typologies (turbines >50m) to be sited within this character type without incurring significant impacts on a number of key characteristics"	
Mountaineering Scotland	*Assessment* *4. Mountaineering Scotland is in general content with the proposed methodology in the Scoping Report. It has two observations which are set out below.* *5. We have no adverse comments on the viewpoints proposed. We particularly support viewpoints 3, 4, and 20 representing the Cairnsmore of Carsphairn massif; viewpoints 11, 12 and 25 representing the Rhinns of Kells; 6, 7 and 21 representing the Southern Upland Way rising to Benbrack (viewpoint 16 feels redundant); and viewpoint 5 representing the Donalds (hills >610m) northeast of Cairnsmore of Carsphairn. We would note that on flat summits walkers will often sit immediately above a break of slope rather than at the summit itself since this offers a better view. Precise siting of the viewpoints on the Cairnsmore of Carsphairn massif should take this into account.*	Noted, viewpoints have been sited away from summits where appropriate to allow clear views towards the Proposed Development.
Tynron Community Council	***Do consultees have any comments in relation to the proposed chapters to be included in the EIAR?*** *We are also concerned about the impacts of Aircraft Warning Lights and their flicker on local homes and the Galloway Dark Sky Park, and we believe this should be an additional chapter in the EIAR.*	A night-time assessment has been undertaken for potential effects on landscape and visual amenity in this chapter including residential receptors (see Volume 3: Appendix 5.5).
	Do consultees agree to an end date of three months prior to the submission of the LVIA and CLVIA after which point any additional sites will not be assessed with the application? *No – given the exponential increase in the number of wind farm planning applications, the increasing heights of turbines and the adverse cumulative impacts on our communities on visual and residential amenity, noise, and disturbance we believe this is unacceptable*	The cumulative baseline assessed is up to date 2 months prior to submission to allow time for the assessment and figures to be formalised.

Source: Quantans Hill Wind Farm Scoping Opinion (Scottish Government, October 2020.

5.7 LANDSCAPE PLANNING POLICY CONTEXT

5.7.1 Details of the National, Regional and Local planning policy of relevance to the Proposed Development is contained in Chapter 4: Climate Change, Legislative and Policy Context. Of reference to landscape and visual amenity is the Dumfries and Galloway Wind Farm Landscape Capacity Study (DGWFLCS) which is used to inform decision making and is referred to as *Appendix C of Part 1 Wind Energy Development: Development Management Considerations Supplementary Guidance*. The document seeks to set out the key characteristics and sensitivities to wind farm development within Dumfries and Galloway administrative area. The document was updated in February 2020 prior to NatureScot releasing updated guidance on landscape sensitivity assessments in Scotland (NatureScot, July 2020).

5.7.2 This identifies the Proposed Development within two separate LCTs as follows:

- Upper Dale LCT – Upper Glenkens Unit; and
- Southern Uplands LCT – Carsphairn Unit.

5.7.3 The Upper Dale Glenkens unit is described as follows:

*'There is a **High** sensitivity to the large typology (turbines 80-150m) and a **High-medium** sensitivity to the medium typology (turbines 50-80m). The openness and more expansive scale of the broader parts of these upper dales, however, offer some opportunities for smaller typologies and there would be a **Medium** sensitivity to the small medium typology (turbines 20-50m) and a **Low** sensitivity to small wind turbines (<20m high).'*

5.7.4 It goes on to state:

'If larger typologies (turbines >50m) were sited within the Upper Glenkens, they could be intervisible with wind farms located on adjacent, surrounding hills in more upland character areas. Cumulative effects may particularly affect elevated and more open views, from hills such as Cairnsmore of Carsphairn and the Rhinns of Kells and sequential views from the A713. The small-medium typology (turbines 20-50m), while more able to fit with other key characteristics of these landscapes, could also result in significant cumulative impacts with wind farm development sited in adjacent upland landscapes if poorly sited although there is scope to minimise inter-visibility between developments.

12.4.3 Key constraints

- *The narrower sections of the Upper Glenkens, especially where enclosure is emphasised by steeper slopes and woodland.*
- *The outcrop hills, including Dundeugh Hill, and the more complex knolly landform often found within the floors and lower slopes of these Upper Dales.*
- *Key landscape features, including water bodies and often extensive designed landscapes such as Garroch.*

- *The Archaeologically Sensitive Areas in the Upper Glenkens.*
- *The high visibility of these dales, which are well settled along the valley floors as well as being highly visible from roads and more elevated farms.*
- *The potential inter-visibility of development within the Upper Glenkens with large wind farms on the nearby Southern Uplands (19) and Foothills with Forest (18a) character types which inhibits scope for larger typologies.*
- *Key views to the landmark hills of Cairnsmore of Carsphairn and the Rhinns of Kells.*
- *The RSA designations which covers much of this landscape*

12.4.4 Opportunities

- *More open and expansive areas, especially where there are larger fields, where the vegetation pattern becomes more extensive and where there is backdrop of larger hills and broad sweeping upland slopes (although cumulative effects with wind farms sited in adjacent upland areas may reduce opportunities in some of these areas).*
- *Areas where settlement is sparser, usually on upper side slopes at the transition with the Foothills with Forest (18a) and Southern Uplands (19) (although some of these areas are constrained by potential cumulative effects with under-construction and consented wind farm development in these adjoining character types).*

There is no scope to locate larger typologies (turbines >50m) within the Upper Glenkens without incurring significant impacts across a wide spectrum of sensitivities.'

5.7.5 The Carsphairn unit of the Southern Uplands LCT is described as follows:

'These areas of the Southern Uplands character type have an overall High sensitivity to the large and medium typologies (turbines >50m).

Regional Scenic Areas cover much of this character type with a High to medium sensitivity accorded in terms of landscape values to both the large and medium development typologies.

24.4.3 Key constraints

- *An often-dramatic landform where high and shapely peaks, steep scarp slopes, crags and deeply incised valleys are interspersed with smoother rolling upland plateaux.*
- *The backdrop and distinctive skyline provided by these uplands to adjoining settled areas such as the upland glens of Moffat and Langholm, plus the broader dales of Nithsdale, the Glenkens and Annandale which have increased visibility.*
- *Areas of extensive heather moorland that notably occur within the Lowther, Langholm and North and East Moffat Hills.*
- *Extensive forestry within adjacent upland areas in Dumfries and Galloway which increases the value of these open, less modified hills and increases the sense of naturalness experienced.*
- *The important contribution that these sculptural and open uplands make to wider scenic quality, particularly forming dramatic backdrops to well-settled dales, as recognised in the RSA designations that cover the majority of these uplands.*
- *Recreational use of these uplands which include a number of 'Corbett' hills and other celebrated features such as the Devil's Beef Tub in upper Annandale and the setting for the Grey Mare's Tail waterfall, and which increase visual sensitivity.*
- *The Talla-Hart Wild Land Area which covers part of the Moffat Hills.*

24.4.4 Opportunities

- *Lower, less complex hill slopes where the small typology (turbines <20m) could be associated with existing settlement on the fringes of the uplands.*

5.7.6 The baseline of each of the LCTs mentioned above are described in Section 5.8 and the direct and indirect effects assessed in Section 5.9.

5.8 BASELINE CONDITIONS

Landscape Baseline

5.8.1 The assessment of landscape effects of the Proposed Development considers the effect on the landscape as a resource or a group of identifiable receptors. These include:

- Landscape fabric and character of the Proposed Development area;
- Generalised Landscape Character Types (LCTs) as identified in NatureScot's Landscape Character database (2019)[1]; and
- Designated landscapes, at international, national, and local level where relevant.

Landscape Character

5.8.2 Landscape character is defined as a distinct, recognisable, and consistent pattern of elements in the landscape that makes one landscape different from another, rather than better or worse. LCTs refer to distinct types of landscape that are relatively homogenous in character. They are generic in nature and can occur more than once in different parts of the country but wherever they occur they share broadly similar combinations of geology, topography, drainage patterns, vegetation, historic land use and settlement pattern.

5.8.3 Overall, the landscape character of the study area broadly consists of upland landscapes which cross the study area in a north east to south west direction. This ranges from the rugged uplands of the central Galloway Hills to the distinctive domed summits of the Southern Uplands. Within the upland landscape there are several notable features including The Merrick (the highest summit in southern Scotland), the distinctive ridgeline of the Rhinns of Kells, and Cairnsmore of Carsphairn massif.

5.8.4 A series of broad dales separate the upland landscapes and contain major rivers such as the Water of Deugh and Water of Ken. These are supplied by tributaries located in adjacent small-scale glens. Settlement within the Southern Uplands is limited to the dales linked by a series of 'A' and 'B' roads.

5.8.5 To the north within East Ayrshire, the study area is characterised by lowland settled farmland interspersed with former coal mining sites, gradually rising southwards to a band of foothills which extend between the Upper Nith Basin in the east and the Stinchar valley in the west.

5.8.6 Within the 45 km study area, a total of 51 LCTs were identified from NatureScot's Landscape Character Database (2019). This complex landscape character baseline is illustrated on Volume 2b: Figure 5.5. The first stage initial assessment of potential effects on the landscape character baseline identified those LCTs with the potential to experience significant effects and therefore requiring detailed assessment (see Volume 3: Appendix 5.3). This was based on the distance between the Proposed Development and the LCT, and the extent of theoretical visibility predicted.

[1] NatureScot (2019) Landscape Character Type Database [https:www.nature.scot] August. Available at: https://www.nature.scot/professional-advice/landscape/landscape-character-assessment/scottish-landscape-character-types-map-and-descriptions (Accessed August 2021)

5.8.7 Of these, 7 LCTs were identified as landscape receptors with the potential to experience significant landscape effects as a result of the Proposed Development and are taken through to be assessed in detail in this Chapter as follows:

- LCT 76: Foothills - Ayrshire;
- LCT 160: Narrow Wooded Valley – Dumfries & Galloway;
- LCT 165: Upper Dale – Dumfries & Galloway;
- LCT 176: Foothills with Forest – Dumfries & Galloway;
- LCT 177: Southern Uplands – Dumfries & Galloway;
- LCT 178: Southern Uplands with Forest – Dumfries & Galloway; and
- LCT 180: Rugged Uplands – Dumfries & Galloway.

5.8.8 The following sources have been used to support the assessment.

- Dumfries and Galloway landscape assessment (Land Use Consultants, 1998);[2]
- NatureScot National Landscape Character Assessment, Landscape Character Type 76: FOOTHILLS - AYRSHIRE (NatureScot, 2019);[3]
- NatureScot National Landscape Character Assessment, Landscape Character Type 160: NARROW WOODED VALLEY – DUMFRIES & GALLOWAY (NatureScot, 2019);[4]
- NatureScot National Landscape Character Assessment, Landscape Character Type 165: UPPER DALE – DUMFRIES & GALLOWAY (NatureScot, 2019);[5]
- NatureScot National Landscape Character Assessment, Landscape Character Type 176: FOOTHILLS WITH FOREST – DUMFRIES & GALLOWAY (NatureScot, 2019);[6]
- NatureScot National Landscape Character Assessment, Landscape Character Type 177: SOUTHERN UPLANDS – DUMFRIES & GALLOWAY (NatureScot, 2019);[7]
- NatureScot National Landscape Character Assessment, Landscape Character Type 178: SOUTHERN UPLANDS WITH FOREST – DUMFRIES & GALLOWAY (NatureScot, 2019);[8]
- NatureScot National Landscape Character Assessment, Landscape Character Type 180: RUGGED UPLANDS– DUMFRIES & GALLOWAY (NatureScot, 2019);[9] and
- Dumfries & Galloway Council Local Development Plan Supplementary Guidance, Part 1 Wind Energy Development: Development Management Considerations Appendix 'C' Dumfries & Galloway Wind Farm Landscape Capacity Study.[10]

5.8.9 Turbines 1 - 6 and 8 - 14 of the Proposed Development area lie within LCT177: Southern Uplands – Dumfries & Galloway, and Turbine 7 within LCT 165: Upper Dale - Dumfries and Galloway.

5.8.10 The baseline for the Proposed Development Area and the seven LCTs assessed is set out in the following paragraphs.

Proposed Development Area

5.8.11 Approximately 1,645 ha of the Proposed Development Area is located within the Carsphairn unit of LCT 177: Southern Uplands – Dumfries & Galloway. This covers the eastern side of Cairnsmore of Carsphairn and Willieanna and includes Beninner and Knockwhirn extending southwards to the Upper Dale – Dumfries & Galloway LCT. Topography within the site typically ranges between 240 m to 797 m AOD, generally sloping southwards towards the Water of Deugh. The site is drained by a series of small watercourses including the Benloch, Knockcray, Polhay and Polshagg Burns. Landcover comprises mostly of marshy rush/purple moor grass pasture and upland acid grassland used predominantly as rough grazing associated with nearby farms. Panoramic views can be obtained from the site within this LCT looking outwards with unobstructed views towards the Rhinns of Kells to the south west.

5.8.12 Recently, two applications for woodland expansion within the site boundary have been consented and planting is underway comprising mixed species woodland. This will extend the existing plantation on Marscalloch Hill westwards to the Marbrack Burn partially located within the Carsphairn unit. The second consented woodland application covers two areas to the south of Knockwhirn and east of Knockgray.

5.8.13 Approximately 81.8 ha of the Proposed Development Area is located within the Upper Glenkens unit of LCT 165: Upper Dale – Dumfries & Galloway. This covers the southern slopes of Craig of Knockgray, extending southwards to the B729 road. The landscape comprises semi-improved pasture contained by post and wire fences, small clumps of broadleaf and coniferous trees and shelterbelt planting, and modified watercourses and drainage. Recent woodland planting extends the existing forestry plantation on Marscalloch Hill westwards to the Marbrack Burn and is partially located within the Upper Glenkens unit. Additionally, as part of a refurbishment to overhead lines in the Carsphairn area, a 400 kV overhead line crosses the south of the Proposed Development in a north west to south east direction. The Proposed Development Area within this LCT is open in character with extensive views across the dale to the surrounding hillsides including the Rhinns of Kells to the south west.

Landscape Sensitivity

5.8.14 The Proposed Development is located within two LCTs which contribute to the juxtaposition between the distinctive Southern Uplands and Upper Dale landscapes. This is recognised in the Dumfries & Galloway

[2] Land Use Consultants (1998) Dumfries and Galloway landscape assessment. Scottish Natural Heritage Review No. 94.

[3] NatureScot (2019) National Landscape Character Assessment, Landscape Character Type 76: FOOTHILLS - AYRSHIRE August. Available at: https://www.nature.scot/sites/default/files/LCA/LCT076-Foothills-Ayrshire-Final.pdf (Accessed August 2021)

[4] NatureScot (2019) National Landscape Character Assessment, Landscape Character Type 160: NARROW WOODED RIVER VALLEY – DUMFRIES & GALLOWAY. Available at: https://www.nature.scot/sites/default/files/LCA/LCT160-NarrowWoodedValley-Dumfries&Galloway-Final.pdf (Accessed August 2021)

[5] NatureScot (2019) National Landscape Character Assessment, Landscape Character Type 165: UPPER DALE – DUMFRIES & GALLOWAY. Available at: https://www.nature.scot/sites/default/files/LCA/LCT165-Upper Dale-Dumfries&Galloway-Final.pdf (Accessed August 2021)

[6] NatureScot (2019) National Landscape Character Assessment, Landscape Character Type 176: FOOTHILLS WITH FOREST – DUMFRIES AND GALLOWAY. Available at: https://www.nature.scot/sites/default/files/LCA/LCT176-FoothillswithForest-Dumfries&Galloway-Final.pdf (Accessed August 2021)

[7] NatureScot (2019) National Landscape Character Assessment, Landscape Character Type 177: SOUTHERN UPLANDS. Available at: https://www.nature.scot/sites/default/files/LCA/LCT 177-Southern Uplands-Dumfries&Galloway-Final.pdf (Accessed August 2021)

[8] NatureScot (2019) National Landscape Character Assessment, Landscape Character Type 177: SOUTHERN UPLANDS WITH FORESTS – DUMFRIES & GALLOWAY. Available at: https://www.nature.scot/sites/default/files/LCA/LCT178-SouthernUplandswithForest-DumfriesandGalloway-Final.pdf (Accessed August 2021)

[9] NatureScot (2019) National Landscape Character Assessment, Landscape Character Type 180: RUGGED UPLANDS – DUMFRIES & GALLOWAY. Available at: https://www.nature.scot/sites/default/files/LCA/LCT180–RuggedUplands–Dumfries&Galloway–Final.pdf (Accessed August 2021)

[10] Dumfries & Galloway Council (2017) Dumfries & Galloway Council Local Development Plan Supplementary Guidance, Part 1 Wind Energy Development: Development Management Considerations Appendix 'C' Dumfries & Galloway Wind Farm Landscape Capacity Study. https://www.dumgal.gov.uk/media/22640/Part-1-Wind-Energy-Development-Development-Management-Considerations-Appendix-C-DGWFLCS/pdf/Wind_Energy_Appendix_C_Landscape_SG_LDP2_Adopted.pdf?m=637184996412100000 (Accessed August 2021)

Local Development Plan for its inclusion in the Galloway Hills Regional Scenic Area (RSA) resulting in a landscape value of **High**. The Proposed Development has some ability to accommodate the type of development proposed as a result of being large-scale, forms the lower slopes of Cairnsmore of Carsphairn and open in character with few small-scale characteristics. Landscape susceptibility of the site is **High**.

5.8.15 Overall landscape sensitivity for the Proposed Development would be **High**.

LCT 76: Foothills – Ayrshire

5.8.16 This LCT covers a series of small-scale hills located in the south of East Ayrshire extending between the Upper Nith Basin in the east, and the Stinchar Valley in the west.

5.8.17 Currently, two operational wind farms are located within this LCT, Hadyard Hill situated 28.8 km to the west and Dersalloch 16.9 km to the north west of the Proposed Development.

5.8.18 Artificial lighting sources within this LCT are limited due to the sparse settlement and man-made elements present. Light pollution tends to be greater in the valleys dissecting the foothills and neighbouring LCTs but at limited levels.

5.8.19 NatureScot identify the key characteristics as follows:

- *'Dissected landform of incised valleys cut between rounded ridges, frequently having a slightly conical form with long shoulder slopes, and plateaux occasionally rising to undramatic summits.*
- *Underlain by red sandstones in the west and coal measures in the east.*
- *Variety of landcover types: lower slopes typically have a pastoral character; with increasing altitude the proportion of rougher grazing rises; and summits are dominated by moorland vegetation.*
- *Swathes of dark green coniferous forest cover many of the rounded peaks and descend on to the lower slopes.*
- *The eastern part of this area, comprising the south eastern part of the Ayrshire Coalfield, has a concentration of large open-cast coal mines.*
- *Scatter of villages and farms in the northern parts of the Landscape Character Type, and very little settlement in more upland areas to the south and east.*
- *Remnants of historic settlement patterns still evident in areas that are unsettled and uncultivated.*
- *Enclosed nature of forested areas, with their foreshortened views, can create a remote, isolated feel.*
- *Simple, largely undeveloped landscape, with foothills often providing scenic backdrops to the settled valleys which surround them.'.*[11]

Landscape Sensitivity

5.8.20 The following sets out landscape value of LCT 76: Foothills – Ayrshire:

Table 5.7: Landscape Value

Landscape Value	
Landscape Quality (Condition):	This LCT is partially located within the buffer of the Galloway International Dark Sky Park and was the former site of the Dark Sky Observatory prior to fire damage in 2021. The LCT is also partially covered by the Doon Valley Special Landscape Character Area (SLCA), South Ayrshire Scenic Area (SA) and Craigengillan Garden and Designed Landscape (GDL) resulting in areas of higher value. Overall, the LCT is comprised large areas of forestry and moorland where quality is considered to be medium.
Scenic quality:	Provides a scenic backdrop to surrounding valleys affording long distance views but diminishes around some former coal mining areas.
Rarity:	Forms a large band of foothills which are unique within Ayrshire.
Representativeness:	Does not include many distinctive summits, the overall landform of the foothills provides an important transitional landscape between the lowlands to the north and the Southern Uplands to the south.
Conservation interests:	Includes many cultural heritage assets, post-industrial features associated with coal mining and sits partially within the Galloway International Dark Sky Park.
Recreation value:	Popular for recreation, includes walking routes, areas for dark sky enthusiasts, fishing, and cycling; in particular, around the Loch Doon area.
Perceptual aspects:	NatureScot wildness mapping indicates that whilst the LCT is generally influenced by management practices, there is a degree of wildness in areas away from main roads, valleys, and forest plantations.
Associations:	Features within the LCT have long associations with literature and activities associated with World War Two.
Landscape value is **High**.	

5.8.21 The following sets out landscape susceptibility of LCT 76: Foothills – Ayrshire:

Table 5.8: Landscape Susceptibility

Landscape Susceptibility	
Landscape scale and geographical extent:	This LCT covers a large part of South Ayrshire. Contrasting in scale, the LCT includes large-scale uplands and small-scale in the numerous valleys that dissect the LCT.
Landform:	Comprises rounded hills with undramatic summits typically not exceeding 300 m in height dissected by a series of incised valleys.
Skylines:	Depending on elevation, the LCT provides the foreground or background to views experienced from lower lying areas.
Landscape pattern and complexity:	At lower elevations, comprises medium-sized fields contained by drystone walls, fences and gappy hedges. At higher elevations, landcover becomes simpler comprising rough pasture interspersed with large-scale forestry plantations.
Settlement and man-made influences:	Settlement tends to be located in adjacent valleys and limited to farms and individual properties elsewhere. Man-made influences include Loch Doon and its associated reservoir infrastructure and from land management practices, coniferous forestry and from past coal mining activity.
Inter-visibility with adjacent landscapes and vistas:	Forms an important backdrop to lower lying areas including several incised valleys. In some views, the LCT forms the foreground in views towards the Southern Uplands.
Perceptual aspects:	The LCT forms a simple landscape with a perception of remoteness, especially in the core area away from settled valleys. Large-scale forestry has altered the character in some locations hiding variations in landform and providing a sense of enclosure.
Landscape susceptibility is **High**.	

5.8.22 Overall sensitivity for the Foothills – Ayrshire LCT is **High**.

[11] SNH (2019) National Landscape Character Assessment, LCT 76 FOOTHILLS - AYRSHIRE

LCT 160: Narrow Wooded Valley – Dumfries & Galloway

5.8.23 Of the six units of this LCT located within the study area, the Ken unit has been identified for assessment due to its proximity to the Proposed Development approximately 1.6 km to the south east, and the extent of theoretical visibility predicted within the unit.

5.8.24 The Ken unit forms a relatively narrow valley (Lorg Glen) which follows the Water of Ken. Orientated in a north east to south west direction, the head of the valley is narrow and enclosed by a combination of steep sided slopes and coniferous forestry. Gradually, as the watercourse flows southwards, the glen broadens and sides become less steep and set further back from the watercourse, which combined with adjacent clear-felled areas reduces the sense of enclosure.

5.8.25 No operational wind farms are located within this LCT but there is intervisibility of operational sites beyond the valley of Windy Standard I and II behind Beninner and Cairnsmore of Carsphairn.

5.8.26 Dark-skies mapping shows that this LCT has very limited light pollution associated with occasional cars travelling along the minor road leading to Lorg and from individual properties within the valley.

5.8.27 NatureScot identify the key characteristics as follows:

- *'Narrow incised valleys with wooded slopes enclosing pasture floors.*
- *Small pastures and arable fields enclosed by hedges/fences in lower reaches and drystone dykes in upper reaches.*
- *Dominant broadleaf (semi-natural) woodland character with conifers on higher slopes.*
- *Lush trough-shaped river valleys with pasture/arable floors enclosed by deciduous wooded slopes.*
- *Riparian trees and woodlands following meandering river courses in lower reaches.*
- *Narrow lanes following valleys and linking isolated houses, occasional settlements and providing access to higher moorland.*
- *Clusters of prehistoric landscapes and settlement up some valleys, notably in Eskdale.*
- *Numerous arched stone bridges over the rivers.*
- *Intimate unspoilt landscape focussing on river views with some adjacent policy landscape.'*[12]

Landscape Sensitivity

5.8.28 The following sets out landscape value of LCT 160: Narrow Wooded Valley – Dumfries & Galloway:

Table 5.9: Landscape Value

Landscape Value	
Landscape Quality (Condition):	This unit is not covered by any national or local level designation. Agriculture and forestry form the main land uses within this unit and their associated management practices contribute to the overall quality of this LCT which is medium.
Scenic quality:	Relatively scenic with numerous interesting landscape features contained within a narrow glen.
Rarity:	Includes some cultural heritage features which are unique to the Glenkens area.
Representativeness:	The LCT is distinctive to Dumfries & Galloway and occurs in several other parts of the county with differing perceptions of tranquillity and remoteness depending on location.
Conservation interests:	Cultural heritage interest includes several historic bridges crossing the Water of Ken such as Smitton's Bridge (Smeaton's Bridge) which carries the B729 road, cairns, and forts. Characterised by 19th – 20th Century field patterns.
Recreation value:	Popular with walkers accessing the Southern Uplands and fishing in the Water of Ken.
Perceptual aspects:	Not considered to be wild on account of its agricultural and forested land use but does have a degree of tranquillity and remoteness due to limited settlement and development.
Associations:	None identified.
Landscape value is considered to be **High**.	

5.8.29 The following sets out landscape susceptibility of LCT 160: Narrow Wooded Valley – Dumfries & Galloway:

Table 5.10: Landscape Susceptibility

Landscape Susceptibility	
Landscape scale and geographical extent:	Generally small-scale covering a limited geographical area that occurs in numerous locations throughout Dumfries & Galloway.
Landform:	Forms the upper reaches of the Water of Ken comprising narrow glen with steep valley sides, a narrow flat floor that gradually broadens to the south.
Skylines:	Due to the steepness of the glen sides, the foreground ridge often forms the skyline from the valley floor screening the higher summits of the Southern Uplands beyond. As the glen broadens to the south, the distinctive summits of Cairnsmore of Carsphairn and Beninner to the north and the Rhinns of Kells to the west are notable features.
Landscape pattern and complexity:	Comprises small-scale fields, often difficult to perceive due to vegetation situated on either side of the Water of Ken with some riparian woodland and small woodlands within the floodplain, rising to rough pasture and large-scale forestry plantations on the valley sides.
Settlement and man-made influences:	The Ken unit includes a short section of the Southern Upland Way which crosses the unit near Stroanfreggan and there is a minor road leading to Lorg running through the glen. This is also used as a timber transport route and access to Windy Rig Wind Farm. A short section of the B729 road crosses the unit in the south.
Inter-visibility with adjacent landscapes and vistas:	Limited in the upper reaches with the nearby summits of the Southern Uplands being visible form the upper valley sides and to the south from the valley floor.
Perceptual aspects:	Small-scale, enclosed, and intimate in the upper reaches of the valley.
Landscape susceptibility is **High**.	

5.8.30 Overall sensitivity for the LCT 160: Narrow Wooded Valley – Dumfries & Galloway is **High**.

LCT 165: Upper Dale – Dumfries & Galloway

5.8.31 This LCT is characteristic of two locations within the study area covering the Ken/Deugh and Nith rivers in Dumfries & Galloway. No theoretical visibility is predicted within the Upper Nithsdale unit located 17.0 km to the north east.

5.8.32 The Upper Glenkens unit extends between Lamford in the north, and St John's Town of Dalry in the south. Situated between the higher ground of the Southern Uplands. The landscape is characterised by a wide flat-bottomed valley of semi-improved farmland enclosed by gently undulating side slopes rising beyond the LCT to the larger hills of the Southern Uplands. Several key roads pass through the LCT including the

[12] SNH (2019) National Landscape Character Assessment LCT 160 NARROW WOODED VALLEY – DUMFRIES & GALLOWAY

A702, A713, A762, B729, and B7000. Settlement is frequent but of limited size comprising villages and hamlets situated close to the main road network.

5.8.33 No operational wind farms are located within the Upper Glenkens unit, but it does experience intervisibility with sites located within neighbouring LCTs such as Windy Standard.

5.8.34 Dark-skies mapping shows that this LCT falls within the darkest categories of night-time lighting. Light pollution is limited to around Carsphairn, cars travelling along roads and from individual properties.

5.8.35 NatureScot identify the key characteristics as follows:

- *'Wide valleys enclosed by high peaks and moorland.*
- *Open with long views.*
- *Notable narrower section of Upper Nithsdale between Thornhill and Mennock.*
- *Improved valley pastures becoming rougher up the valley sides.*
- *Medium to large scale enclosures with dry stone dykes.*
- *Riparian woodlands along the main river and up tributary channels.*
- *Medium to large scale forests on the valley sides and extending over horizons from higher ground.*
- *Large scale wind farm development characteristic of some adjacent upland fringes and backdrop skylines.*
- *Mining settlements and remnants of industrial activity such as mine ruins and bings.'*[13]

Landscape Sensitivity

5.8.36 The following sets out landscape value of LCT 165: Upper Dale – Dumfries & Galloway:

Table 5.11: Landscape Value

Landscape Value	
Landscape Quality (Condition):	This LCT is recognised in the Local Development Plan by its inclusion in the Galloway Hills RSA which covers much of the unit. Agriculture and estates form the main land uses within this unit and their associated management practices contribute to the overall quality of this LCT.
Scenic quality:	Generally scenic on account of the diversity of landscape features within the unit resulting in an attractive agricultural landscape with estates and woodland. Forms an interesting juxtaposition of managed farmland within the dale floor and simpler upland sides of moorland, rough pasture, and forestry.
Rarity:	Forms one of two areas situated in Dumfries & Galloway.
Representativeness:	The LCT is distinctive to Dumfries & Galloway.
Conservation interests:	It is documented that the Upper Glenkens unit displays evidence of post improvement (19th – 20th Century) field systems and farming on the bottom of the valley, designed landscapes including the non-inventory designed landscape of Knockgray, numerous archaeological sites such as cairns, forts, enclosed field systems, castles, and historic bridges.
Recreation value:	Recreation pursuits include walking, and the unit is crossed by the Southern Upland Way (SUW). Other interests include cycling, fishing, and shooting.
Perceptual aspects:	Despite being managed for agriculture and estates; the unit is influenced by the nearby Southern Uplands giving a perception of an upland landscape.
Associations:	Has a long history associated with travel owing to its importance as a commercial route through the Southern Uplands.
Landscape Value	
Landscape value is **High**	

5.8.37 The following sets out landscape susceptibility of LCT 165: Upper Dale – Dumfries & Galloway:

Table 5.12: Landscape Susceptibility

Landscape Susceptibility	
Landscape scale and geographical extent:	The Upper Glenkens unit is medium in geographic scale but contains many small-scale landscape features within the bottom of the valley comprising complex pattern of fields set either side of the Water of Deugh, interspersed by areas of woodland, knolls, and buildings. This contrasts with the side slopes which have less features, open and are simpler in character forming a transitional area between the settled valley floor and surrounding uplands.
Landform:	Gently undulating and flat bottomed which gradually rise to steep-side slopes providing some enclosure. Seamless topography transition between the lowland dale and upland landscapes with some rocky knolls.
Skylines:	Skylines on the edge of the dale are sensitive and include low ridgelines with intervisibility of the uplands beyond including the distinctive form of the Cairnsmore of Carsphairn massif and the ridgeline of the Rhinns of Kells located in neighbouring LCTs.
Landscape pattern and complexity:	Agriculture forms the main land use with improved to semi-improved grassland being the predominant landcover interspersed with small areas of woodland, shelterbelts, coniferous plantations, and riparian woodland which traces the Ken and Deugh Waters and their associated tributaries.
Settlement and man-made influences:	Despite being settled and containing man-made features, there is a perception of an upland landscape within this unit owing to the influence from the surrounding uplands.
Inter-visibility with adjacent landscapes and vistas:	Distant to short range views depending on tree cover with intervisibility of the surrounding Southern Uplands.
Perceptual aspects:	Experiences a degree of enclosure due to the surrounding uplands, is well-settled and is not considered remote or secluded
Landscape susceptibility is **High-medium**.	

5.8.38 Overall sensitivity for the LCT 165: Upper Dale – Dumfries & Galloway is **High**.

LCT 176: Foothills with Forest – Dumfries & Galloway

5.8.39 This LCT covers five separate locations within the southern half of the study area. Two units, the Rhinns of Kells located 2.7 km to the south west, and the Stroan unit 4.2 km to the south east are predicted to receive theoretical visibility of the Proposed Development. This LCT is characterised by a series of foothills planted with large scale forestry on the side slopes and open moorland hill tops.

5.8.40 No operational turbines are located within the Rhinns of Kells unit and in the Stroan unit, Blackcraig Wind Farm is situated 13.7 km to the south east of the Proposed Development.

5.8.41 Dark-skies mapping shows that this LCT falls within the darkest categories of night-time lighting. Light pollution is very limited due to the lack of settlement and occurs mainly in adjacent LCTs associated with cars travelling along roads and from individual properties.

[13] SNH (2019) National Landscape Character Assessment LCT 165 UPPER DALE – DUMFRIES & GALLOWAY

5.8.42 NatureScot identify the key characteristics as follows:

- *'Dark green blanket of forest covering undulating foothills.*
- *Changing landscape with areas with large and medium scale forestry operations and wind farm development.*
- *Forested areas dominated by Sitka Spruce, interspersed with mixed conifers and broadleaf planting, undergoing felling and replanting in large coupes.*
- *Tall mature conifers at roadside.*
- *Areas of more complex, locally distinctive and smaller-scale landscapes, with semi-improved pasture with walled enclosures on open ground, occasional lochs and estate policies, distinctive ridges and landmark summits.*
- *Areas of relict landscape with remains of pre-improvement settlement and agriculture clustered in burn valleys.*
- *Wind farms, locally defining the character in some areas of central Dumfries and Galloway.'*

Landscape Sensitivity

5.8.43 The following sets out landscape value of LCT 176: Foothills with Forest – Dumfries & Galloway:

Table 5.13: Landscape Value

Landscape Value	
Landscape Quality (Condition):	The Rhinns of Kells unit is entirely within the Galloway Hills RSA which also covers a very limited part of the Stroan unit south west of New Galloway. The Rhinns of Kells unit falls within the buffer and partially within the core area of the Galloway International Dark Skies Park.
Scenic quality:	The Rhinns of Kells unit forms a transitional landscape and the foreground to the Rugged Uplands to the west, especially from lower lying areas.
Rarity:	This LCT is characteristic to Dumfries & Galloway and the Scottish Borders.
Representativeness:	This unit is representative of the large, forested areas found in Dumfries & Galloway.
Conservation interests:	Much of the landscape is covered by commercial forestry which reduces the conservation interest although there are areas of interest in both units of the LCT.
Recreation value:	Recreation is generally limited to walking and cycling along forest tracks and accessing the higher more open summits.
Perceptual aspects:	Forms a contrasting perception of enclosure as a result of the presence of forestry with open areas above the tree line.
Associations:	Predominantly known for being the location of large-scale forestry plantations during the 20th Century
Landscape value is considered to be **High** for the Rhinns of Kells unit and **Medium** for the Stroan unit.	

5.8.44 The following sets out landscape susceptibility of LCT 176: Foothills with Forest – Dumfries & Galloway:

Table 5.14: Landscape Susceptibility

Landscape Susceptibility	
Landscape scale and geographical extent:	Scale varies between small and large depending on elevation and influence of forestry.
Landform:	Comprises hills between 170 – 250 m in elevation that are undulating with rounded summits. Extensive forestry coverage screens underlying variations in topography on slopes and watercourses. Includes some pronounced peaks.
Skylines:	Forms the skyline from both elevated and lower-level areas.
Landscape pattern and complexity:	Relatively simple owing to its upland nature and large-scale forestry plantations. Between plantations, there are more diverse fringes of mixed woodland, open ground and watercourses.
Settlement and man-made influences:	Heavily influenced by forestry and associated infrastructure such as access tracks limiting settlement.
Inter-visibility with adjacent landscapes and vistas:	Forms a transitional landscape between the lower lying dales and Rugged Uplands LCTs.
Perceptual aspects:	Unified and simple character with a perception of enclosure and openness depending on forestry coverage which also reduces the wild qualities.
Landscape susceptibility is considered **High** for the Rhinns of Kells unit and **Medium** for the Stroan unit.	

5.8.45 Overall sensitivity for the LCT 176: Foothills with Forest – Dumfries & Galloway is **High** for the Rhinns of Kells unit and **Medium** for the Stroan unit.

LCT 177: Southern Uplands – Dumfries & Galloway

5.8.46 Covering a large part of Dumfries & Galloway, Scottish Borders, Ayrshire, and South Lanarkshire, the LCT comprises a series of large, rounded hills divided by U-shaped valleys. Landcover is predominantly grass moorland with areas of heather, extensive coniferous forestry and several operational wind farms including Windy Rig, Whiteside and Sanquhar. Settlement is sparse and mainly confined to lower hill slopes within U-shaped valleys which also form the main transport corridors through the LCT.

5.8.47 Dark-skies mapping shows that this LCT falls within the darkest categories of night-time lighting. Light pollution is limited to sources in neighbouring LCTs within Glenkens.

5.8.48 NatureScot identify the key characteristics as follows:

- *'Large, smooth dome/conical shaped hills, predominantly grass-covered.*
- *Open and exposed character except within incised valleys.*
- *Dramatically sculpted landforms and awe-inspiring scale.*
- *Distinctive dark brown/purple colour of heather on some of the higher areas.*
- *Pockets of woodland in incised valleys.*
- *Stone dykes occasionally define the lower limit.*
- *Legacy of lead and other mining activity, with extensive archaeological remains around the former mining village of Wanlockhead.*
- *Wind farms locally characteristic, away from the more dramatic, scenic and sculptural slopes and skylines.'*

Landscape Sensitivity

5.8.49 The following sets out landscape value of LCT 177: Southern Uplands – Dumfries & Galloway:

Table 5.15: Landscape Value

Landscape Value	
Landscape Quality (Condition):	This LCT is not covered by any national designations but is recognised in the Dumfries & Galloway Local Development Plan as being covered by the Galloway Hills RSA. The Carsphairn unit also includes the distinctive mass of Cairnsmore of

Landscape Value	
	Carsphairn (a Corbett) and associated hills and is a popular hill recreationally as well being experienced from lower elevations.
Scenic quality:	Scenic and popular with walkers.
Rarity:	Occurs in many locations throughout Dumfries & Galloway and the Scottish Borders. Unusual to be dominated by one distinctive peak.
Representativeness:	Provides a good representation of the different characteristics of this LCT.
Conservation interests:	Some associated with cultural heritage assets and includes a past crash site from World War 2.
Recreation value:	Popular with walkers and experienced from lower levels within Glenkens.
Perceptual aspects:	Large-scale open landscape with a degree of tranquillity and remoteness away from the more settled glens.
Associations:	Has many associations culturally and in written work mainly focussing on the summit of Cairnsmore of Carsphairn.
Landscape value is **High**.	

5.8.50 The following sets out landscape susceptibility of LCT177: Southern Uplands – Dumfries & Galloway:

Table 5.16: Landscape Susceptibility

Landscape Susceptibility	
Landscape scale and geographical extent:	Large in vertical scale especially in comparisons to neighbouring LCTs. Also covers a large geographic area and has the potential to accommodate developments of the type proposed.
Landform:	The Carsphairn unit is characterised by large domed and slightly conical shaped hills with steep sides, clefts, and glens.
Skylines:	Forms a distinctive skyline both from lower lying areas within Glenkens and from upland areas such as the Rhinns of Kells to the south west.
Landscape pattern and complexity:	Uniform in pattern comprising acidic grassland and heather.
Settlement and man-made influences:	Very limited due to steep landform.
Inter-visibility with adjacent landscapes and vistas:	Forms the backdrop to adjacent LCTs and Glenkens and includes the landmark hill of Cairnsmore of Carsphairn.
Perceptual aspects:	Large-scale, with extensive visibility over the surrounding landscapes.
Landscape susceptibility is considered to be **High**	

5.8.51 Overall sensitivity for the LCT 160: Narrow Wooded Valley – Dumfries & Galloway is **High**.

LCT 178: Southern Uplands with Forest – Dumfries & Galloway

5.8.52 Two units of this LCT are located in close proximity to the Proposed Development, the Carsphairn unit 1.3 km to the north and the Ken unit abuts the Proposed Development to the east.

5.8.53 Similar to the Southern Uplands – Dumfries & Galloway LCT, both units of this LCT are characterised by a series of large, rounded hills divided by U-shaped valleys. However, forestry forms the main landcover throughout both units.

5.8.54 Both units have operational wind farms, the Carsphairn unit includes South Kyle and Windy Standard I and II, and the Ken unit Wether Hill.

5.8.55 Dark-skies mapping shows that this LCT falls within the darkest categories of night-time lighting. Light pollution is limited to sources in neighbouring LCTs.

5.8.56 NatureScot identify the key characteristics as follows:

- *Large, smooth dome-shaped hills with large scale dark green forests on slopes and over lower summits.*
- *Predominantly simple, gently rolling landform.*
- *Some areas of more complex and smaller-scale landscapes, with steep slopes enclosing heads of valleys and/or where uplands remain open.*
- *Changing landscapes with large scale forestry operations and wind farm development.*
- *Forested areas dominated by Sitka Spruce, interspersed with mixed conifers and broadleaf planting, and undergoing felling and replanting in large coupes.*
- *Wind farms are a key characteristic in some areas.*
- *Expansive scale.*[14]

Landscape Sensitivity

5.8.57 The following sets out landscape value of LCT 178: Southern Uplands with Forest – Dumfries & Galloway:

Table 5.17: Landscape Value

Landscape Value	
Landscape Quality (Condition):	This LCT is not covered by any national designations but is recognised in the Dumfries & Galloway Local Development Plan as being covered by the Galloway Hills RSA.
Scenic quality:	Scenic providing the backdrop to neighbouring glens and popular with walkers.
Rarity:	Occurs in many locations throughout Dumfries & Galloway and the Scottish Borders.
Representativeness:	Provides a good representation of the different characteristics of this LCT.
Conservation interests:	Heavily influenced by forestry includes some historical features such as cairns and hillforts. Move towards broadleaf species and increased species diversity in forest planting.
Recreation value:	Popular with walkers and cyclists utilising existing access tracks.
Perceptual aspects:	Large-scale, semi-enclosed to open landscape with a degree of tranquillity and remoteness away from the glens. Wild qualities reduced by large-scale forestry planting.
Associations:	Has many associations culturally and in written work mainly focussing on the large-scale forest plantations of the 20th Century.
Landscape value is **High**.	

5.8.58 The following sets out landscape susceptibility of LCT 178: Southern Uplands with Forest – Dumfries & Galloway:

Table 5.18: Landscape Susceptibility

Landscape Susceptibility	
Landscape scale and geographical extent:	Large in vertical scale especially in comparisons to neighbouring LCTs. Also covers a large geographic area.

[14] SNH (2019) National Landscape Character Assessment LCT 178 SOUTHERN UPLANDS WITH FOREST – DUMFRIES & GALLOWAY

Landscape Susceptibility	
Landform:	Is characterised by large domed and slightly conical shaped hills although smaller than the neighbouring Southern Uplands LCT, with steep sides, clefts and glens.
Skylines:	Forms a backdrop to lower lying areas within Glenkens and from upland areas such as the Rhinns of Kells to the south west.
Landscape pattern and complexity:	Large-scale forestry with smaller areas of acidic grassland and heather. Clear areas on hill summits and between forest plantations. Mover towards greater tree diversity has reduced the extent of mono-culture plantations.
Settlement and man-made influences:	Includes Windy Standard, South Kyle and Wether Hill Wind Farms, large-scale forestry and access tracks to access forest plantations.
Inter-visibility with adjacent landscapes and vistas:	Forms the backdrop to adjacent LCTs and Glenkens and includes the landmark hill of Cairnsmore of Carsphairn.
Perceptual aspects:	Large-scale, with extensive visibility over the surrounding landscapes where open areas occur. For the majority, perception of enclosure due to forestry.
Landscape susceptibility is **Medium**.	

5.8.59 Overall sensitivity for the LCT 178: Southern Uplands with Forest – Dumfries & Galloway is **High**.

LCT 180: Rugged Uplands – Dumfries & Galloway

5.8.60 Three units of this LCT are located to the west and south of the Proposed Development covering the Rhinns of Kells, Merrick and Fell of Fleet. Widespread theoretical visibility is predicted in the Rhinns of Kells unit 3 km to the west of the Proposed Development and has been included in the assessment. The remaining two units, the Merrick and Fell of Fleet are predicted to receive limited theoretical visibility and would be more distant and therefore, have not been included in the assessment.

5.8.61 No operational wind farms are located within this LCT.

5.8.62 Dark-skies mapping shows that this LCT falls within the darkest categories of night-time lighting. Light pollution is limited to sources in neighbouring LCTs.

5.8.63 NatureScot identify the key characteristics as follows:

- *'Massive, rugged peaks, rising steeply with craggy sides.*
- *Heather covered slopes, contrasting with white granite outcrops.*
- *Exposed 'highland' landscape.*
- *Dark cliffs and peripheral ridges.*
- *Numerous water features such as lochs and small burns.*
- *Forests on lower slopes.*
- *Open and wild character.'*[15]

Landscape Sensitivity

5.8.64 The following sets out landscape value of LCT 180: Rugged Uplands – Dumfries & Galloway:

Table 5.19: Landscape Value

Landscape Value	
Landscape Quality (Condition):	This LCT is not covered by any national designations but is recognised in the Dumfries & Galloway Local Development Plan as being covered by the Galloway Hills RSA. The unit also includes the distinctive ridgeline of the Rhinns of Kells and falls partially within the Galloway International Dark Skies Park.
Scenic quality:	Very scenic and popular with walkers and visitors.
Rarity:	Occurs in a few locations throughout Dumfries & Galloway.
Representativeness:	Provides a good representation of the different characteristics of this LCT.
Conservation interests:	Some associated with cultural heritage assets.
Recreation value:	Popular with walkers and dark sky enthusiasts.
Perceptual aspects:	Large-scale open landscape with a degree of tranquillity and remoteness away from the glens.
Associations:	Has many associations culturally and in written work mainly focussing on the Rhinns of Kells
Landscape value is **High**.	

5.8.65 The following sets out landscape susceptibility of LCT 180: Rugged Uplands – Dumfries & Galloway:

Table 5.20: Landscape Susceptibility

Landscape Susceptibility	
Landscape scale and geographical extent:	Large in vertical scale especially in comparison to neighbouring LCTs. Also covers a large geographic area.
Landform:	The Carsphairn unit is characterised by large, rugged peaks with steep sides, clefts and glens.
Skylines:	Forms a distinctive skyline both from lower lying areas within Glenkens and from upland areas such as the Rhinns of Kells to the south west.
Landscape pattern and complexity:	Uniform in pattern comprising acidic grassland and heather.
Settlement and man-made influences:	Very limited due to steep landform.
Inter-visibility with adjacent landscapes and vistas:	Forms the backdrop to adjacent LCTs and Glenkens and includes the landmark Rhinns of Kells
Perceptual aspects:	Large-scale, with extensive visibility over the surrounding landscapes.
Landscape susceptibility is **High**.	

5.8.66 Overall sensitivity for the LCT 180: Rugged Uplands – Dumfries & Galloway is **High**.

Designated & Protected Landscapes

5.8.67 The criteria used to define designated landscapes varies greatly and these are generally defined within landscape planning policy and documentation. The level of designation also varies between internationally acclaimed landscapes, nationally recognised landscapes, and local landscape designations, identified by each Local Planning Authority. The Galloway Dark Skies Park is the only international designation relevant to landscape and visual that is located within the study area.

5.8.68 Designations present within the 45 km study area are identified on Volume 2b: Figure 5.6a.

5.8.69 The first stage initial assessment was undertaken to identify those designated landscapes with the potential to experience significant effects and therefore requiring detailed assessment in the LVIA (see Volume 3: Appendix 5.4).

[15] SNH (2019) National Landscape Character Assessment LCT 180 RUGGED UPLANDS – DUMFRIES & GALLOWAY

5.8.70 A total of 3 National Scenic Areas (NSA), 21 Gardens and Designed Landscapes (GDL) and 12 local landscape designations (Special Landscape Areas / Regional Scenic Areas) were identified within the study area. Of these, the following have been taken forward to the detailed assessment:

- Galloway Hills Regional Scenic Area (RSA); and
- Loch Doon Sensitive Landscape Character Area (SLCA).

5.8.71 Additionally, The Merrick Wild Land Area (WLA) is located approximately 13.1 km to the west of the Proposed Development. Wild Land Areas are not a statutory designation but are identified as a nationally important asset in National Planning Framework 3 (NPF3) and as such are afforded "*areas of significant protection*" status within Table 1 (Page 39) of Scottish Planning Policy (SPP). SPP states that in the context of any proposed development a WLA *"Further consideration will be required to demonstrate that any significant effects on the qualities of these areas can be substantially overcome by siting, design or other mitigation."*

5.8.72 NatureScot's revised guidance *Assessing impacts on Wild Land Areas, Technical Guidance* (2020) states that *'This guidance should only be applied to proposals whose nature, siting, scale or design are likely to result in a significant effect on the qualities of a WLA. Given this, assessments are more likely for proposals within a WLA, and are less-likely for proposals outwith the WLA.'*

5.8.73 Analysis of the ZTV (see Volume 2b: Figure 5.6b) shows that theoretical visibility of the Proposed Development within The Merrick WLA would be very limited on account of screening from landform comprising the Rhinns of Kells in the intervening landscape. For this reason, combined with the distance involved, no Wild Land Assessment has been undertaken of The Merrick WLA as it is not considered that the introduction of the Proposed Development would result in a significant effect to the wild land attributes of the WLA.

5.8.74 Descriptions of the location, special qualities, and landscape sensitivity for each of the landscape designations is set in the following paragraphs.

Galloway Hills RSA

5.8.75 This RSA covers the central area of Dumfries & Galloway extending from the coastline in the south, comprising rugged uplands, domed and semi-conical peaks dissected by a series of narrow glens and broad dales. More recently, the RSA has been enlarged to include the visual envelopes of the three major valleys surrounding the hills. This has led to the inclusion of foothills, the lower slopes of the eastern and western flanks of the hill range, and the Cairnsmore of Carsphairn hill range.

5.8.76 No special qualities of the designation are available, and the following description is set out in the Regional Scenic Areas Technical Paper (January 2018) by Dumfries & Galloway Council as follows:

'The uplands vary in character from the massive craggy peaks of the Rugged Granite Uplands with their heather covered slopes and granite outcrops to the smoother, rounder, lower summits of the Foothills, and their extensive forested counterparts. The designated area was extended to include the dramatic sculptural peaks of the Cairnsmore of Carsphairn Southern Uplands Landscape Unit to the east, as well as the forested eastern slopes of the Rhinns of Kells.

The peripheral Narrow Wooded Valleys and the Coastal Flats of adjacent estuaries were included both for their own inherent characteristics and because of their scenic juxtaposition with the uplands. Scenic Area boundaries follow the immediate outward facing visual envelope of these valleys. More distant hills outwith the central hill mass of the Galloway Uplands, but which may be visible from these valleys, were excluded as being less critical to the scenic value of the area, but the potential impact on the designated area of proposals in these areas should be considered.'

5.8.77 Windy Rig operational wind farm is partially located in the north of the designation. All other wind farms are experienced beyond the RSA, predominantly east of Glenkens.

5.8.78 Dark-skies mapping shows that this RSA falls within the darkest categories of night-time lighting highlighted by the Galloway International Dark Skies Park also covering the area. Light pollution is limited to sources within Glenkens, and from higher elevations the settled lowlands situated beyond the Southern Uplands.

Landscape Sensitivity

5.8.79 The Galloway Hills RSA is recognised in the Dumfries & Galloway Local Development Plan 2019 and is covers the Galloway International Dark Skies Park core and buffer areas. There are areas within the RSA considered to be of **Very High** sensitivity such as the Merrick Wild Land Area and the Dark Skies Park. Overall, the RSA is considered to have a **High** landscape value on account of its local level designation

5.8.80 This RSA is large in scale and geographical extent with an open character, simple pattern, and land cover, and characterised by rounded domed, slightly conical and rugged hills with deep glens. It is considered that the landscape characteristics of this RSA have some ability to accommodate certain elements of the development without undue adverse effects occurring. This would be limited to the Southern Uplands and adjacent foothills where both landform and forestry is simpler in character. Overall, landscape susceptibility is considered **High**.

5.8.81 Overall, it is considered that the Galloway Hills RSA has a **High** landscape sensitivity.

Doon Valley SLCA

5.8.82 This designation covers the foothills to the west of Loch Doon in East Ayrshire.

5.8.83 The Loch Doon Sensitive Landscape Character Area is described as follows in East Ayrshire Local Development Plan Landscape Area Background Paper (2015):

'The gently undulating upland landscape forms a fairly narrow band of low hills lying at the head of the Girvan Valley and on the west side of the Doon Valley.

Towards the North, the landscape is simpler with a lower, gentle plateau, whilst the southern part of the landscape contains more pronounced landmark features.'

5.8.84 No operational wind farms are located within this SLCA.

5.8.85 Artificial light sources are limited within this SLCA due to the limited settlement and man-made elements. Light pollution tends to be greater in the valley to the east of Loch Doon in the form of isolated properties and vehicles travelling along the A713 road.

Landscape Sensitivity

5.8.86 The Loch Doon SLCA is recognised in the East Ayrshire Local Development Plan 2020 and is covers part of the core and buffer areas of the Galloway International Dark Skies Park. Overall, the SLCA is considered to have an overall **High** landscape value.

5.8.87 This SLCA is large in scale and geographical extent with an open character, characterised by rounded low foothills of rough pasture and forestry plantations. The SLCA is considered to have some ability to accommodate certain elements of the development without undue adverse effects resulting in a **Medium** susceptibility to landscape change.

5.8.88 Overall, it is considered that the Loch Doon SLCA has a **High** landscape sensitivity as a result of its designation within local planning policy.

Visual Baseline

5.8.89 The assessment of visual effects of the Proposed Development considers the effect on visual receptors or viewers throughout the study area. Visual receptors are people who will be affected by changes in views or visual amenity at different places. They are usually grouped by what they are doing at these places and include:

- People living and working in the area, such as residents and farm workers;
- People who view the Proposed Development sequentially such as those travelling through the area on road, rail or other forms of transport;
- People visiting promoted tourist attractions and landscapes; and
- People pursuing other recreational activities.

5.8.90 These visual receptors comprise the visual baseline.

Selected Viewpoints

5.8.91 Analysis of the ZTVs, together with site knowledge and verification were used to identify a provisional list of viewpoints which were investigated during scoping stage consultation with the Planning Authorities and NatureScot. The scoping report identified a list of provisional selected viewpoints to be included in the finalised LVIA assessment. Following a review of the scoping opinion, a desk-based survey and site verification, a finalised list of 25 viewpoints was taken forward.

5.8.92 The finalised list of selected viewpoints includes a variety of different types of view to represent the worst-case scenario of views of the Proposed Development. These are referred to as representative views, specific views, and exemplifying views from publicly accessible locations, which are defined in GLVIA3 as:

- *'Representative viewpoints: selected to represent the experience of different types of visual receptors, where larger number of viewpoints cannot all be included individually and where the significant effects are unlikely to differ. For example, certain points may be chosen to represent the views of users of particular public footpaths and bridleways;*
- *Specific viewpoints: chosen because they are key views and sometimes promoted viewpoints within the landscape, including for example scenic viewpoints from roads, specific local visitor attractions, viewpoints in areas that are particular noteworthy for visual and/or recreational amenity, such as landscapes with statutory landscape designations, or viewpoints with particular cultural landscape associations; and*
- *Exemplifying viewpoints: chosen specifically to demonstrate a particular effect or specific issue, which might be the restricted visibility at certain locations.'*

5.8.93 Viewpoints are selected to take account of the viewing experience (such as static views from settlements and sequential views from routes) cumulative views of other developments and as far as possible are representative of the range of key visual receptors and view types (including panoramas, vistas, glimpsed views), as well as being located at varying distances, elevations, and orientations from the Proposed Development.

5.8.94 Although these selected viewpoints primarily represent visual receptors, their location within certain designated landscapes or character types illustrate potential changes in the experiences from these landscapes, giving an indication of potential landscape effects. The predicted views from the selected viewpoints may therefore be cited as examples of such landscape effects within the Landscape Assessment detailed in Section 5. 11.

5.8.95 The baseline for the selected viewpoints assessed in the LVIA are identified in Table 5.21:

Table 5.21: Selected Viewpoints

VP No.	Location	Coordinate		Distance to nearest turbine	Landscape Receptors	Visual Receptors	Existing View	Sensitivity		
		Easting	Northing					Value	Susceptibility	Overall Sensitivity
1	**Carsphairn War Memorial** is located to the south east of the village of Carsphairn close to the junction between the A713 and B729 roads where it can easily be accessed from.	256857	593088	1.6 km	LCT 165: Upper Dale – Dumfries & Galloway Galloway Hills RSA	Visitors	Obtains open views of the surrounding landscape and due to containment from surrounding hillsides, short to medium range views can be experienced. Despite this it is possible to see the upper slopes of Black Shoulder and Beninner to the north east, and Cairnsgarroch, Corserine and Coran of Portmark to the south west. Also includes close views of a 400kV overhead transmission line. Artificial lighting is limited to cars travelling on the A713 road and light glow from nearby Carsphairn and lights from individual properties.	This viewpoint is located within the Galloway Hills RSA and commemorates the war service of the local population. Value is **High**.	The war memorial is in a prominent location and visitors attention is focussed on the memorial and surrounding landscape. Susceptibility to change is **High**.	**High**
2	**Carsphairn Community Garden** is located on the eastern edge of the village and is accessed via the A713 road. The gardens are located on a site sloping down towards the A713 road.	256291	593211	2.0 km	LCT 165: Upper Dale – Dumfries & Galloway Galloway Hills RSA	Residents	The gardens are located on a site sloping down towards the A713 road. The foreground gardens provide the main interest at this location comprising retaining walls, planting beds and tree planting. However, the surrounding landscape forms an important role in the setting of the gardens. This is highlighted by an interpretation board which identifies the summits of the hills forming the Rhinns of Kells, which is visible extending between the north west and south west beyond the village. To the north, views are partially filtered by tree planting, buildings and the rising slopes leading to Craig of Knockgray. As the viewpoint is located in Carsphairn, during darkness there are many forms of artificial lighting from cars passing through the village, street lights and lights emitting from properties.	This viewpoint is located within the Galloway Hills RSA and was created by the local community for residents and visitors to enjoy. Value is considered to be **High**.	The community gardens are located in a prominent location within the village overlooking the Parish Church with distant views towards the Rhinns of Kells. Residents and visitors' attention is focussed both within the garden and towards the Rhinns of Kells in which the summits are shown on an interpretation board. The susceptibility of the view to change is considered to be **High**.	**High**
3	**Cairnsmore of Carsphairn** This hill forms the highest point within the Carsphairn and Scaur Hills range of the Southern Uplands, 6 km to the north east of the village of Carsphairn. The summit is accessed from the A713 at Bridge-end and follows a track to the north east before turning to a rough grassy track. Alternatively, the summit can be accessed from a ridgeline leading from Willieanna, Dunpool and Black Shoulder. From the summit, views are open and extensive but due to the summit forming a plateau, the Proposed Development was largely screened by landform.	259545	597722	2.4 km	LCT 177: Southern Uplands – Dumfries & Galloway Galloway Hills RSA	Walkers	From the summit, extensive visibility can be obtained across Glenkens towards the central Galloway Hills including the distinctive ridgeline of the Rhinns of Kells and the summit of The Merrick to the south-west and in clear visibility, the Solway coastline to the south. To the north, east, and south east, extensive views across the Southern Uplands and include several operational wind farms comprising Windy Standard I and II, Windy Rig, Afton, Sanquhar, and Wether Hill. Dark-skies mapping shows that this viewpoint is situated within the darkest categories of night-time lighting. Light pollution is limited to sources in neighbouring Glenkens and settled areas beyond the Southern Uplands.	This viewpoint is located within the Galloway Hills RSA, a Corbett and is a popular walking route. Value is considered to be **High**.	Susceptibility is also considered to be **High** as walkers' attention will be focussed on the views of the surrounding landscape.	**High**

VP No.	Location	Coordinate Easting	Coordinate Northing	Distance to nearest turbine	Landscape Receptors	Visual Receptors	Existing View	Sensitivity Value	Sensitivity Susceptibility	Sensitivity Overall Sensitivity
	Therefore, for the purposes of this assessment, the viewpoint location was moved further downhill to enable better views of the Proposed Development.									
4	**Beninner** Is located south east of Cairnsmore of Carsphairn. The summit can be accessed via an access track close to Benloch Burn or alternatively from the summit of Cairnsmore of Carsphairn	260442	596845	2.1 km	LCT 177: Southern Uplands – Dumfries & Galloway Galloway Hills RSA	Walkers	From the summit, extensive visibility can be obtained across Glenkens towards the central Galloway Hills including the distinctive ridgeline of the Rhinns of Kells and the summit of The Merrick to the south-west and in clear visibility, the Solway coastline to the south. To the north and north west, views are partially restricted by foreground rising landform Operational wind farms are visible including Blackcraig and Wether Hill. Dark-skies mapping shows that this viewpoint is situated within the darkest categories of night-time lighting. Light pollution is limited to sources in neighbouring Glenkens and settled areas beyond the Southern Uplands.	This viewpoint is located within the Galloway Hills RSA, a Donald and is a popular walking route for walkers. Value is considered to be **High**.	Susceptibility is also considered to be **High** as walkers' attention will be focussed on the views of the surrounding landscape	**High**.
5	**Alhang** Located to the west of Glen Lorg, this summit can be accessed from Glen Lorg to the south east or alternatively from Glen Afton to the north as part of longer walk.	264231	601026	6.4 km	LCT 178: Southern Uplands with Forest – Dumfries & Galloway	Visitors Walkers	From the summit, extensive visibility can be obtained across the adjacent hill sides of the Southern Uplands including the Cairnsmore of Carsphairn massif and distant views of the Galloway Hills including the distinctive ridgeline of the Rhinns of Kells and the summit of The Merrick. This includes close views of operational wind farms such as Windy Rig, Afton, Windy Standard I and II, Whiteside Hill, and Wether Hill. Dark-skies mapping shows that this viewpoint is situated within the darkest categories of night-time lighting Light pollution is limited to sources in neighbouring Glenkens and settled areas beyond the Southern Uplands.	This viewpoint is part of the Carsphairn and Scaur range of hills and is the smallest Donald of the group. But is not located within any national or local landscape. Value is considered to be **High**.	Susceptibility is also considered to be **High** as walkers' attention will be focussed on the views of the surrounding landscape.	**High**
6	**Benbrack** This viewpoint forms a high point on the Southern Upland Way. It can be accessed from the minor road at Stroanpatrick 6.4 km to the south west or alternatively from the minor road at Polskeoch 5.0 km to the north.	268023	597029	7.5 km	LCT 178: Southern Uplands with Forest – Dumfries & Galloway	Walkers	From the summit, extensive visibility can be obtained across the adjacent hill sides including the Cairnsmore of Carsphairn massif and distant views of the foothills along the Dumfries & Galloway and East Ayrshire border, the Galloway Hills including the distinctive ridgeline of the Rhinns of Kells and the summit of The Merrick to the south-west and in clear visibility. This includes medium range views of Windy Rig, Afton, Windy Standard I and II, and Wether Hill operational wind farms. Dark-skies mapping shows that this viewpoint is situated within the darkest categories of night-time lighting. Light pollution is limited to sources in neighbouring Glenkens and settled areas beyond the Southern Uplands.	This viewpoint is not located within any national or local landscape designations but is a summit on the SUW and forms the setting for The Striding Arches sculpture by Andy Goldsworthy. Value is considered to be **High**.	Susceptibility is also considered to be **High** as walkers' attention will be focussed on the views of the surrounding landscape.	**High**
7	**Southern Upland Way (North East of Stroanfreggan)**	264869	597029	4 km	LCT 178: Southern Uplands with Forest – Dumfries & Galloway	Walkers	From this viewpoint, foreground landform to the west limits visibility although the top of Cairnsmore of Carsphairn is visible above the ridgeline. In other	This viewpoint is not located within any national or local landscape designations but is on	Susceptibility is also considered to be **High** as walkers' attention will be	**High**

VP No.	Location	Coordinate		Distance to nearest turbine	Landscape Receptors	Visual Receptors	Existing View	Sensitivity		
		Easting	Northing					Value	Susceptibility	Overall Sensitivity
	This viewpoint is located on the Southern Upland Way and can be accessed from the minor road 1.1 km to the south west.						directions, open views are on to the immediate surrounding landscape limiting views further afield to the hill tops of the Southern Uplands. Operational wind farms can be viewed further to the north and to the east and include Windy Rig. Windy Standard and Wether Hill. Dark-skies mapping shows that this viewpoint is situated within the darkest categories of night-time lighting. Light pollution is limited due to screening from foreground topography.	the SUW. Value is considered to be **High**.	focussed on the views of the surrounding landscape.	
8	**B729 Road (South East of Carsphairn)** This viewpoint is located on the B729 Rd to the south east of Burnfoot.	259390	592030	1.5 km	LCT 165: Upper Dale – Dumfries & Galloway Galloway Hills RSA	Road users	Views from this viewpoint tend to be enclosed by surrounding landform, sparse forestry and roadside vegetation with the Cairnsmore of Carsphairn massif breaking the foreground ridgeline to the north. There is limited visibility of operational wind farms from this location due to screening by trees. Light pollution is very limited in the vicinity with sources of light being limited to cars travelling along the road and from isolated houses.	This viewpoint is located within the Galloway Hills RSA and is popular with cyclists. Value is considered to be **High**.	Susceptibility is also considered to be **High-medium** as road users' attention will be focussed on the surrounding landscape	**High**
9	**Minor Road between A713 and B729** Located on the minor road between B729 and A713 roads approximately 370 m to the south of the junction with the B729 road.	260452	590750	2.2 km	LCT 165: Upper Dale – Dumfries & Galloway Galloway Hills RSA	Road users	Obtains open views onto surrounding rough pasture, moorland and forestry but are limited in distance due to foreground landform. Includes views of Cairnsmore of Carsphairn and Dundeugh Hill. There is limited visibility of operational wind farms from this location due to screening by landform and forestry. Light pollution is very limited in the vicinity with sources of light being limited to cars travelling along the road and from isolated houses.	This road is located within the Galloway Hills RSA. Value is **High**.	Susceptibility is considered to be **Medium** as road users' attention is less likely to be focussed on the surrounding landscape	**High**
10	**Cairn Avel** is located to the south of Carsphairn and can be accessed via the A713road along a track which leads to Carnaval.	255949	592462	2.7 km	LCT 165: Upper Dale – Dumfries & Galloway Galloway Hills RSA	Walkers	Open views across Upper Glenkens can be obtained including Carsphairn village. The surrounding hills to the east and west provide containment. Due to its lower elevation within Glenkens, views of operational windfarms are limited by a combination of landform and forestry although Wether Hill and Windy Rig and South Kyle break the distant horizon. Light pollution experienced from this location is predominantly from nearby properties at Carsphairn and vehicles on the A713 road.	This viewpoint is located within the Galloway Hills RSA and is situated next to Cairn Avel. Value is **High**.	Susceptibility is also considered to be **High** as walkers' attention will be focussed on the views of the surrounding landscape.	**High**
11	**Corserine (Scar of Folk)** is the highest point on the Rhinns of Kells and is accessed via Forrest Estate to the east. Forming part of a circular route, the summit can be accessed via forestry tracks to the west before leading onto steep open country leading to the Scar of Folk, or alternatively, from the summit of Meikle Millyea to	250445	587285	10.2 km	LCT 180: Rugged Uplands – Dumfries & Galloway Galloway Hills RSA	Walkers	Obtains extensive views across Glenkens backdropped by the Southern Uplands and foothills of the Galloway Hills. A concentration of operational turbines can be viewed to the north east including Windy Standard I and II, South Kyle, and Windy Rig. Further turbines are visible beyond the foreground wind farms on a clear day. Light pollution experienced from this location is predominantly from properties and vehicles within Glenkens to the east and from around Ayr Bay to the north, and along the Solway coast to the south east.	This viewpoint is located within the Galloway Hills RSA, a Corbett and is a popular walking route. Value is **High**.	Susceptibility is also considered to be **High** as walkers' attention will be focussed on the views of the surrounding landscape.	**High**

VP No.	Location	Coordinate		Distance to nearest turbine	Landscape Receptors	Visual Receptors	Existing View	Sensitivity		
		Easting	Northing					Value	Susceptibility	Overall Sensitivity
	the south or Coran of Portmark to the north.									
12	**Meikle Millyea** Forms the southernmost summit of the Rhinns of Kells and can be accessed from Forrest Estate or alternatively as a ridge walk/circular walk extending from Corserine to the north.	251840	582891	12.7 km	LCT 180: Rugged Uplands – Dumfries & Galloway Galloway Hills RSA	Walkers	Extensive views across Glenkens backdropped by the Southern Uplands and foothills of the Galloway Hills. There is a concentration of operational turbines visible beyond Cairnsmore of Carsphairn including Windy Standard I and II, South Kyle, and Windy Rig. Further turbines are visible beyond the foreground wind farms on a clear day. Light pollution experienced from this location is predominantly from properties and vehicles within Glenkens.	This viewpoint is located within the Galloway Hills RSA, a Donald and is a popular walking route. Value is considered to be **High**.	Susceptibility is also considered to be **High** as walkers' attention will be focussed on the views of the surrounding landscape.	**High**
13	**Dundeugh** Is a viewpoint on a promontory separating the Water of Deugh and Water of Ken. Can be accessed via parking area at Dundeugh Castle before following forestry tracks around the eastern side of Dundeugh Hill.	260968	589738	3.3 km	LCT 165: Upper Dale – Dumfries & Galloway Galloway Hills RSA	Walkers	Views from this location are restricted by forest cover on the hill limiting visibility to small clearings and gaps in woodland. To the north and north east, extensive views over the Ken floodplain can be obtained backdropped by Cairnsmore of Carsphairn massif. Views of operational wind farms are limited by landform with Windy Standard and Windy Rig partially visible to the east of Beninner. Light pollution experienced from this location is predominantly from vehicles on nearby roads and properties within Glenkens to the north.	This viewpoint is located within the Galloway Hills RSA and is a popular local walking route. Value is considered to be **High**.	Susceptibility is also considered to be **High** as walkers' attention will be focussed on the views of the surrounding landscape.	**High**
14	**Stroanfreggan Cairn** located to the east of the Southern Upland Way and can be accessed from the B729 road to the north, before heading south for approximately 300 m of the SUW.	264016	591423	3.8 km	LCT 160: Narrow Wooded River Valley – Dumfries & Galloway	Visitors Walkers	Views from the cairn are onto foreground moorland, semi-improved pasture, and forestry with the summits of the Southern Uplands beyond. Operational windfarms are limited from this location due to screening by landform and forestry. Light pollution experienced from this location is predominantly from properties and vehicles within Glenkens.	This viewpoint is not located within any national or local landscape designations but is situated next to Stroanfreggan Cairn and on the SUW. Value is **High**.	Susceptibility is also considered to be **High** as walkers' attention will be focussed on the views of the surrounding landscape.	**High**
15	**B7000 Road (South of High Bridge of Ken)** Located east of Arndarroch.	261841	589276	4.0 km	LCT 165: Upper Dale – Dumfries & Galloway	Road users	Obtains extensive views up and down Upper Glenkens across farmland with distant views of the Rhinns of Kells to the south west, and Southern Uplands to the north east. Views of operational wind farms are limited from this location due to being set further back from Upper Glenkens although it is possible to see Wether Hill breaking the horizon to the north east. Light pollution experienced from this location is predominantly from properties and vehicles within Glenkens.	This viewpoint is located on the periphery of the Galloway Hills RSA and is popular with cyclists. Value is **High**.	Susceptibility is also considered to be **High-medium** as road users' attention will be focussed on the surrounding landscape	**High**
16	**Black Hill** This viewpoint forms a high point on the Southern Upland Way. It can be accessed from the minor road at Polskeoch 3.2 km to the north, or alternatively from the minor road at Stroanpatrick 8.5 km to the south west.	268838	598906	8.9 km	LCT 178: Southern Uplands with Forest – Dumfries & Galloway	Walkers	From the summit, extensive visibility can be obtained across the adjacent hill sides including the Cairnsmore of Carsphairn massif and distant views of the foothills along the Dumfries & Galloway and East Ayrshire border, and the Galloway Hills including the distinctive ridgeline of the Rhinns of Kells to the south-west. This includes views of Windy Rig, Afton, Windy Standard I and II, Whiteside Hill and Wether Hill. Dark-skies mapping shows that this viewpoint is	This viewpoint is not located within any national or local landscape designations but is a summit on the SUW. Value is **High**.	Susceptibility is also considered to be **High** as walkers' attention will be focussed on the views of the surrounding landscape.	**High**

VP No.	Location	Coordinate		Distance to nearest turbine	Landscape Receptors	Visual Receptors	Existing View	Sensitivity		
		Easting	Northing					Value	Susceptibility	Overall Sensitivity
							situated within the darkest categories of night-time lighting. Light pollution is limited to cars and properties within Glenkens.			
17	**A762 Road (North of New Galloway)** Located at a parking area on the road 11.1 km to the north of New Galloway.	262989	579023	14.2 km	LCT 164: Flooded Valley Galloway Hills RSA	Road users	Obtains views up and down Upper Glenkens comprising farmland, moorland and forestry which are enclosed by the surrounding hills sides. Views of operational wind farms are limited due to screening by landform and their position further back from the dale and include Blackcraig, to the east and a cluster AT Windy Standard to the north. Dark-skies mapping shows that this viewpoint is situated within the darkest categories of night-time lighting. Light pollution is limited to cars and properties within Glenkens and nearby New Galloway.	This viewpoint is located within the Galloway Hills RSA. Value is **High**.	Susceptibility is also considered to be **High** as road users' attention will be focussed on the surrounding landscape	**High**
18	**A713 Road (South of Carsphairn)** Located at a parking place 2.3 km to the south east of Carsphairn.	257703	592176	1.8 km	LCT 165: Upper Dale – Dumfries & Galloway	Road users	Obtains views along Upper Glenkens but are restricted by foreground landform, vegetation forming a middle-range horizon in which the surrounding hills sides protrude above. Dark-skies mapping shows that this viewpoint is situated within the darkest categories of night-time lighting. Light pollution is very limited in the vicinity with sources of artificial light from nearby Carsphairn and traffic travelling on the A713 road.	This viewpoint is located within the Galloway Hills RSA. Value is **High**.	Susceptibility is also considered to be **High** as road users' attention will be focussed on the surrounding landscape	**High**
19	**A713 Road (North of Carsphairn)** Located 1.4 km to the north west of Carsphairn.	255347	594789	2.3 km	LCT 165: Upper Dale – Dumfries & Galloway Galloway Hills RSA	Road users	Obtains short to mid-range views along Upper Glenkens with landform forming a false horizon. Larger hill tops protrude above and includes close views of the Cairnsmore of Carsphairn massif. Visibility of operational wind farms is limited due to screening by landform and their position further back from the dale. Dark-skies mapping shows that this viewpoint is situated within the darkest categories of night-time lighting. Light pollution is very limited in the vicinity with sources of artificial light from nearby Carsphairn and traffic travelling on the A713 road.	This viewpoint is located within the Galloway Hills RSA. Value is **High**.	Susceptibility is also considered to be **High-medium** as road users' attention will be focussed on the surrounding landscape	**High**
20	**Black Shoulder** The summit is accessed from the A713 at Bridge-end and follows a track to the north east before turning to a rough grassy track. Alternatively, the summit can be accessed from Cairnsmore of Carsphairn to the north east as part of a circular walk incorporating Beninner.	259270	596792	1.5 km	LCT 177: Southern Uplands – Dumfries & Galloway Galloway Hills RSA	Walkers	Representative of views obtained from the footpath leading to Cairnsmore of Carsphairn. From the summit, extensive visibility can be obtained across the adjacent hill sides and distant views of the foothills along the Dumfries & Galloway and East Ayrshire border, and the Galloway Hills including the distinctive ridgeline of the Rhinns of Kells to the south-west. This includes distant visibility of Blackcraig and Wether Hill operational wind farms. Dark-skies mapping shows that this viewpoint is situated within the darkest categories of night-time lighting. Light pollution is very limited in the vicinity with sources of artificial light being limited to Upper Glenkens.	This viewpoint is located within the Galloway Hills RSA. Value is **High**.	Susceptibility is also considered to be **High** as walkers' attention will be focussed on the views of the surrounding landscape.	**High**.

VP No.	Location	Coordinate		Distance to nearest turbine	Landscape Receptors	Visual Receptors	Existing View	Sensitivity		
		Easting	Northing					Value	Susceptibility	Overall Sensitivity
21	**Manquhill Hill** This viewpoint forms a high point on the Southern Upland Way. It can be accessed from the minor road at Stroanpatrick 3.4 km to the south west or alternatively from the minor road at Polskeoch 7.7 km to the north east.	266163	594663	5.1 km	LCT 178: Southern Uplands with Forest – Dumfries & Galloway	Walkers	From the summit, extensive visibility can be obtained across the adjacent hill sides including the Cairnsmore of Carsphairn massif and distant views of the foothills along the Dumfries & Galloway and East Ayrshire border, and the Galloway Hills including the Rhinns of Kells. This includes close views of Windy Rig, Afton, Windy Standard I and II, and Wether Hill. Dark-skies mapping shows that this viewpoint is situated within the darkest categories of night-time lighting. Light pollution is very limited in the vicinity with sources of artificial light being visible within Glenkens from properties and cars travelling along roads.	This viewpoint is not located within any national or local landscape designations but is on the SUW. Value is considered to be **High**.	Susceptibility is also considered to be **High** as walkers' attention will be focussed on the views of the surrounding landscape.	**High**
22	**Maiden's Hill** Located between Tarfessock and Kirriereoch Hill, this viewpoint can be accessed from Glentrool via The Merrick.	240797	590550	17.3 km	LCT 83: Rugged Uplands – Ayrshire South Ayrshire Scenic Area Galloway International Dark Skies Park	Walkers	Obtains extensive visibility across the Galloway Hills and the Southern Uplands with a limited perception of valleys and lowland areas. Views of operational wind farms can be seen to the east where concentrations of turbines are visible including Afton, South Kyle, Windy Standard I & II and Windy Rig, with numerous other schemes beyond that are visible on a clear day. Light pollution is very limited to artificial lighting from properties and cars beyond the Galloway Hills.	This viewpoint is located within the South Ayrshire Scenic Area and the Galloway International Dark Skies Park. Value is considered to be **High**.	Susceptibility is also considered to be **High** as walkers' attention will be focussed on the views of the surrounding landscape.	**High**
23	**Darnaw (Memorial)** Located to the west of Clatteringshaws Loch, the viewpoint can be accessed via Old Edinburgh Road to the south through forestry before emerging above the treeline at Craignell.	251592	576550	18.6 km	LCT 176: Foothills with Forest – Dumfries & Galloway Galloway Hills RSA Galloway International Dark Skies Park	Visitors Walkers	Views over Clatteringshaws Loch and surrounding forested covered hills with more distant views of the Southern Uplands to the north east and the Galloway Hills to the north west. Visibility of operational wind farms is limited due to distance and intervening screening from vegetation. Light pollution is very limited to artificial lighting from properties and cars within Glenkens.	This viewpoint is located within the Galloway Hills RSA and Galloway International Dark Skies Park and is situated next to Darnaw Memorial. Value is considered to be **High**.	Susceptibility is also considered to be **High** as walkers' attention will be focussed on the views of the surrounding landscape.	**High**
24	**Culmark Hill** Forms a high point on the SUW between the B729 road 1.8 km to the north, and a minor road 1.4 km to the south	264372	589719	5.0 km	LCT 176: Foothills with Forest – Dumfries & Galloway	Walkers	Extensive views across Upper Glenkens onto surrounding hills including Cairnsmore of Carsphairn and the Rhinns of Kells. Visibility of operational wind farms can be obtained behind Cairnsmore of Carsphairn and further to the north east where Windy Rig is located. Light pollution is limited to properties and vehicles travelling along roads within Upper Glenkens.	This viewpoint is not located within any national or local landscape designations but is on the SUW. Value is considered to be **High**.	Susceptibility is also considered to be **High** as walkers' attention will be focussed on the views of the surrounding landscape.	**High**
25	**Coran of Portmark** Located to the west of Carsphairn can be accessed from the A713 road at Holm of Daltallochan before following a rough track to the west to the summit.	250933	593667	6.8 km	LCT 180: Rugged Uplands – Dumfries & Galloway Galloway Hills RSA	Walkers	Extensive views across Glenkens backdropped by the Southern Uplands most notably Cairnsmore of Carsphairn. Concentration of operational turbines can be viewed either side of Cairnsmore of Carsphairn including Windy Standard I and II, and Windy Rig. Further turbines are visible beyond these on a clear day. Artificial light pollution experienced from this location is predominantly from properties and vehicles within Glenkens.	This viewpoint is located within the Galloway Hills RSA, a Donald and is a popular walking route. Value is considered to be **High**.	Susceptibility is also considered to be **High** as walkers' attention will be focussed on the views of the surrounding landscape.	**High**

Source: Volume 2b: Figure 5.2a – 5.4:

Residential Receptors

5.8.96 Residential receptors are divided into individual residential properties close to the Proposed Development (within 2 km) and whole settlements within the study area.

Individual residential properties

5.8.97 The Landscape Institute has published a guidance note to support landscape professionals in undertaking *Residential Visual Amenity Assessment* (Landscape Institute, 2019) for developments[16]. This document promotes a logical approach to the assessment of views of developments from residential receptors. Table 1 of Scottish Planning Policy (SPP) states a distance of 2 km for the consideration of visual impact.

5.8.98 Using OS and GIS data mapping, a total of 18 properties/property groups were identified within a 2 km radius of the outermost proposed turbines.

5.8.99 A review of aerial photography was undertaken to ascertain the access or approach to the property, the orientation of the property, the extent of its curtilage and the presence of vegetation and buildings around the property. A ZTV was then prepared, and the properties plotted as shown in Volume 2c: Figures A5.5.1 – A5.5.18. This would allow for any properties out with the ZTV to be scoped out of the Residential Visual Amenity Assessment. 18 properties/property groups were within the ZTV for the Proposed Development. Site survey was then carried out to verify these desktop studies and to ascertain whether properties were indeed inhabited.

5.8.100 The following individual residential properties are assessed in detail in the RVAA in Volume 3: Appendix 5.5 and listed below:

- Property 1: North Liggate;
- Property 2: South Liggate;
- Property 3: Knockgray Cottage;
- Property 4: Stables Cottage;
- Property 5: Knockgray Farm;
- Property 6: Marbrae Farm;
- Property 7: Old Burnfoot Cottage;
- Property 8: Burnfoot;
- Property 9: Burniston;
- Property 10: Marbrack & Marbrack Cottage;
- Property 11: Polwhirn;
- Property 12: Kensglen;
- Property 13: Netherloskie;
- Property 14: Furmiston;
- Property 15: Marscalloch Cottage;
- Property 16: Property near Liggat Bridge;
- Property 17: White Crook; and
- Property 18: Cumnock Knowes

[16] Residential Visual Amenity Assessment (RVAA) Technical Guidance Note 2/19.

Settlements

5.8.101 The distribution of settlements throughout the study area generally correlates to the key valleys and consequently the key transportation routes. To the north, settlement is widespread set within rolling lowland farmland reducing to along dales as the study area progresses southwards. Within 10 km of the Proposed Development, there are numerous individual residential properties, farmsteads and hamlets/building groups and scattered small villages. Site work verified the selection of one settlement, Carsphairn to be assessed in detail for potential effects, in the event of the addition of the Proposed Development.

Carsphairn

5.8.102 Carsphairn is situated within upper Glenkens and set out in a linear arrangement in a north west to south east direction along the A713 road. The surrounding landscape is generally open allowing views beyond the settlement across farmland onto the nearby hillsides. To the north, this is curtailed by the rising landform of the Cairnsmore of Carsphairn massif. However, to the south, extensive views of the ridgeline forming the Rhinns of Kells can be obtained from much of the village.

5.8.103 For the purpose of this assessment, all residential receptors are considered to be of **High** sensitivity to change in their view. This considers that people at their home attach High value to their existing view and visual amenity and are more susceptible to being affected by changes in their visual amenity.

Sequential routes

5.8.104 The main transportation routes generally follow the broad valleys and dales with some minor routes along narrow wooded valleys. The principal routes include the A713 road which travels through the study area in a north west to south east direction and several 'A' roads including the A702, A713, A762, connected by a network of 'B' roads and minor roads which link farms and estates located in adjacent glens with the main road network travelling through Glenkens

5.8.105 Several long-distance footpaths also pass through the study area, the closest of these to the Proposed Development is the Southern Upland Way (SUW) crosses in a north east to south west direction. There are also several other long-distance routes in the study area comprising Scottish Hill Tracks and Heritage Trails.

5.8.106 As a viewer moves through the landscape along these linear routes, this can lead to a series of viewpoints and experiences which may include other developments in addition to the Proposed Development, together with ever changing views of the Proposed Development itself. These are known as sequential effects.

5.8.107 Analysis of the ZTVs and OS based mapping identified theoretical visibility of the Proposed Development from several sections of sequential road and recreational routes within the study area. Initial first stage assessment was undertaken on road routes, long distance footpaths, cycle routes and core paths. Site work verified the selection of ten sequential routes to be taken forward to be assessed in the LVIA for potential effects (see Volume 2b: Figures 5.8a – 5.8k), in the event of the addition of the Proposed Development as follows:

- A713 road;
- B729 road;
- Southern Upland Way;
- Scottish Hill Track 76: Bargrennan to Polharrow;
- Scottish Hill Track 77: Bargrennan to Carsphairn or Dalmellington;
- Scottish Hill Track 80: Barr to Carsphairn;
- Scottish Hill Track 84: New Cumnock to St John's Town of Dalry;

- Polmaddy Pack Road Heritage Trail;
- Sanquhar to Stroanpatrick Heritage Path; and
- Core Paths with 5 km.

A713 road

5.8.108 The A713 is a road between Ayr and Castle Douglas Castle Douglas. Within the study area, the road crosses in a north west to south east direction following Glenkens.

5.8.109 The road predominantly passes through farmland and moorland interspersed with forestry and woodland. Visibility experienced from the road is mixed and is often enclosed by landform or when passing through forestry and woodland, to experiencing open views of Upper Glenkens, allowing the surrounding Southern Uplands to periodically be viewed from long sections.

5.8.110 Promoted as the Galloway Tourist Route, the road passes through the Galloway Hills RSA resulting in a **High** value. Susceptibility is High-medium as road users' attention will be focussed on views of the surrounding landscape. Overall, visual sensitivity is **High-medium**.

B729 road

5.8.111 The B729 Road starts to the north of Dumfries and heads west towards the A713 road in an east to west orientation. Sections of the route pass through the Thornhill Uplands and Galloway Hills RSA.

5.8.112 Views experienced from this road are mixed and mainly influenced by woodland cover with occasional open views towards surrounding upland landscapes and across Upper Glenkens.

5.8.113 The route is scenic passing through farmland and forest and provides an alternative to the busier 'A' roads in the area resulting in a **High** value Susceptibility is also considered to be **High** as road users attention is likely to appreciate the surrounding landscape.

Southern Upland Way

5.8.114 The Southern Upland Way is one of Scotland's Great Trails comprising 12 stages of which two, Stage 3: Bargrennan to Dalry and Stage 4: Dalry to Sanquhar cross the study area generally in an east to west direction. Both sections cross a mixture of open ground, often elevated allowing extensive views across the upland landscapes and across a series of dales and glens dissecting the route, to sections of forestry where visibility is severely reduced. A short section of the route crosses Upper Glenkens allowing a different perspective of looking up at the surrounding uplands from a lower elevation.

5.8.115 The trail is popular with walkers or runners on day trips, completing sections or the entire trail. Part of the trail passes through the Galloway Hills RSA and value is considered **High**. Susceptibility is also considered to be **High** as walkers' attention will be focussed on the views of the surrounding landscape. Overall visual sensitivity is **High**.

Scottish Hill Track 76: Bargrennan to Polharrow

5.8.116 This route crosses between Bargrennan to the south west and Polharrow in the east descending the Rhinns of Kells south of Corserine. Predominantly crossing the upland landscape, east of the Rhinns of Kells, the path descends to the forested lower hillsides into Upper Glenkens.

5.8.117 Views from the path are generally open and extensive as a result of elevation with landform providing some containment to the west. As the path descends from the Rhinns of Kells, visibility is influenced by forestry cover allowing views across the dale towards the Cairnsmore of Carsphairn massif and surrounding Southern Uplands. Part of the trail passes through the Galloway Hills RSA and value is considered **High**. Susceptibility is also considered to be **High** as walkers' attention will be focussed on the views of the surrounding landscape. Overall visual sensitivity is **High**.

Scottish Hill Track 77: Bargrennan to Carsphairn or Dalmellington

5.8.118 This route extends between Dalmellington in the north to Carsphairn in the south and follows the western side of Loch Doon. Visibility is mixed heading south from Dalmellington due to a combination of landform and woodland cover which reduces the extent of views from some sections. On reaching Loch Doon the landscape opens out allowing distant views towards the Southern Uplands.

5.8.119 Part of the trail passes through the Loch Doon SLCA, and the Galloway Hills RSA and value is considered **High**. Susceptibility is considered to be **High** as walkers' attention will be focussed on the views of the surrounding landscape. Overall visual sensitivity is **High**.

Scottish Hill Track 80: Barr to Carsphairn

5.8.120 This route extends between Barr and Carsphairn and crosses a predominantly upland landscape of the Galloway and Ayrshire Hills. Within 15 km, the route crosses a mixture of farmland and moorland allowing open views of the surrounding landscape. On reaching Loch Doon, the route follows a path through forestry reducing visibility.

5.8.121 Part of the trail passes through the Galloway Hills RSA and value is considered **High**. Susceptibility is also considered to be **High** as walkers' attention will be focussed on the views of the surrounding landscape. Overall visual sensitivity is **High**.

Scottish Hill Track 84: New Cumnock to St John's Town of Dalry

5.8.122 Within 15 km of the Proposed Development, this route follows the SUW from St John's Town of Dalry to Stroanpatrick before turning off and heading in a north direction across forestry on Auchrae Hill, emerging at Alhang and crossing across the Southern Uplands towards New Cumnock. For much of this route, open views of the surrounding landscape can be obtained including close views of Windy Rig and Afton operational sites.

5.8.123 The trail is popular with walkers or runners on day trips, completing sections or the entire trail. Part of the trail passes through the Galloway Hills RSA and value is considered **High**. Susceptibility is also considered to be **High** as walkers' attention will be focussed on the views of the surrounding landscape. Overall visual sensitivity is **High**.

Polmaddy Pack Road Heritage Trail

5.8.124 This track starts at the A714 road near the B729 junction at Liggat and continues in a south easterly direction to Dundeugh Hill. The first half of the route crosses farmland and moorland affording extensive views across Upper Glenkens and the surrounding uplands, before entering forestry which reduces the extent of visibility.

5.8.125 Part of the trail passes through the Galloway Hills RSA and value is considered **High**. Susceptibility is also considered to be **High** as walkers' attention will be focussed on the views of the surrounding landscape. Overall visual sensitivity is **High**.

Sanquhar to Stroanpatrick Heritage Path

5.8.126 Within 15 km, this route follows the same path as the Scottish Hill Track 84 in leaving the SUW near Stroanfreggan and continuing northwards across Auchrae Hill. For much of this route, open views of the surrounding landscape can be obtained including close views of Windy Rig and Afton operational sites.

5.8.127 Part of the trail passes through the Galloway Hills RSA and value is considered **High**. Susceptibility is also considered to be **High** as walkers' attention will be focussed on the views of the surrounding landscape. Overall visual sensitivity is **High**.

Core Paths with 5 km

5.8.128 8 Core Paths have been identified within 5 km of the Proposed Development as follows:

- CP182 - extends north east from the A713 road via Knockgray onto the Proposed Development to the west of Quantans Hill;
- CP16 - follows a track from Garryhorn to the west of the site before heading north west around Garryhorn Rig and into forestry;
- CP164 follows the route of the SUW;
- CP199 - follows a track north east from the B7000 road along the Black Water;
- CP23 - follows a series of tracks around Dundeugh Hill as well as ascending to the summit of the hill.;
- CP487 - follows a track extending from the A713 road at Green Well of Scotland, north east ascending the lower slopes of Cairnsmore of Carsphairn;
- CP504 - follows the SUW to the east of the Proposed Development; and
- CP594 - extends from a track near Lamford, bypassing the north of Lamford Hill in an easterly direction towards Dodd Hill and is predominantly in forestry.

5.8.129 All Core Paths are identified within the Dumfries & Galloway Local Development Plan and value is considered **High**. Susceptibility is also considered to be **High** as walkers' attention will be focussed on the views of the surrounding landscape. Overall visual sensitivity is **High**.

Cumulative Baseline

5.8.130 Within the study area there are large concentrations of operational wind farms located to the north of Cairnsmore of Carsphairn within 10 km in the core area of the Southern Uplands. These developments include Windy Standard I and II, and Afton which follow ridgelines and are set back from the surrounding valleys. Two cluster developments, Windy Rig, approximately 7 km to the north east and South Kyle 9-13 km to the north are located on the edge of the Southern Uplands and contrast in pattern. Visibility of these operational wind farms is widespread across the higher ground of the Southern Uplands and in nearby Glen Kens in which Blackcraig is located approximately 15 km to the south east and visible at the southern end of the glen. Beyond 13 km, there are a number of further wind farms to the north east that include Hare Hill I & II, Sanquhar, Whiteside and Twentyshilling between 15 – 20 km, and Dersalloch 18 km to the north west.

5.8.131 The addition of Scenario 2 developments to the baseline would result in a further concentration of turbines in the vicinity of Windy Standard and South Kyle within 15 km. These would include Benbrack, Enoch Hill, Pencloe Variation and Windy Standard III, and beyond Overhill and North Kyle between 15 and 20 km. To the east Lorg would be situated around 8 km, and Troston Loch, Margree and Glenshimmeroch to the south east at approximately 10 km.

5.8.132 Several wind farm application sites have been submitted which would result in further concentrations of turbines to the north, east and south east near Scenario 1 and 2 baseline sites mentioned above. An application to Repower Windy Standard 1 has been submitted which will increase the turbine sizes but reduce the overall numbers. To the north, Greenburn at approximately 17 km, Sclenteuch and Knockkippen at 18 km to the north west, Euchanhead and Sanquhar 10 – 14 km to the east, Shepherds Rig immediately to the south east of the Proposed Development and Fell 15 km to the south east form the Scenario 3 baseline.

5.8.133 Details of operational and cumulative sites are set out in Volume 3: Appendix 5.2.

5.9 POTENTIAL IMPACTS DURING DEVELOPMENT PHASES

5.9.1 Based on the detailed description of the Proposed Development in Chapter 3: Project Description, the likely sources of landscape and visual impacts that will occur during each phase are as follows:

Table 5.22: Potential sources of landscape and visual effects during each development phase

Construction	Operational	Decommissioning
Vehicular/personnel movements, including vehicles associated with the construction travelling in both directions along the B709 road and lighting in the Proposed Development Area.	Occasional maintenance activity and vehicular/personnel movements around the site and on local roads.	Vehicular/personnel movements, including lighting on the site.
The disturbance of areas of land and surface vegetation.	Access tracks and hardstanding areas at each turbine location at ground level.	Access tracks will either be left for use by the landowner or covered in topsoil.
Excavation of borrow pit and reinstatement.	Site monitoring of restoration.	Implementation of site restoration following an agreed Decommissioning Method Statement.
The upgrading of existing site access tracks and formation of new tracks, crane hardstandings at each turbine location and the substation.		Deplanting of grid infrastructure, removal of the grid connection compound, and reinstatement of the compound location to match the character and condition of the existing landscape where required.
Installation of new substation control building.	Onsite substation.	Removal of substation and control building.
Reinstatement of temporary compounds, borrow pits stock piles and track sides following construction.	Site monitoring of restoration.	Reinstatement of temporary compounds, track sides during decommissioning.
The gradual introduction of tall vertical structures (turbines and a monitoring mast) and the use of cranes during installation. The turbines themselves would be erected over a short period, typically 1-2 days per turbine, and the appearance of the construction cranes in views of the site would therefore be of short duration.	Tall vertical structures with moving parts (turbines and monitoring masts), and medium intensity aviation lights.	Dismantling and removal of wind turbines and anemometer masts, trimming of foundations to a depth of 1 m below ground surface levels, and restoration of turbine locations to match the character and appearance the existing landscape.

5.9.2 Post decommissioning of the Proposed Development, including the removal of all above ground structures and reinstatement works, the remaining effects would largely relate to the retained site entrance and site tracks, and the restored borrow pits. The site will be returned to rough pasture and open moorland.

5.9.3 Potential effects of the Construction and Decommissioning phases would include temporary effects on the landscape fabric of the Proposed Development Area and on the landscape character and visual amenity of the immediate area. The potential effects of the Construction and Decommissioning Phases are considered together in this assessment due to the similarity of operations involved for the Proposed Development Area and wider landscape.

5.9.4 The LVIA considers the residual effects of the construction and operational phases resulting from the introduction of the Proposed Development following the mitigation measures which have been embedded into the design of the proposed layout.

5.10 MITIGATION

5.10.1 It is accepted that wind farms, by their nature and scale, generally result in some significant landscape and visual effects. The iterative design approach aimed to mitigate such significant effects through careful siting and design of developments. Whilst the element with greatest potential for significant effects will generally be the wind turbines, the associated infrastructure such as tracks, powerlines, substations, and control buildings must also be carefully considered. NatureScot's current guidance *Siting and Designing Wind Farms in the Landscape* (version 3a August 2017 para 1.15) states that *'Wind farms should be sited and designed so that adverse effects on landscape and visual amenity are minimised and so that landscapes which are highly valued are given due protection. If wind farms are sited and designed well the capacity of our landscape to incorporate this type of development is maximised.'*

5.10.2 Paragraph 3.22 of NatureScot's guidance goes on to state that '*It is important to site and design a wind farm so that it relates directly to the qualities of a specific site. The main design elements are likely to include the following:*

- *'Layout and number of wind turbines;*
- *Size, design, and proportion of wind turbines;*
- *Type, route and design of new and existing upgraded access tracks, including the amount of cut and fill required and the junctions with public roads;*
- *Location, design and restoration of hardstandings;*
- *Location, design and restoration of borrow pits;*
- *Location, design and restoration of temporary construction compounds;*
- *Location and size of wind monitoring masts;*
- *Positioning and mitigation of turbine lighting (if required);*
- *Visitor facilities, including paths, signs, parking and visitor centre (if proposed); and*
- *Land management changes, such as muirburn, woodland management or felling, fences, and stock grazing.'*

5.10.3 Based on NatureScot's guidance together with an analysis of the baseline context of the Proposed Development area and advice received from consultees, the embedded mitigation would include consideration of the following issues in relation to the landscape, visual and cumulative context:

Site location and layout

5.10.4 The siting and layout of the Proposed Development was based on an iterative design process aimed at reducing environmental effects whilst achieving suitable technical and commercial (as discussed further in both Chapter 2: Site Design and Design Evolution and Chapter 4: Climate Change, Legislative and Policy Context).

Design Principles

5.10.5 The design strategy for the key elements of the Proposed Development has considered the following objectives:

- To maximise site efficiency and electricity production;
- To provide a turbine layout with simple form, which relates to the landform and landscape character of the site and its surroundings;
- Retain a suitable separation between operational / consented wind farms and the Proposed Development;
- To avoid areas of constraint where practical;
- To create a turbine layout which reflects the scale of the landscape in which it is located;
- To avoid an overly complex and visually confusing layout;
- To achieve a balanced composition of the turbines against the landscape and skyline from key viewpoint locations;
- To relate turbine height to topography;
- To give due consideration to turbine proportions; and
- To reflect the pattern of nearby existing and consented wind farms as far as practical.

Proposed Turbines

5.10.6 The Proposed Development would make use of three bladed horizontal axis turbines with tubular steel towers. Care was taken to achieve a balanced ratio between tower height and blade length.

5.10.7 With regard to the colour of the proposed turbines, NatureScot guidance[17] states that '*Selecting the most appropriate colour for a turbine(s) is an important part of detailed windfarm design and mitigation. It has previously been assumed that wind turbines could be painted a colour that would camouflage them against their background. Experience has shown that it is not possible to 'hide' turbines'* (para 2.7).

5.10.8 Para 2.9 of this guidance goes on to state that *'As a rule for most rural areas of Scotland:*

- *a single colour of turbine is generally preferable;*
- *a light grey colour generally achieves the best balance between reducing visibility and visual impacts when seen against the sky, although this works less well when viewed against the land;*
- *light coloured turbines seen against a land backdrop may have greater prominence than light or dark turbines seen against the sky;*
- *paint reflection should be minimised. Texture is an important factor in reducing reflectivity, and matt or light absorbent finishes are preferable; and*
- *for multiple wind farm groups or wind farm extensions, cumulative colour effects will be a key consideration. A strategic to turbine colour is desirable and the colour of turbines should generally be consistent.'*

5.10.9 In cognisance of the guidance, a simple pale grey colour and non-reflective render is therefore proposed for the proposed turbines.

5.10.10 Consideration of landscape and visual matters has also influenced the supporting infrastructure which has included locating the proposed Borrow Pits, Substation, Control Building, Energy Storage and Permanent Compound to the east of the site away from residential properties and footpaths.

Aviation Lighting

5.10.11 Elements of the proposed development at 150m or greater in height would require lighting under Article 222 of the Air Navigation Order (ANO, 2016). This requires medium intensity 'steady' red aviation lights (emitting 2,000 candela) to be fitted at the wind turbine nacelle level. In addition, the CAA requires low intensity lights to be fitted at the intermediate level on the turbine tower (CAA, 2017). The intermediate lights will be 32 candela. It is proposed that visibility sensors are installed on relevant turbines to measure prevailing atmospheric conditions and visibility range. Should atmospheric conditions (for example an absence of low cloud cover, rain, mist, haze or fog) mean that visibility around the site is greater than 5km from the Proposed Development, CAA policy permits lights to

[17] SNH (2017) *Siting and Designing Wind Farms in the Landscape (Version 3a)*

operate in a lower intensity mode of 200 candela (being a minimum of 10% of their capable illumination). If visibility is restricted to 5km or less, by weather conditions, the lights would operate at their full 2,000 candela. In effect, the CAA policy allows 'dimming' of the lights depending on meteorological conditions, which has the effect of reducing the perceived intensity of light in clear conditions.

5.10.12 A reduced lighting scheme has been developed for the project to minimise the visual effects of aviation lighting on receptors. This has led to five turbines being lit around the perimeter of the Proposed Development and includes turbines T1 / T3/ T10 / T12/ T14.

Access Tracks

5.10.13 Approximately 14.65 km of new tracks would be required, including sections linking to proposed turbine locations. New tracks have been designed, amongst other environmental criteria, to avoid prominent slopes and summits to reduce the requirement for cut and fill.

5.10.14 During the construction phase of the Proposed Development all access tracks would be constructed/widened to a nominal width of 5 m and wider on bends and junctions to accommodate construction vehicles and abnormal load deliveries.

5.10.15 The proposed internal tracks are aligned so as to take advantage of the screening effect of intervening topography and/or vegetation where possible.

Crane Pads

5.10.16 These would be surfaced to match the proposed track construction. Whilst crane pads would be retained for the duration of the Proposed Development, they are likely to be fully or partially screened from the majority of external viewpoints by topography and the angle of view.

Cabling, Substation, Control Building, Energy Storage and Permanent Compound

5.10.17 In order to avoid potential visibility of the grid connection cables these would be undergrounded within the site from each turbine to the substation and onsite grid connection. Undergrounded sections of cable would, wherever practicable, be placed beside proposed access tracks to reduce disturbance of the landscape and to ease future maintenance.

5.10.18 A new Substation, Control Building, Energy Storage and Permanent Compound would be constructed on site (see Volume 2a: Figure 1.1: Site Layout) and will be used for the management of the Proposed Development. This has been situated away from residential properties and the Southern Upland Way as well as close to the main turbine access track to avoid the requirement for further access tracks. These elements of the Proposed Development will be screened to some degree by site topography and recently planted forestry as it matures.

Construction Compound

5.10.19 During the construction phase of the Proposed Development, a temporary construction compound and laydown areas will be required. Upon completion of construction works, the compound would be removed and the ground reinstated. In order to ensure that the compound and laydown area can be returned to a condition consistent with the existing landscape, suitable construction methods and soil handling methods would be adopted.

Borrow Pits

5.10.20 The aggregate required for the new tracks and for upgrading of existing tracks would be won from several borrow pits to be identified from the borrow pit search areas shown on see Volume 2a: Figure 1.1. These excavations are located to avoid prominent slopes and summits in order to screen most excavation activities from visually sensitive locations reducing the potential effect on the landscape and visual resource. Site won aggregate would aid the access tracks to blend in with the surrounding landscape and reduce the requirement for importing foreign material to site. Each borrow pit would be restored during the construction phase of the Proposed Development and subject to suitable aftercare provisions.

Construction Methods and Landscape Reinstatement

5.10.21 Throughout all phases of the Proposed Development, ground disturbance on site would be confined, as far as practicable, to access tracks, turbine base areas, lay-down areas, crane pads and undergrounded sections of the grid connection cables. The proposed location of these elements is described in Chapter 3: Project Description (see Volume 2a: Figures 3.1 – 3.10). Moreover, working widths would be restricted and carefully monitored and any existing landscape feature or materials arising from site operations that are to be retained would be safeguarded.

5.10.22 No significant stockpiles of aggregate would be retained on site during construction. Any aggregate arising from the proposed borrow pits would be placed directly in situ.

5.10.23 All soils stripped from construction areas and borrow pits would be retained in clearly demarcated stockpiles of no greater than 3 m height in locations immediately around the edges of borrow pit excavations and/or directly placed to reinstate track sides.

5.10.24 On completion of the construction phase, all areas subject to ground disturbance would be reinstated to match adjoining undisturbed ground. Additionally, the surface of the temporary compound(s) would be scarified to prepare the surface for subsoil base and seeded to match surrounding vegetation.

5.10.25 A detailed construction and reinstatement method statement would be agreed with Dumfries & Galloway Councils, NatureScot and SEPA prior to commencement of construction activities.

Decommissioning

5.10.26 During decommissioning of the Proposed Development, all above ground structures (including access tracks) would be removed and the ground reinstated. Subject to further assessment of site hydrology and soil cover depths, below ground structures and foundations would be left in place to avoid further disturbance.

5.11 LANDSCAPE ASSESSMENT

5.11.1 The aim of the Landscape Impact Assessment (LIA) is to identify, predict and evaluate potential key effects arising from the addition of the Proposed Development on the landscape as an environmental resource in its own right. Landscape effects may be caused by changes to the constituent features or elements of the landscape, its aesthetic or perceptual qualities and overall character. Landscape effects on designated landscapes are also considered in this assessment. This involves the assessment of changes to the special landscape qualities, which determine its reason for designation and the overall integrity of the designation.

5.11.2 Assessing the significance of landscape effects requires the identification of the landscape receptors, the consideration of the nature of the landscape receptors (sensitivity) and the nature of the effect (magnitude) which would be experienced by each landscape receptor because of the Proposed Development. The methodology for the landscape assessment is detailed in Volume 3: Appendix 5.1, including the method of identifying the susceptibility of landscape receptors. The lower the susceptibility, the greater the ability of the landscape character area/landscape designation to accommodate the Proposed Development without undue adverse effects.

5.11.3 A Cumulative Landscape Impact Assessment (CLIA) is also included in the following LIA and considers the level of effect as a result of the addition of the proposed development into each cumulative baseline scenario separately.

5.11.4 The following provides a summary of the effects on the landscape character of the Proposed Development Area and landscape character within the wider study area.

Effect on Landscape Fabric and character of the Proposed Development Area

Proposed Development During Construction

5.11.5 Turbines 1 – 6 and 8 - 14 of the Proposed Development Area lie within LCT 177: Southern Uplands – Dumfries & Galloway, and Turbine 7 within LCT 165: Upper Dale – Dumfries and Galloway. Overall sensitivity for the Proposed Development Area is **High**.

5.11.6 During the construction phase of the Proposed Development, there will be potential for short-term direct effects of activities associated with the construction of infrastructure and turbines. Potential effects during this phase are reversible unless otherwise stated (e.g., creation of permanent new features such as earthworks, access tracks, hardstanding's and components of the development that will be retained post decommissioning).

5.11.7 The construction stage of the Proposed Development would result in direct physical effects to the Proposed Development. The following provides a summary of activities related to the construction phase:

- Construction/decommissioning of access tracks (including upgrades) and crane pad hardstandings;
- Creation of borrow pits and the extraction of material followed by reinstatement;
- Construction/restoration of a temporary construction compound;
- Construction/Decommissioning of a control building, energy storage and compound;
- Construction/decommissioning of 14 wind turbines and associated crane operations;
- Excavation/reinstatement of cable trenches;
- Construction/decommissioning of permanent met masts (located within each land portion);
- General reinstatement works; and
- Vehicular/personnel movements on site.

5.11.8 Such operations would result in direct effects on the landscape fabric of the Proposed Development Area. This will include excavation of ground vegetation, earthworks, the introduction of new elements and activity associated with construction which would contrast with the existing land use and moorland context.

5.11.9 It is considered the magnitude of effect on the landscape resource of the site would be **Substantia**l resulting from the direct physical and the size and scale of proposed changes over a localised area within LCT 177: Southern Uplands – Dumfries & Galloway and LCT 165: Upper Dale – Dumfries & Galloway. This would be temporary in nature and reversible in the long-term.

5.11.10 This will result in a **Major significant** effect on the physical landscape fabric of the Proposed Development Area. The nature of these effects would be short-term (reversible), direct and negative.

Proposed Development During Operation

5.11.11 Following reinstatement post construction, the site area would enter the operational stage with activity within the Proposed Development reducing to works associated with the operation and maintenance of 14 wind turbines, battery storage and substation. The nature of the effects on the Proposed Development would be long term during the operational life of the Proposed Development and reversible beyond this period as a result of decommissioning. There are currently no consented or proposed wind farm developments located within, or in close proximity which could contribute to direct cumulative landscape effects to the Proposed Development.

5.11.12 Magnitude of change on the landscape resource of the Proposed Development would remain as **Substantial** during operation due to the size and scale of the changes occurring in a localised area including the introduction of 14 operational wind turbines, met masts, access tracks, compound, battery storage and substation.

5.11.13 This would result in a **Majo**r **significant** effect on the physical landscape fabric of the Proposed Development during operation. The nature of these effects would be direct, long-term but reversible.

Effect on Landscape Character in the Wider Landscape

5.11.14 Of the fifty-one LCTs located within the 45 km study area, five have been identified as potentially experiencing a significant landscape effect due the Proposed Development as follows:

LCT 165: Upper Dale – Dumfries & Galloway

5.11.15 The ZTV indicates widespread theoretical visibility within 5 km of the Proposed Development of 12-14 turbines extending directly to the south of the Proposed Development. Some of these areas comprise coniferous plantation which, combined with forestry in the neighbouring LCT, would reduce the extent of overall visibility experienced within this unit. To the north of Carsphairn, theoretical visibility reduces to 1-6 turbines within the floor of the dale, increasing to 1-12 on the western side which faces the Proposed Development extending to 7.1 km. To the south east beyond 5 km, theoretical visibility extends along the dale floor and sides becoming less widespread southwards to 13.2 km at St John's Town of Dalry. Intervening screening from woodland and forestry would reduce actual visibility experienced.

5.11.16 A series of viewpoints represent the different views of the Proposed Development experienced in this LCT as follows:

- Volume 2c: Figure 5.14a-g: Viewpoint 1: Carsphairn War Memorial;
- Volume 2c: Figure 5.15a-f: Viewpoint 2: Carsphairn Community Garden;
- Volume 2c: Figure 5.21a-f: Viewpoint 8: B729 Road (South east of Carsphairn);
- Volume 2c: Figure 5.22a-f: Viewpoint 9: Minor road between A713 and B729;
- Volume 2c: Figure 5.27a-f: Viewpoint 13: Drumcleugh;
- Volume 2c: Figure 5.28a-f: Viewpoint 15: B7000 Road (South of High Bridge of Ken);
- Volume 2c: Figure 5.31a-f: A713 Road (South of Carsphairn); and
- Volume 2c: Figure 5.32a-f: A713 Road (North of Carsphairn).

5.11.17 The aviation intensity ZTV shows widespread theoretical visibility of all five turbines that would be lit. This would occur immediately to the south of the Proposed Development and is predicted to be 2000 – 40 candela (ca) (poor visibility) and 200- 4 ca (clear visibility), the latter being the worst-case scenario. Lighting intensities would reduce as the distance increases from the Proposed Development but are typically similar in brightness to a car brake night at night-time.

During Construction (Scenario 1)

5.11.18 Within the wider LCT, indirect effects would occur within the northern part of the LCT around Upper Glenkens where the site enabling works and installation of turbines would form a new activity and feature within the landscape, contrasting with the proposed sites existing context. The size and scale of the change would be large extending out to 5 km. Landscape magnitude of change during construction would be **Substantial** extending out to 5 km. Thereafter, activities associated with construction would be less apparent owing to intervening screening by woodland and forestry within the dale resulting in a **Moderate** to **Slight** landscape magnitude of change as the distance increases from the Proposed Development. This would result in a **Major** significant effect within 5 km of the Proposed Development, reducing to **Moderate** and **Minor** not significant levels thereafter.

During Operation (Scenario 1)

5.11.19 The nature of the effects on landscape character would be both direct and indirect, long term during the operational life of the Proposed Development and reversible beyond this period as a result of decommissioning.

5.11.20 The Proposed Development would be more prominent within the Upper Glenkens unit of this LCT compared to the operational wind farms which are further set back from the LCT. This would be perceived from areas where operational turbines are already visible, the exception being a few scattered areas in the vicinity of Brockloch, Carsphairn, Glenhoul and Earlstoun. The introduction of the proposed turbines would predominantly be experienced from the northern half of the unit within the foreground of the Cairnsmore of Carsphairn massif extending southwards to 5 km. Here there would be intervisibility of all turbines which would become additional vertical features within the backdrop to the dale. This would alter the perception of the landscape experienced beyond the unit but would not affect the overall characteristics which would remain intact. Beyond 5 km, theoretical visibility would decrease in terms of the number of turbines experienced by screening from intervening landform, woodland and forestry.

5.11.21 Within the wider unit, landscape magnitude of effect would be **Substantial** extending out to 5 km from the proposed turbines. Thereafter, activities associated with operation would be less apparent owing to intervening screening by woodland and forestry within the dale resulting in a **Moderate** to **Slight** landscape magnitude of effect as the distance increases from the Proposed Development and it becomes less prominent within the perceptual experience. This would result in a **Major significant** effect within 5 km of the Proposed Development, reducing to **Moderate** and **Minor** non-significant effects.

5.11.22 All five of the aviation lights would be visible within the Upper Glenkens area within 5 km of the Proposed Development., This would result in additional lighting being experienced within the dale during hours of darkness and would be seen in the context of artificial lighting from properties and vehicles within the dale, and sky glow from Carsphairn. Magnitude of effect would be **Slight** on account of the limited number of lights visible resulting in a **Moderate** not significant effect where the lighting intensity would reduce with distance.

Cumulative Effects

5.11.23 None of the consented schemes considered would be located within this unit; however, they would increase the presence of turbines experienced in the Upper Glenkens unit. This is due to the consented schemes being located closer to the unit than the operational sites. The most notable of these would be Glenshimmeroch and Troston Loch located 2.8 and 4.3 km to the east of the LCT, and the Benbrack development located 1.1 km to the north east.

5.11.24 The addition of the Proposed Development to this cumulative baseline would further increase the number of turbines experienced from within this unit, albeit would not be an uncharacteristic feature. As described in Scenario 1, this would be widespread within 5 km to the south of the Proposed Development where the consented schemes mentioned are not as prominent and further back from the dale sides. The cumulative ZTV shows that there would be no additional theoretical visibility as a result of the Proposed Development when combined with the operational and consented sites. Wind turbine development would be experienced sequentially whilst passing through the dale and would be a regular occurrence.

5.11.25 Cumulative magnitude of change for Scenario 1 would still broadly apply for the consented scenario and remain as **Substantial** within 5 km, decreasing thereafter with distance. The consented sites would not be lit by aviation lighting and there would be no change to the assessment of Scenario 1.

5.11.26 The Scenario 3 baseline would include the addition of Shepherds Rig directly to the east of the Proposed Development and Margree 4.8 km to the east in the vicinity of Troston Loch and Glenshimmeroch consented schemes. Further application sites are located to the north, north east and south east but are considered too far for any significant combined or successive effects to occur within the Upper Glenkens unit. The addition of the Proposed Development to this cumulative baseline would result in turbines being experienced closely in combination with Shepherds Rig and extend the horizontal extent of turbines within the locality. Both sites would appear as one wind farm although there would be some variations in turbine height and spacings between the two developments.

5.11.27 This would result in a **Substantial** magnitude of change as a result of increasing the influence of wind farm development on the unit. The Margree development would largely affect the southern half of the Upper Glenkens unit where the Proposed Development has less influence owing to intervening screening by woodland and forestry within the dale resulting in a **Moderate** to **Slight** cumulative magnitude of effect as the distance increases from the Proposed Development. This would result in a **Major significant** effect within 5 km, reducing with distance within the LCT to **Moderate** and **Minor** not significant levels due to distance and intervening screening from woodland.

5.11.28 The Shepherds Rig site would not be lit by aviation lighting but there is potential for further aviation lights to be visible from tip height extensions to the Glenshimmeroch scheme and should Benbrack explore this route. This would result in a slight increase in turbine lights experienced from within the unit alongside the Proposed Development but would not lead to additional light pollution if mitigation methods were followed.

LCT 177: Southern Uplands – Dumfries & Galloway

5.11.29 Overall sensitivity for the Southern Uplands LCT is **High**.

5.11.30 The ZTV shows widespread theoretical visibility of 14 turbines within the site boundary extending beyond the Proposed Development to the west of Craig of Knockgray. The exception to this is to the north of the shoulder adjoining Cairnsmore of Carsphairn with Beninner where no theoretical visibility is predicted on account of screening from landform. Beyond the site boundary to the north, theoretical visibility would be limited to the summits and south facing upper slopes of Moorbrook Hill, Green Hill, Dodd Hill and Alhang.

5.11.31 The aviation intensity ZTV shows theoretical visibility of 200 ca (clear conditions) aviation lights experienced from Knockwhirn, Willieanna and the lower slopes of Beninner between elevations of 350 - 550 m AOD, and on the south facing slopes of Green Hill, Moorbrook Hill, Mid Hill of Glenhead and Alhang. To the south, below 350 m AOD, light intensities would reduce to 140 – 4 ca (clear visibility).

5.11.32 Aviation lights fitted on 2 turbines would be experienced within the Proposed Development Area and on Holm Hill to the south west; and aviation lighting on 3 turbines beyond the site boundary to the north and north east at higher elevations.

5.11.33 A series of viewpoints represent the type of view experienced in the wider LCT as follows:

- Volume 2c: Figure 5.16a-f: Viewpoint 3: Cairnsmore of Carsphairn;
- Volume 2c: Figure 5.17a-f: Viewpoint 4: Beninner; and
- Volume 2c: Figure 5.33a-f: Viewpoint 20: Black Shoulder.

During Construction (Scenario 1)

5.11.34 During construction, site enabling works and the installation of turbines and associated infrastructure would result in direct effects on the landscape fabric of the Proposed Development site area as mentioned above. Within the wider area, the size and scale of the changes would affect the southern part of the Carsphairn unit where the proposed turbines would form a new prominent tall vertical feature alongside the supporting infrastructure.

5.11.35 This would result in a substantial change in terms of the perceptual experience which would occur mainly within the Proposed Development Area and immediate surrounding hill sides. On completion of the construction phase, there would be no additional alterations to the Proposed Development.

5.11.36 Landscape magnitude of effect during construction would be **Substantial** for the Proposed Development and within the immediate vicinity. Thereafter, activities associated with construction would be less apparent owing to screening

by landform within the unit resulting in **Slight** and **Negligible** landscape magnitude of effect. This would result in a **Major significant** effect within the Proposed Development Area and its immediate environs, reducing to **Moderate** and **Minor** not significant effects elsewhere due to screening from landform.

During Operation (Scenario 1)

5.11.37 The nature of the effects on landscape character would be both direct and indirect, long term during the operational life of the Proposed Development and reversible beyond this period as a result of decommissioning. The direct effects upon character would arise from the siting of 13 turbines, anemometry mast, substation and access tracks within the unit as discussed above for the Proposed Development.

5.11.38 The Proposed Development would be more prominent within the Carsphairn unit of this LCT compared to the operational schemes which are located to the north and north west of Cairnsmore of Carsphairn and further back in the upland landscape. It is recognised that from some southern parts of the LCT, the proposed turbines would form a new prominent feature in front of the Cairnsmore of Carsphairn massif. Areas predicted to receive theoretical visibility to the north would be limited to the upper components of the turbines as a result of screening from landform which would also screen the supporting infrastructure.

5.11.39 Magnitude of effect would be **Substantial**, resulting from the size and scale of the changes including the introduction of 13 wind turbines, anemometry mast and access tracks. These would-be long-term features within the landscape but reversible resulting in a **Major significant** effect.

5.11.40 Overall, magnitude of change beyond the Proposed Development boundary would be **Slight** on account of the small geographical area affected and screening by landform resulting in similar intervisibility to the operational sites, albeit closer. This would result in a **Moderate** not significant effect on account of the limited area affected within the LCT and influence of screening from landform.

5.11.41 All five lights would be experienced within the Carsphairn unit at various intensities depending on elevation. This would result in additional lighting within an area not currently affected by artificial lighting. The size and scale of the change would be small on account of the limited numbers of lights visible where the intensities would be controlled to reduce light pollution and gradually reduce as distance increases. Magnitude of effect is **Slight**, long-term, and reversible. This would result in a **Moderate** not significant effect due to the limited extent of the proposed artificial lighting combined with distance.

Cumulative Effects

5.11.42 No consented sites are located within the Carsphairn unit. Potential cumulative effects would be related to sites situated in neighbouring LCTs to the north and north west comprising Windy Standard III and Benbrack, and to the south east consisting of Glenshimmeroch, Margree and Troston Loch. The sites to the north would be separated from the Proposed Development by the land mass of Cairnsmore of Carsphairn and generally be experienced successively. Whilst the sites to the south east would be more visible but at distances in excess of 6.9 km.

5.11.43 The closest consented schemes to the Proposed Development would not require aviation lighting in their current form and there would be no increase to the effect predicted for Scenario 1.

5.11.44 Similar to Scenario 2, no application sites (Scenario 3) have been submitted within the Carsphairn unit. Within the wider landscape, application sites would increase the number of turbines to the north (Windy Standard Repower), Euchanhead and Sanquhar II to the east, and Shepherds Rig immediately to the south east of the Proposed Development.

5.11.45 The introduction of the Proposed Development in combination with Shepherds Rig would increase the influence of turbines in the southern part of the Carsphairn unit appearing as one wind farm. The remaining site s would have less influence alongside the Proposed Development on account of distance and screening by intervening landform.

5.11.46 Magnitude of effect would remain as **Substantial** for the Carspahirn unit of the LCT resulting in a **Major** significant effect.

5.11.47 Some of the sites mentioned would require aviation light due to the size of turbines, this would introduce new lighting sources into the landscape. However, due to the distances involved, lighting intensities would reduce and would not alter light pollution levels. Magnitude of change would remain as **Slight**, long-term, and reversible. This would result in a **Moderate** not significant effect due to the limited extent of the proposed artificial lighting.

LCT 176: Foothills with Forest – Dumfries & Galloway

5.11.48 The Proposed Development is not located within this unit of the LCT; therefore, effects upon landscape character would be indirect and associated with the perception of turbines experienced in a neighbouring LCT. Overall sensitivity of the Rhinns of Kells Unit is **High** and the Stroan Unit **Medium**.

5.11.49 The ZTV indicates that the Rhinns of Kells unit would receive theoretical visibility from east facing slopes and summits between 2.8 – 15.9 km from the Proposed Development. The majority of this would occur on forested areas. Beyond 15.9 km, theoretical visibility would be limited to the summits around Darnaw.

5.11.50 Within the Stroan unit, theoretical visibility is predicted on north facing slopes between 4.2 – 23.2 km to the south east. Similar to the Rhinns of Kells unit, this would predominantly occur in forested areas.

5.11.51 Both units of this LCT are predicted to receive theoretical visibility of aviation lights. This would occur in elevated areas covering hill tops and ridgelines in both units where 200 - 75 (clear visibility) intensities would be experienced. Within the Rhinns of Kells unit, lighting is predicted from all 5 turbine lights and the Stroan unit lighting mounted on 2 turbines, with lighting intensities decreasing with distance.

5.11.52 A series of viewpoints represent the types of view experienced in the LCT as follows:

- Volume 2c: Figure 5.14a-g: Viewpoint 23: Darnaw (Memorial); and
- Volume 2c: Figure 5.15a-f: Viewpoint 24: Culmark Hill.

During Construction (Scenario 1)

5.11.53 No activities associated with construction would occur within this unit of the LCT and potential effects would be indirect. Project components experienced from this LCT would include the installation of turbines and, anemometry mast. Partial intervisibility of the supporting infrastructure from open parts of the LCT where there is limited forestry would be obtained.

5.11.54 This would include crane operations as tower sections, nacelle and blades are installed incrementally over a short-term period of 15 months.

5.11.55 The size and scale of the change would be most apparent within 7 km, thereafter, reducing with distance. This would affect a relatively small area to the south west of the Proposed Development Area and north facing slopes where breaks in forest cover allows. Magnitude of effect would be **Slight**, short-term, and reversible. Potential effects would be **Moderate** and **significant** for both units of the LCT on account of the close intervisibility of construction activities within 7 km, reducing as distance increases to non-significant levels.

During Operation (Scenario 1)

5.11.56 During operation, the change to key characteristics would be similar to those described above for construction, the exception being rotating turbines would be perceived. This would be experienced in the context of operational wind farms but would be closer to both units.

5.11.57 Due to the forested nature of the LCT, the Proposed Development would be visible from a small area located within both units assessed. Magnitude of effect is predicted to remain as **Slight** within 7 km reducing to **Negligible** levels

as distance increases, this would be long-term and reversible and result in a **Moderate significant** effect on account of the close intervisibility experienced, reducing with distance to non-significant levels.

5.11.58 Aviation lights would be perceived alongside lights from regular traffic travelling on the A713 road, and isolated properties in the foreground. All 5 lights would be experienced at various intensities at distances ranging between 4.2 – 23.2km from the Rhinns of Kells unit, and the lighting of 2 aviation lights in the Stroan unit. Magnitude of change would be **Slight**, long-term, and reversible. This would result in a **Moderate** not significant effect due to the limited number of the proposed lights combined with screening by forestry and distance.

Cumulative Effects

5.11.59 The consented Torrs Hill two turbine scheme is located within the Rhinns of Kells unit and Glenshimmeroch, Margree, Troston Loch and Knockman Hill developments situated within the Stroan unit.

5.11.60 The addition of the Proposed Development would lead to further turbines located to the north east and north of the LCT. As noted in Scenario 1, only a small area of both units of this LCT would be affected, whereas the consented schemes would have more of an influence on this LCT due to being located within it.

5.11.61 It is not considered that the addition of the Proposed Development to the operational and consented baseline would alter the key characteristics of this LCT and cumulative magnitude of change would remain as **Slight** reducing to **Negligible** levels as distance increases, long-term and reversible.

5.11.62 The closest consented schemes to the Proposed Development would not require aviation lighting in their current form.

5.11.63 Three further developments, Fell and Garcrogo are proposed within the Stroan unit to the north, and Shepherds Rig in the neighbouring LCT to the north. The addition of the Proposed Development to this baseline would increase the influence of turbines perceived to the north and would appear as part of the Shepherds Rig wind farm. It is not considered that the introduction of the Proposed Development to this baseline would be detrimental to the key characteristics of the LCT but would increase the perception of turbines experienced beyond the LCT. Cumulative magnitude of effect for Scenario 3 is considered at the upper levels of **Moderate** reducing to **Slight** as distances increases, long-term and reversible. Cumulative effects would therefore increase for Scenario 3 resulting in a **Major-moderate** effect and **significant**.

5.11.64 The application sites and consented sites that have submitted tip height extensions would require aviation lighting due to being over 150 m in height. This would increase the number of aviation lights experienced to the north east and north. The addition of the Proposed Developments aviation lights would increase the number of lights visible within this LCT. However, the application sites would be further away from the area most affected by the Proposed Development within 7 km and would not affect the key characteristics of the LCT. Magnitude of change would remain as **Slight**, long-term, and reversible. This would result in a **Moderate** not significant effect at night-time due to the limited extent of the proposed artificial lighting combined with distance.

LCT 178: Southern Uplands with Forest – Dumfries & Galloway

5.11.65 The Proposed Development is not located within this unit of the LCT and therefore, effects upon landscape character would be indirect. Overall sensitivity is **High** for the Southern Uplands with Forest LCT.

5.11.66 Within the Carsphairn unit, theoretical visibility would mainly occur in the south of the unit covering Brockloch Craig, Lamford Hill, Benbrack and Waterhead Hill where 1-14 turbines are predicted to be theoretically visible.

5.11.67 Within the Ken unit, theoretical visibility would be greater on account of it being closer to the Proposed Development. This would predominantly occur to the east and west of Glen Lorg as well as Cornharrow and predominantly cover forested areas.

5.11.68 The aviation intensity ZTV shows limited theoretical visibility of the reduced lighting scheme within the Cairnsmore unit of the LCT. This would occur on Waterhead Hill, Dodd Hill, Benbrack and Lamford Hill where 200 ca (clear visibility) intensity lights would be experienced although this would occur within forestry on Waterhead and Dodd Hills. At lower levels between Lamford Hill and Benbrack, 750 – 10 ca intensity would be experienced depending on elevation.

5.11.69 All five aviation lights will be experienced within the southern half of the Ken unit of this LCT. This will include 200 ca (clear visibility) in elevated areas reducing to 750 – 40 at lower elevations. Much of this would be experienced from forestry plantations with limited areas of moorland and a section of the SUW affected as it crosses Manquhill Hill and Benbrack.

5.11.70 A series of viewpoints represent the types of view experienced from this LCT as follows:

- Volume 2c: Figure 5.18a-f: Viewpoint 5: Alhang;
- Volume 2c: Figure 5.20a-f: Viewpoint 7: Southern Upland Way (North East of Stroanfreggan); and
- Volume 2c: Figure 5.34a-g: Viewpoint 21: Manquhill Hill.

During Construction (Scenario 1)

5.11.71 The size and scale of the change to the key characteristics within this LCT would be limited, indirect and associated with the erection of turbines including crane operations. This would be perceived in proximity in the Ken unit extending out to 12.2 km to the south east. Within the Carsphairn unit, this would be between 1.3 – 8.8 km. and generally limited to the southern part of each unit. Magnitude of effect would be **Moderate** in proximity to the Proposed Development reducing to **Slight** and **Negligible** levels as distance increase and the influence of screening from topography. This would be short term and reversible. Effects during construction would be **Major-moderate** significant in a localised area; thereafter, reducing to **Moderate** and **Minor** not significant levels due to distance and screening by forestry.

During Operation (Scenario 1)

5.11.72 During operation, the change to key characteristics would be similar to those described above for construction, the exception being operational turbines would be perceived. This would be experienced in the context of other operational wind farms within the landscape but would be closer to both units.

5.11.73 Due to the forested nature of the LCT, the Proposed Development would influence an area out to 10 km within both units. As mentioned, much of this area is covered by forestry which is the predominant characteristic. Magnitude of effect would be **Moderate** in proximity to the Proposed Development reducing to **Slight** and **Negligible** levels as distance increases, long-term, and reversible. Effects during operation would be **Major-moderate** significant occurring in a localised area; thereafter, reducing to **Moderate** and **Minor** not significant levels due to distance and screening by forestry.

5.11.74 All five lights would be experienced at various intensities at distances ranging from the Proposed Development boundary to 12.2 km although this would cover predominantly forested slopes. Magnitude of effect would be **Slight**, long-term, and reversible. This would result in a **Moderate** not significant effect due to the limited extent of the proposed artificial lighting combined with distance.

Cumulative Effects

5.11.75 Within the Carsphairn unit, Benbrack and Windy Standard III developments have received consent, and Lorg in the Ken unit.

5.11.76 The addition of the Proposed Development would lead to further turbines being located between the two units of the LCT, extending turbines further to the south west. However, this would be experienced from areas that are generally forested and located close to the location of the operational schemes. Magnitude of effect would remain

as **Slight**, long-term, and reversible. Effects would be **Major-moderate** and **significant** in a localised area; thereafter, reducing to **Moderate** and **Minor** not significant levels due to distance and screening by a combination of landform and forestry which provides a clear separation between developments.

5.11.77 The closest consented schemes to the Proposed Development would not require aviation lighting in their current form and there would be no change to the baseline.

5.11.78 For Scenario 3, Shepherds Rig and Cornharrow are both located within the Ken unit of this LCT.

5.11.79 The introduction of the Proposed Development would not lead to direct changes to the key characteristics but would result in a perceptual change of turbines extending north west from Shepherds Rig into the neighbouring LCT. This would be mainly experienced within 10 km of the Proposed Development where Shepherds Rig will have more of an influence on the key characteristics and reduce sensitivity. There would be a higher number of turbines experienced perceptually from within the Ken unit. The magnitude of effect would remain the same as Scenarios 1 and 2 as **Major-moderate** and **significant** within a localised area, reducing to non-significant levels with distance.

5.11.80 The application sites and consented sites that have submitted tip height extensions would require aviation lighting due to being over 150 m in height. This would increase the number of aviation lights experienced to the north west and south east although Shepherds Rig would not. The addition of the Proposed Development aviation lights would increase the number of artificial lights visible within this LCT. However, the application sites would be further away from the area affected and theoretical visibility of aviation lighting would be limited and generally in forested areas. Magnitude of change would be **Slight**, long-term, and reversible. This would result in a **Moderate** not significant effect due to the limited extent of the proposed artificial lighting.

LCT 180: Rugged Uplands – Dumfries & Galloway

5.11.81 The Proposed Development is not located within this unit of the LCT and therefore, effects upon landscape character would be indirect. Overall sensitivity for the Rugged Uplands – Dumfries & Galloway LCT is **High**.

5.11.82 The ZTV indicates that theoretical visibility would be widespread extending to 8.1 km to the west of the Proposed Development within the Rhinns of Kells unit. This generally covers open ground although at lower elevations to the west of the Upper Dale LCT, would affect an area of forestry. All 14 turbines would be intervisible from Black Craig, Knockower, Lumps of Garryhorn and Cairnsgarroch. Beyond 8 km, theoretical visibility would reduce occurring on summits and east facing slopes along summits forming the Rhinns of Kells extending 13.3 km to the south west of the Proposed Development.

5.11.83 The aviation intensity ZTV shows the east facing slopes of the Rhinns of Kells unit of this LCT as experiencing theoretical visibility of all five of the aviation lights mounted on turbines. This would be experienced at 200 ca (clear visibility) and would occur within the buffer of the Galloway Skies Dark Sky Park with intensities reducing with distance.

5.11.84 A series of viewpoints represent the type of view experienced in the LCT as follows:

- Volume 2c: Figure 5.24a-g: Viewpoint 11: Corserine (Scar of Folk); and
- Volume 2c: Figure 5.38agf: Viewpoint 25: Coran of Portmark.

During Construction (Scenario 1)

5.11.85 The size and scale of the change to the key characteristics within this LCT would be indirect and associated with the erection of turbines including crane operations. This would be perceived from 3 km to 13.3 km to the south west from a large part of the unit. Magnitude of change would be **Moderate** within 8 km reducing to **Slight** and **Negligible** levels as distance increase and the influence of screening from topography. This would be short term and reversible. Effects would be **Major-moderate significant** within 8 km, reducing to **Moderate** and **Minor** not significant levels as distances increase.

During Operation (Scenario 1)

5.11.86 The Proposed Development would be more prominent within 8 km compared to the operational schemes which are located to the north east and east. From the Rhinns of Kells ridgeline, turbines would sit on the lower slopes of Cairnsmore of Carsphairn back clothed by landform. This would be experienced from a large part of the Rhinns of Kells unit. Magnitude of effect on the landscape resource would be **Moderate**, resulting from the size and scale of the changes including the introduction of 14 wind turbines, anemometry mast and access tracks. These would-be long-term features within the landscape but reversible. Effects would be **Major-moderate** significant within 8 km, reducing to **Moderate** and **Minor** not significant levels as distances increase.

5.11.87 All five lights would be experienced within the Rhinns of Kells unit at various intensities depending on elevation. This would result in additional lighting within an area not currently affected by artificial lighting. The size and scale of the change would be small on account of five lights being visible. Magnitude of change is **Slight**, long-term and reversible. This would result in a **Moderate** not significant effect due to the limited extent of the proposed artificial lighting combined with distance.

Cumulative Effects

5.11.88 No consented sites are located within the Rhinns of Kells unit. Potential cumulative effects would be related to sites located in neighbouring LCTs to the north and east comprising Windy Standard III and Benbrack, and to the south east consisting of Glenshimmeroch, Margree and Troston Loch. The sites to the north east would be separated from the Proposed Development by the land mass of Cairnsmore of Carsphairn whilst the sites to the south east would be more visible.

5.11.89 Magnitude of effect would remain as Moderate resulting in a **Major-moderate significant** effect.

5.11.90 The closest consented schemes to the Proposed Development would not require aviation lighting in their current form and there would be no increase to the magnitude of change and subsequent effect.

5.11.91 Similar to Scenario 2, no application sites have been submitted to be located within the Rhinns of Kells unit. Application sites would increase to the north east including Cornharrow and Euchanhead. Shepherds Rig would be located adjacent to the Proposed Development and extend turbines to the south east.

5.11.92 The introduction of the Proposed Development to this baseline would increase the influence of turbines perceived in the Rhinns of Kells unit in combination with the Shepherds Rig development resulting in a slight increase to magnitude. This would occur within 8 km of the Proposed Development within the LCT; thereafter reducing to **Slight** overall, long-term, and reversible. Effects would be **Major** significant within 8 km, reducing to **Moderate** and **Mino**r not significant levels as distances increase.

5.11.93 Some of the sites mentioned would require aviation light due to the size of turbines, this would introduce new lighting sources into the landscape. However, due to the distances involved, lighting intensities would reduce and would not alter light pollution levels. Magnitude of change would be **Slight**, long-term, and reversible. This would result in a **Moderate** not significant effect due to the limited extent of the proposed artificial lighting combined with distance.

5.11.94 Two LCTs have been assessed as not experiencing significant effects as follows:

LCT 76: Foothills

5.11.95 The Proposed Development is not located within this unit of the LCT and therefore potential effects would be indirect and associated with the perception of turbines experienced in a neighbouring LCT. Overall sensitivity is considered **High**.

5.11.96 The ZTV indicates theoretical visibility to the east and west of Loch Doon on south and south east facing slopes comprising 1-12 turbines, increasing to 14 turbines in elevated areas such as Big Hill of Glenmount. Thereafter,

limited to elevated locations around Loch Braden, Glenalla Fell, Garleffin Fell, Craigmoddie and Dersalloch Hill to the north west, and south facing hillsides north of Waterside.

5.11.97 The aviation intensity ZTV shows limited theoretical visibility of the reduced lighting scheme within the north western unit of this LCT. This would occur in elevated areas to the east and west of Loch Doon, Dersalloch Hill, near Loch Braden, Tairlaw Ridge and Garleffin. This would predominantly be experienced at light intensities of 75 ca (clear visibility). The summits of Big Hill of Glenmount, Craig Dhu and Glenalla Fell are predicted to experience aviation lighting mounted on Turbines 8 and 15 at 200 ca (clear visibility), albeit at distances of 15.1 – 16.9 km where light intensity would reduce due to distance. The areas affected lie within the buffer of the Galloway International Dark Sky Park, no theoretical visibility is predicted at the location of the former Dark Skies Observatory.

During Construction (Scenario 1)

5.11.98 The size and scale of the change to the key characteristics within this LCT would be limited, indirect and associated with the erection of turbines including crane operations. This would be perceived at distances of 7.8 – 27.1 km with the main change occurring to the east and west of Loch Doon between 7.8 – 10 km. From this location, the erection of turbines would be experienced within proximity to Cairnsmore of Carsphairn. This would occur from a small part of the overall LCT where the extent of the Proposed Development would be limited. The perceptual change would be short-term and reversible resulting in a localised **Slight** magnitude of change during construction and overall **Negligible**. This would result in a **Moderate** not significant effect on account of the limited area affected and distance from the Proposed Development, and **Minor** not significant effect overall.

During Operation (Scenario 1)

5.11.99 During operation, the change to key characteristics would be like those described above for construction, the exception being rotating turbines would be perceived. This would be experienced in the context of operational wind farms located in neighbouring LCTs at similar distances.

5.11.100 Landscape magnitude of change during operation would be localised **Slight** around Loch Doon and **Negligible** overall, long-term, and reversible. This would result in a **Moderate** not significant effect on account of the limited area affected and distance from the Proposed Development, and **Minor** not significant overall.

5.11.101 At night-time, the aviation lights of the reduced lighting scheme would be experienced beyond the Galloway International Dark Skies Park. This would be perceived alongside lights from regular traffic travelling on the A713 road, and isolated properties in the foreground. All 5 lights would be experienced at various intensities at distances ranging between 7.8 – 27.1 km from a limited part of the LCT. Night-time magnitude of change would be localised **Slight** around Loch Doon and **Negligible** overall, long-term, and reversible. This would result in a **Moderate** not significant effect due to the limited extent of the proposed artificial lighting combined with distance.

Cumulative Effects

5.11.102 Three consented sites are situated in the northern unit of this LCT, Polquhairn, Overhill 17.6 km and Greenburn 18.4 km to the north of the Proposed Development. Additionally, there are also several other consented developments within the study area and of these, Benbrack and Windy Standard III to the east in a neighbouring LCT would be the most prominent. The addition of the Proposed Development would extend turbines southwards and be experienced successively alongside the operational and consented sites at a similar distance from the LCT.

5.11.103 It is not considered that the addition of the Proposed Development to the operational and consented baseline would alter the key characteristics of this LCT and cumulative magnitude of change would remain as localised **Slight** and **Negligible** overall, long-term and reversible.

5.11.104 The closest consented schemes to the Proposed Development would not require aviation lighting in their current form. Magnitude of change would be localised **Slight** and **Negligible**, long-term, and reversible. This would result in a **Moderate** not significant effect due to the limited extent of the proposed artificial lighting combined with distance.

5.11.105 Four further developments, Greenburn, North Kyle, Knockcronal and Sclenteuch are proposed within this LCT to the north, and Shepherds Rig to the south east and adjacent to the Proposed Development. There have also been variations submitted for tip height extension at Overhill. The addition of the Proposed Development to this cumulative baseline would be like that experienced in Scenario 2 whereby, turbines would be perceived successively from the area to the east and west of Loch Doon. However, all the developments mentioned would be set back from this area and it is not considered that the addition of the Proposed Development would be detrimental to the key characteristics of the LCT.

5.11.106 The application sites and tip height variations consented sites would require aviation lighting due to being over 150 m in height. This would increase the number of aviation lights experienced to the north east and east of Loch Doon. These would be distant and in the opposite direction to the Galloway Dark Skies Park core area. Magnitude of change would be localised **Slight** and **Negligible** overall, long-term, and reversible. This would result in a **Moderate** not significant effect due to the limited extent of the proposed artificial lighting combined with distance.

LCT 160: Narrow Wooded River Valley – Dumfries and Galloway

5.11.107 The Proposed Development is not located within this unit of the LCT; therefore, effects upon landscape character would be indirect and associated with the perception of turbines experienced in a neighbouring LCT. Overall sensitivity is considered **High**.

5.11.108 The ZTV shows widespread theoretical visibility of 1-6 turbines from the valley floor, increasing to 10-14 on west facing slopes to the east of the Water of Ken as the elevation increases. This is predicted to be widespread in the central part of the Ken unit extending as far as Corlae in the north and thereafter limited to the eastern edge comprising 1 – 12 turbines.

5.11.109 Theoretical visibility predicted mainly occurs in areas of coniferous woodland which when combined with the forested slopes of the neighbouring LCT to the west, would reduce the actual intervisibility of the Proposed Development depending on harvest cycles.

5.11.110 The aviation intensity ZTV shows theoretical visibility of the reduced lighting scheme would be limited to the eastern side of the valley on west facing slopes. This would extend from Corlae in the north to Culmark Moss with lighting intensities predicted between 200 - 4ca (clear visibility), of aviation lights mounted on four turbines. The lights of one turbine would not be visible within this LCT. Theoretical visibility of aviation lights would occur mainly on the forested glen sides and limited within the floodplain and affect the short section of the SUW and the B729 road in the south.

During Construction (Scenario 1)

5.11.111 No activities associated with construction would occur within this unit of the LCT and potential effects would be indirect. Project components experienced from this LCT would be limited to the installation of turbines and anemometry mast as the supporting infrastructure would be screened by intervening landform and forestry. This would include crane operations as tower sections, nacelle and blades are installed incrementally over a short-term period of 15 months.

5.11.112 Changes to the key characteristics would be perceptual rather than physical. Turbine locations would be set back from the glen with a combination of screening and forestry reducing the extent of the Proposed Development experienced depending on elevation. The eastern turbines would be the most notable with the remainder of the site being largely screened in blade tips being intervisible. This would reduce the size and scale of the change occurring which would cover a smaller area than indicated by the ZTV. Magnitude of change during construction would be Slight, short-term, and reversible. This would result in a **Moderate** not significant effect on account of screening by forestry and landform.

5.11.113 A series of viewpoints represent the perceptual change experienced in the wider LCT as follows:

- Volume 2c: Figure 5.27a-f: Viewpoint 14: Stroanfreggan Cairn; and
- Volume 2c: Figure 9.12: Cultural Heritage Viewpoint AOC30 - Stroanfreggan Craig Fort.

During Operation (Scenario 1)

5.11.114 During operation, the Proposed Development would form a new feature beyond the Ken unit of the LCT to the west. This would be experienced in the context of existing operational wind farms noted previously, albeit the Proposed Development would be closer to the unit and experienced within the foreground of Cairnsmore of Carsphairn from the southern extent of the Ken unit. The proposed turbines would not dominate the scale of the glen or features contained within it on account of being set back from the sides and presence of forestry would reduce the vertical extent of the turbines. This would alter periodically as forested areas were clear felled and replanted altering the geographic area within the Ken unit affected. Nevertheless, from the floor of the glen, a limited number of turbines would be intervisible, increasing with elevation on side slopes although it should be noted that these are predominantly forested. Magnitude of change during operation would remain as **Slight**, long-term, and reversible. This would result in a **Moderate** not significant effect on account of screening by forestry and landform.

5.11.115 As noted in the ZTV analysis, four aviation lights would potentially be experienced in hours of darkness with light intensities predicted to be 200 - 4 ca (poor visibility) depending on elevation, This would occur mainly on the upper slides of the glen and be further reduced by adjacent forestry. The presence of aviation lights would not increase light pollution within the glen during hours of darkness. Magnitude of change would be **Slight**, long-term, and reversible. This would result in a **Moderate** not significant effect due to the limited extent of the proposed artificial lighting combined with distance.

Cumulative Effects

5.11.116 No consented sites are located within the Ken unit although the consented Lorg scheme is located to the east of the head of the glen and would be intervisible above foreground coniferous woodland introducing turbines as a feature within the floor of the glen. The consented sites of Windy Standard III and Benbrack to the north, and Glenshimmeroch, Troston Loch and Margree to the south would have a limited influence on the unit on account of being set further back from the valley sides which reduces the extent of intervisibility within the glen.

5.11.117 The Proposed Development would be experienced successively with Lorg from the areas noted above. The size and scale of the change would be small in comparison to Lorg on account of the Proposed Development being set further back from the valley sides. Magnitude of change and the potential effect would remain the same as that assessed for Scenario 1.

5.11.118 The consented Lorg turbines would not be lit by aviation lighting and there would be no change to the night-time baseline assessed in Scenario 1.

5.11.119 Several application sites are planned in the surrounding area including Euchanhead 2.0 km to the north east, Cornharrow 31.8 km to the east, and Shepherds Rig directly to the west. Of these sites, Shepherds Rig would have the greatest influence on the character of the Ken unit due to its proximity. The cumulative ZTV suggests that the Ken unit would receive extensive visibility of this development although it is recognised that this would be reduced by screening from forestry. Nevertheless, the eastern turbines of the development would become a characterising influence on the glen.

5.11.120 The addition of the Proposed Development to this cumulative baseline would result in further turbines being experienced beyond Shepherds Rig with both developments appearing as one wind farm. The Proposed Development would be set back further from the glen and less prominent due to screening from landform and forestry. This would occur from the locations noted above and include combined intervisibility with Shepherds Rig and successive intervisibility with Lorg. Magnitude of change would increase slightly but not to the extent where the effect would be significant due to screening and remain the same as Scenario 1 levels.

5.11.121 The proposed Shepherds Rig turbines would not be lit by aviation lighting and there would be no change to the assessment of Scenario 1.

Effect on Designated and Protected Landscapes

5.11.122 Of the thirty-six landscape designations that were identified within 45 km (see Volume 3: Appendix 5.4), the Galloway Hills RSA has been identified as potentially receiving a significant effect as summarised below.

Galloway Hills RSA

5.11.123 The following project components would be located within this RSA (see Volume 2a: Figure 1.1):

- 14 x turbines;
- 1 x anemometry mast;
- 14 x crane pad hardstanding's and temporary infrastructure areas;
- Access tracks;
- Borrow pits;
- Temporary compound(s);
- Battery Storage;
- Substation; and
- Temporary batching plant(s).

5.11.124 The ZTV indicates that theoretical visibility would largely occur within the north and east of the RSA in an area contained by the Southern Uplands to the north including Cairnsmore of Carsphairn, the southern side of Glen Lorg to the south east, the Rhinns of Kells to the south west, and extend along Glenkens to the north west and south east. This would be widespread within 5 km, thereafter, reducing to the upper hill slopes and summits facing the site and southwards along Glenkens. To the west beyond the Rhinns of Kells, theoretical visibility is reduced by landform screening and limited to hill tops of Little Spear, Black Gairy at 11.5 km where 1-3 turbines are predicted to be visible, and around Darnaw and Cairnsmore of Carsfleet where 1-14 turbines are predicted at a distances of 18 – 35 km to the south west.

5.11.125 The aviation intensity ZTV shows theoretical visibility of 200 (clear conditions) would be experienced on Knockwhirn, Willieanna and the lower slopes of Beninner between elevations of 350 - 550 m AOD and on the south facing slopes of Green Hill, Moorbrook Hill, Mid Hill of Glenhead and Alhang. Beyond the site boundary, theoretical visibility of aviation lighting would reduce in terms of the geographic area affected and intensity as distance increases from the Proposed Development where all five turbines would be visible to the Rhinns of Kells. In lower lying areas this would occur mainly on forested foothills with actual visibility would be from clearings and hill tops.

During Construction (Scenario 1)

5.11.126 During construction, site enabling works would be undertaken to gain access to the site and establish temporary site compounds, this would be followed by the installation of turbines and associated infrastructure.

5.11.127 Such operations would result in direct effects on the landscape fabric of the Proposed Development Area. This would include excavation of ground vegetation, earthworks, the introduction of new elements and activity associated with construction which would contrast with the existing land use and moorland context. Some of the construction works would be of a temporary and reversible in nature of short to medium duration where areas are cleared such as temporary compounds. On completion, these would be reinstated according to best practice as described in Chapter 3: Project Description. Other elements would give rise to longer term effects where project components have altered the landscape or are left in situ following decommissioning such as earth cuttings on access tracks.

5.11.128 The size and scale of the changes within the Galloway Hills RSA would be relatively small in terms of land take within the designation, the scale of the change would be substantial in terms of the perceptual experience which

would occur within the Proposed Development extending along Glenkens to the north west and south east, as well as covering the landscape as far as the Rhinns of Kells which would provide some containment to the south west. On completion of the construction phase, there would be no additional alterations to the Proposed Development.

5.11.129 Landscape magnitude of effect during construction would be **Substantial** for the Proposed Development and within the immediate vicinity where the special qualities of the designation would be affected. Thereafter, activities associated with construction would be less apparent owing to screening by landform and forestry within the RSA resulting in **Slight** and **Negligible** landscape magnitude of effect. This would result in a **Major significant** effect for the Proposed Development and vicinity, reducing to **Moderate** and **Minor** not significant levels as distance increases.

During Operation (Scenario 1)

5.11.130 Following reinstatement post construction, the site area would enter the operational stage with activity within the Proposed Development reducing to works associated with the operation and maintenance of wind turbines.

5.11.131 The nature of the effects on the RSA would be both direct and indirect, long term during the operational life of the Proposed Development and reversible beyond this period because of decommissioning. The direct effects upon character would arise from the siting of 14 turbines, anemometry mast, substation, and access tracks within the RSA.

5.11.132 The Proposed Development would be prominent within 8 km and affect the special qualities of the RSA within this area; thereafter, reduce as a result of distance. It is recognised that from the Rhinns of Kells, the proposed turbines would form a new feature in front of the hill and connecting summits. Areas predicted to receive theoretical visibility to the north would be limited to the upper parts of the turbines as a result of screening from landform which would also screen the supporting infrastructure.

5.11.133 Magnitude of change on the landscape resource of the Proposed Development would be **Substantial**, resulting from the size and scale of the changes including the introduction of 14 wind turbines, anemometry mast and access tracks. These would-be long-term features within the landscape but reversible. This would result in a **Major significant** effect for the Proposed Development.

5.11.134 This would result in a **Major** significant effect within 8 km reducing to **Moderate** and **Negligible** (not significant effects elsewhere as distance increases.

5.11.135 All five lights would be experienced within the RSA at various intensities depending on elevation. This would result in additional lighting within an area not currently affected by artificial lighting but in directions away from the Galloway International Dark Skies Park and seen in the context of artificial lighting in Glenkens. The size and scale of the change would be small resulting in a **Slight** magnitude which would be long-term and reversible. This would result in a **Moderate** not significant effect due to the limited extent of the proposed artificial lighting combined with distance.

Cumulative Effects

5.11.136 One site has been granted consent within the Galloway Hills RSA, the two turbine scheme Torrs Hill located 7.1 km to the south west.

5.11.137 Potential cumulative effects would be related to sites located beyond the designation to the north and east comprising Windy Standard III and Benbrack, and to the south east consisting of Cornharrow, Glenshimmeroch, Margree and Troston Loch. The sites to the north east would be separated from the Proposed Development by the land mass of Cairnsmore of Carsphairn whilst the sites to the south east would be more prominent.

5.11.138 One application site would be partially within this RSA, Shepherds Rig in the north east which lies adjacent to the Proposed Development.

5.11.139 Application sites would increase the number of turbines to the east of the Proposed Development Sanquhar II Euchanhead.

5.11.140 The introduction of the Proposed Development to Scenario 2 and 3 baselines would increase the influence of turbines perceived in the RSA; however, the application sites mentioned have less influence in the area due to a combination of being set further back, distance and screening from landform and forestry. Cumulative magnitude of effect would remain as **Substantial** for both Scenarios 2 and 3 within 8 km, thereafter, reducing to **Slight** overall, long-term, and reversible. This would lead to a **Major** effect for Scenario 2 and Scenario 3, both of which would be **significant** within 8 km, reducing with distance to **Moderate** and **Minor** not significant levels.

5.11.141 Some of the sites mentioned would require aviation light due to the size of turbines, this would introduce new lighting sources into the landscape. However, due to the distances involved, lighting intensities would reduce and would not alter light pollution levels or the special qualities of the RSA. Magnitude of change would be **Slight**, long-term, and reversible. This would result in a **Moderate** not significant effect due to the limited extent of the proposed artificial lighting combined with distance.

5.11.142 One other local designation was identified for assessment but was deemed to receive not significant effects as follows.

Loch Doon SLCA

5.11.143 The Proposed Development is not located within this designation; therefore, effects upon its qualities would be indirect and associated with the perception of turbines.

5.11.144 The ZTV indicates theoretical visibility to the east and west of Loch Doon on south and south east facing slopes comprising 1-12 turbines, increasing to 14 turbines in elevated areas such as Big Hill of Glenmount. Thereafter, becomes limited to elevated locations to the west of Loch Doon including Craiglee and Wee Hill of Craiginulloch.

5.11.145 The aviation intensity ZTV shows limited theoretical visibility of the reduced lighting scheme mainly to the west of Loch Doon. This would occur in elevated areas of lights at intensities of 75 ca (clear visibility), albeit at distances of 9.1 - 14.4km. The summits of Big Hill of Glenmount, and Craiglee are predicted to experience aviation lighting mounted on Turbines 8 and 15 at 200 (clear visibility), at distances of 13.1 where intensity would reduce because of distance. The areas affected lie within the buffer of the Galloway International Dark Sky Park, no theoretical visibility is predicted at the location of the former Dark Skies Observatory.

During Construction (Scenario 1)

5.11.146 The size and scale of the change to the special qualities of the SLCA would be limited, indirect and associated with the erection of turbines including crane operations. This would be perceived at distances of 7.8 – 25.3 km with the main change occurring to the east and west of Loch Doon between 7.8 – 13 km. From this location, the erection of turbines would be experienced within proximity to Cairnsmore of Carsphairn. This would occur from a small part of the overall SLCA where the extent of the Proposed Development would be limited. The perceptual change would be short-term and reversible resulting in a localised **Slight** magnitude of change during construction and overall **Negligible**. This would result in a **Moderate** not significant effect due to the limited extent of the Proposed Development theoretically visible, reducing to **Minor** and **Negligible** levels with distance and from the effects of screening from landform.

During Operation (Scenario 1)

5.11.147 During operation, the change to the special qualities would be similar to those described above for construction, the exception being rotating turbines would be perceived. This would be experienced in the context of operational wind farms located in neighbouring LCTs at similar distances.

5.11.148 Landscape magnitude of change during operation would be localised **Slight** around Loch Doon and **Negligible** overall, long-term, and reversible. This would result in a **Moderate** not significant effect due to the limited extent of the Proposed Development theoretically visible, reducing to **Minor** and **Negligible** levels with distance and from the effects of screening from landform.

5.11.149 At night-time, the aviation lights of the reduced lighting scheme would be experienced beyond the boundaries and away from the Galloway International Dark Skies Park. This would be perceived alongside lights from regular traffic travelling on the A713 road, and isolated properties in the foreground. All 5 lights would be experienced at various intensities at distances ranging between 9.1 – 14.4 km from a limited part of the LCT.

5.11.150 Night-time magnitude of change would be localised **Slight** around Loch Doon and **Negligible** overall, long-term, and reversible. This would result in a **Moderate** not significant effect due to the limited extent of the proposed artificial lighting combined with distance.

Cumulative Effects

5.11.151 No consented sites in this designation but would be perceived to the east, of these, Benbrack and Windy Standard III would be the most prominent. The addition of the Proposed Development would extend turbines southwards and be experienced successively alongside the operational and consented sites at a similar distance from the SLCA.

5.11.152 It is not considered that the addition of the Proposed Development to the operational and consented baseline would alter the special qualities of this SLCA and cumulative magnitude of effect would remain as localised **Slight** and **Negligible** overall, long-term, and reversible. Magnitude of effect would be localised **Slight** and **Negligible**, long-term, and reversible. This would result in a **Moderate** not significant effect due to the limited extent.

5.11.153 Scenario 3 would result in further turbine developments to the north including Sclenteuch and Knockcronal on either side of Dersalloch. The addition of the Proposed Development to this cumulative baseline would be similar to that experienced in Scenario 2 whereby, turbines would be perceived successively from the area to the east and west of Loch Doon. However, all the developments mentioned would be set back from this area and it is not considered that the addition of the Proposed Development would be detrimental to the special qualities of the SLCA. Cumulative magnitude of change for Scenario 3 is considered to remain as localised **Slight**, and **Negligible** overall, long-term, and reversible. This would result in a **Moderate** not significant effect due to the limited extent of the Proposed Development theoretically visible, reducing to **Minor** and **Negligible** levels with distance and from the effects of screening from landform.

5.11.154 The application sites and tip height variations consented sites would require aviation lighting due to being over 150 m in height. This would increase the number of aviation lights experienced to the north east and east of Loch Doon. These would be distant and in the opposite direction to the Galloway Dark Skies Park Core Area. Magnitude of change would be localised **Slight** and **Negligible** overall, long-term, and reversible. This would result in a **Moderate** not significant effect due to the limited extent of the proposed artificial lighting combined with distance.

5.12 VISUAL IMPACT ASSESSMENT

5.12.1 The aim of the Visual Impact Assessment (VIA) is to identify, predict and evaluate potential key effects arising from the addition of the Proposed Development on people's views and visual amenity. Effects on views and visual amenity as experienced by people can be caused by changes in the appearance of the landscape resulting from the Proposed Development. A description of the visual baseline and analysis of ZTVs is contained in Table 5.18.

5.12.2 Assessing the significance of visual effects requires the identification of the visual receptors, the consideration of the nature of the visual receptors (sensitivity) and the nature of the effect (magnitude), which would be experienced by each visual receptor as a result of the Proposed Development. The methodology for the visual assessment is detailed in Volume 3: Appendix 5.1.

5.12.3 A Cumulative Visual Impact Assessment (CVIA) is also included in the following VIA and considers the level of effect as a result of the addition of the Proposed Development into each cumulative baseline scenario separately.

Table 5.23: Viewpoint Assessment

VP No.	Viewpoint Name	Sensitivity	Visual Magnitude of Effect			Level of Visual Effects		
			During Construction (Scenario 1)	During Operation (Scenario 1)	Cumulative Magnitude of Change	During Construction (Scenario 1)	During Operation (Scenario 1)	Cumulative Assessment
1	**Carsphairn War Memorial**	**High**	During construction, close visibility of activities associated with site enabling works and the installation of turbines would be seen to the east of the viewpoint location. Magnitude of effect would be **Substantial**.	All 14 turbines (12 hubs) would be visible from this location at 1.5 km appearing in the foreground of views to the east. 2 Aviation lights would be seen directly (Turbines 10 & 14) at light intensities of 8 – 4 ca. Due to the proximity of the viewpoint to the Proposed Development, it would also be possible to see the light reflecting on the blades when passing the vertical position of the other aviation lights. Magnitude of effect would be **Substantial**, long-term and reversible.	Views of Scenario 2 schemes would be limited with Troston Loch barely being visible due to screening by topography and Glenshimmeroch and Margree partially visible to the east as a distant cluster. The Proposed Development would be prominent and much closer. For Scenario 3, Shepherds Rig would be partially visible to the north east. The addition of the Proposed Development to would extend turbines closer to the viewpoint. Both schemes would be viewed as one wind farm. Magnitude of effect would remain as **Substantial**, long-term, and reversible for both cumulative scenarios.	**Major (significant)**	**Major (significant)**	**Major (significant)** for Scenarios 2 and 3.
2	**Carsphairn Community Garden**	**High**	During construction, partial visibility of activities associated with site enabling works and the installation of turbines would be seen to the north east of the viewpoint location. Magnitude of effect would be **Moderate**.	13 turbines (10 hubs) would be visible from this location at 2.0 km. This would not occupy the main view which is onto the foreground gardens and beyond the village towards the Rhinns of Kells. Magnitude of effect would be **Moderate**, long-term, and reversible.	Views of Scenario 2 schemes would be limited with Troston Loch barely being visible due to screening by topography and Glenshimmeroch and Margree being partially visible to the south east as a distant cluster. The Proposed Development would be prominent and much closer. Shepherds Rig would be partially visible to the north east. The addition of the Proposed Development to would extend turbines closer to the viewpoint. Both schemes would be viewed as one wind farm. Magnitude of effect would remain as **Substantial**, long-term, and reversible for both cumulative scenarios.	**Major-moderate (significant)**	**Major-moderate (significant)**	**Major-moderate (significant)** for Scenarios 2 and 3.
3	**Cairnsmore of Carsphairn**	**High**	During construction, close visibility of activities associated with site enabling works and the installation of turbines would be seen below the viewpoint location. Magnitude of effect would be **Substantial**.	14 turbines (10 at hubs) would be viewed below this viewpoint. Turbines would be back clothed by Glenkens and close in views to the south. This would also include the met mast and short sections of access tracks. Magnitude of effect is **Substantial**.	Several consented sites (Scenario 2) would be visible from this viewpoint. The majority of these would occur to the east including, Twentyshilling Hill and Lorg, and to the south east including Glenshimmeroch, Margree, Knockman Hill, Troston Loch Sandy Knowe, Sanquhar Six, and Troston Loch. To the south west lies the two-turbine scheme of Torrs Hill in the foreground of the Rhinns of Kells. The Proposed Development would be viewed in the foreground of the view, separate from the operational and consented sites and close. Cumulative magnitude of effect would be **Substantial**. Scenario 3 application sites would result in an increase of turbines to the east including Euchanhead, Sanquhar II, Cornharrow, Shepherds Rig and Fell. The Proposed Development would be viewed within the foreground and extend turbines from the Shepherds Rig development closer to the viewpoint. Magnitude of change is **Substantial**.	**Major (significant)**	**Major (significant)**	**Major (significant)** for Scenarios 2 and 3.

VP No.	Viewpoint Name	Sensitivity	Visual Magnitude of Effect			Level of Visual Effects		
			During Construction (Scenario 1)	During Operation (Scenario 1)	Cumulative Magnitude of Change	During Construction (Scenario 1)	During Operation (Scenario 1)	Cumulative Assessment
4	**Beninner**	**High**	During construction, close visibility of activities associated with site enabling works and the installation of turbines would be seen below the viewpoint location. Magnitude of effect would be **Substanti**al.	14 turbines (13 hubs) would be viewed below this viewpoint. Turbines would be backclothed by Glenkens and close in views to the south. This would also include the met mast and short sections of access tracks. Magnitude of effect is **Substantial**.	Scenario 2 sites would be visible to the east including Twentyshilling Hill and Lorg, to the south east including Glenshimmeroch, Knockman Hill, Troston Loch Sandy Knowe, Sanquhar Six, and Troston Loch. To the south west lies the two-turbine scheme of Torrs Hill in the foreground of the Rhinns of Kells. The Proposed Development would be viewed in the foreground of the view, separate from the operational and consented sites and close. Cumulative magnitude of effect would be **Substantial**. Scenario 3 application sites would result in an increase of turbines to the east including Euchanhead, Sanquhar II, Cornharrow, Shepherds Rig and Fell. The Proposed Development would be viewed within the foreground and extend turbines from the Shepherds Rig development closer to the viewpoint. Magnitude of effect is **Substantial**.	**Major (significant)**	**Major (significant)**	**Major (significant)** for Scenarios 2 and 3.
5	**Alhang**	**High**	During construction, visibility of activities associated with the installation of 5 turbines would be seen below the viewpoint location. Magnitude of effect would be **Slight**.	5 turbines would be viewed below this viewpoint occupying a small part of the overall view with the remainder of turbines being screened by foreground landform. Turbines would be backclothed by Glenkens and distant foothills. A combination of forestry and landform would screen the supporting infrastructure. Magnitude of effect is **Slight**.	Several consented sites (Scenario 2) would be visible from this viewpoint. Including close views of Afton, Windy Rig and Lorg. The Proposed Development would increase the presence of turbines successively although as noted in Scenario 1, this would occupy a small part of the view and largely be screened by landform. Resulting in no change to the Scenario 1 assessment. The addition of application sites would result in Shepherds Rig being viewed to the south west and Euchanhead to the north east. The introduction of the Proposed Development would result in a very slight increase in horizontal extent of turbines which would be viewed as part of Shepherds Rig. This would increase magnitude of effect to **Moderate** for Scenario 3.	Moderate (not significant) on account of the limited extent of the Proposed Development visible.	Moderate (not significant) on account of the limited extent of the Proposed Development visible.	Moderate (not significant) for Scenario 2. **Moderate (significant)** for Scenario 3 due to extending turbine development in views alongside Shepherds Rig.
6	**Benbrack**	**High**	During construction, activities associated with the installation of all 14 turbines would be seen. Magnitude of effect would be **Slight**.	14 turbines (11 hubs) would be visible 7.5km away adjacent to Cairnsmore of Carsphairn. This would include the met mast with a combination of landform and forestry screening views of the substation and access tracks. Magnitude of effect would be **Slight**.	The addition of the Scenario 2 developments would lead to further concentration of turbines closer to operational wind farms. The addition of the Proposed Development would result in turbines being viewed on the other side of Cairnsmore of Carsphairn in an area currently unaffected. This would result in a **Slight** magnitude of effect. Scenario 3 would be similar to Scenario 2, the exception being Shepherds Rig which would extend turbines to the other side of Cairnsmore of Carsphairn. The Proposed Development would appear beyond the Shepherds Rig development and increase the horizontal extent of turbines in the view and would appear as one overall development. Magnitude of effect would be **Moderate**.	**Moderate (significant)** due to increasing turbines to an area currently unaffected.	**Moderate (significant)** due to increasing turbines to an area currently unaffected.	**Moderate (significant)** for Scenario 2. **Major-moderate (significant)** for Scenario 3 on account of turbines being viewed in combination with Shepherds Rig.

VP No.	Viewpoint Name	Visual Magnitude of Effect				Level of Visual Effects		
		Sensitivity	During Construction (Scenario 1)	During Operation (Scenario 1)	Cumulative Magnitude of Change	During Construction (Scenario 1)	During Operation (Scenario 1)	Cumulative Assessment
7	**Southern Upland Way (North East of Stroanfreggan)**	**High**	During construction, activities associated with the installation of blades on 7 turbines would be seen with the remainder being screened by landform. Magnitude of effect would be **Slight**.	The blades of 7 turbines would be visible with the remainder being screened by landform. Magnitude of effect is **Slight**.	There would be limited change when considering the Scenario 2 baseline due to the Proposed Development largely being screened. Scenario 3 baseline would result in Shepherds Rig being viewed in combination with the Proposed Development but would be more prominent above the foreground ridgeline. The blades of 7 turbines from the Proposed Development would appear as part of Shepherds Rig. Magnitude of effect would remain as **Slight**.	Moderate (not significant) due to the very small part of the Proposed Development visible.	Moderate (not significant) due to the very small part of the Proposed Development visible.	Moderate (not significant) due to the very small part of the Proposed Development visible for both scenarios.
8	**B729 Road (South East of Carsphairn)**	**High-medium**	Obtains close views of turbine installation with some partial screening occurring from foreground roadside vegetation. Magnitude of effect is **Substantial**	Turbines would be very close to this viewpoint with foreground forestry and woodland providing some screening, which over time will increase as the tree crop matures. Nevertheless, the turbines would be visible from this location. Magnitude of effect would be **Substantial**.	Limited views of Scenario 2 and 3 baseline developments from this location resulting in no change to the assessment of Scenario 1..	**Major (significant)**	**Major (significant)**	**Major (significant)** for Scenarios 2 and 3.
9	**Minor Road between A713 and B729**	**High-medium**	During construction, activities associated with the installation of all 14 turbines would be seen. Magnitude of effect would be **Substantial**.	All 14 of the proposed turbines would be visible from this location at 2.2 km. This would include the met mast although the substation and access tracks would be screened from view by foreground forestry. Turbines would be viewed in the foreground of Cairnsmore of Carsphairn. Magnitude of effect is **Substantial**.	Views of consented sites would be limited to Troston Loch and Glenshimmeroch to the east. Both sites would mainly be screened by forestry. Four turbines of Shepherds Rig would break the skyline to the north east mainly comprising blades due to screening from forestry. Cumulative magnitude of effect would remain as **Substantial**.	**Major (significant)**	**Major (significant)**	**Major (significant)** for Scenarios 2 and 3.
10	**Cairn Avel**	**High**	During construction, activities associated with the installation of all 14 turbines would be seen. Magnitude of effect would be **Substantial**.	All 14 of the proposed turbines would be visible at 2.7 km from this location, 2 of which would be partially screened by landform. This would include the met mast although the substation and access tracks would be screened partially from view by mitigation planting and forestry as it establishes. Magnitude of effect is **Substantial**.	Views of consented sites would be limited to Troston Loch and Glenshimmeroch to the east, and Benbrack, Enoch Hill and Windy Standard III to the north. Scenario 3 baseline would lead to views of Shepherds Rig in the mid-ground. The Proposed Development would increase the presence of turbines viewed from this location extending the development closer to the viewpoint location whilst appearing as one wind farm in combination with Shepherds Rig. Magnitude of effect for both scenarios would be **Substantial**.	**Major (significant)**	**Major (significant)**	**Major (significant)** for Scenarios 2 and 3.
11	**Corserine (Scar of Folk)**	**High**	The installation of all 14 turbines would be visible on the lower slopes of Cairnsmore of Carsphairn. Magnitude of effect is **Slight**.	All 14 turbines would be visible during operation in front of Cairnsmore of Carsphairn at 10.3 km. 5 aviation lights would be visible from this viewpoint at light intensities of 200 ca (clear visibility) but at a distance of 10.2 km appearing as faint red lights above Carsphairn. Magnitude of effect is **Slight**.	Scenario 2 sites would lead to a larger concentration of wind turbines beyond Cairnsmore of Carsphairn when viewed alongside the operational sites of Scenario 1. The Proposed Development would extend turbines to the foreground of Cairnsmore of Carsphairn Magnitude of effect for Scenario 2 is **Slight**. Scenario 3 would also increase the number of turbines viewed beyond Cairnsmore of Carsphairn leading to a continuous line of turbines. Shepherds	**Moderate (significant)** due to introducing turbines into an area currently unaffected.	**Moderate (significant)** due to introducing turbines into an area currently unaffected.	**Moderate (significant)** for Scenario 2, increasing to **Major-moderate (significant**) for Scenario 3 on account of the Proposed Development being located adjacent to Shepherds Rig increasing the horizontal extent of turbines.

VP No.	Viewpoint Name	Sensitivity	Visual Magnitude of Effect			Level of Visual Effects		
			During Construction (Scenario 1)	During Operation (Scenario 1)	Cumulative Magnitude of Change	During Construction (Scenario 1)	During Operation (Scenario 1)	Cumulative Assessment
					Rig would extend turbines from Wether Hill creating a line to the south of Cairnsmore of Carsphairn. The introduction of the Proposed Development would further increase the spread of turbines in the foreground of the mountain. Magnitude of effect would be **Moderate**.			
12	**Meikle Millyea**	**High**	The installation of all 14 turbines would be visible on the lower slopes of Cairnsmore of Carsphairn. Magnitude of effect is **Slight**.	All 14 turbines would be visible during operation in front of Cairnsmore of Carsphairn at 12.7 km. Magnitude of effect is **Slight**.	Scenario 2 sites would lead to a larger concentration of wind turbines beyond Cairnsmore of Carsphairn when viewed alongside the operational sites of Scenario 1. The Proposed Development would extend turbines to the foreground of Cairnsmore of Carsphairn Magnitude of change is **Slight**. Scenario 3 would also increase the number of turbines viewed beyond Cairnsmore of Carsphairn leading to a continuous line of turbines. Shepherds Rig would extend turbines from Wether Hill towards Cairnsmore of Carsphairn. The introduction of the Proposed Development would further increase the spread of turbines in the foreground of the mountain. Magnitude of effect would be **Moderate**.	**Moderate (significant)** due to introducing turbines into an area currently unaffected.	**Moderate (significant)** due to introducing turbines into an area currently unaffected.	**Moderate (significant)** for Scenario 2, increasing to **Major-moderate (significant**) for Scenario 3 on account of the Proposed Development being located adjacent to Shepherds Rig increasing the horizontal extent of turbines.
13	**Dundeugh**	**High**	The installation of all 14 turbines would be visible on the lower slopes of Cairnsmore of Carsphairn. Magnitude of effect is **Substantial**.	All 14 turbines would be visible during operation in front of Cairnsmore of Carsphairn at 3.3 km. Magnitude of effect is **Substantial**.	Several consented schemes would be visible from this viewpoint including Benbrack to the north, Troston Loch, Glenshimmeroch and Lorg to the east. For Scenario 3 baseline, the Proposed Development would be viewed alongside Shepherds Rig Wind Farm with both sites appearing as one large wind farm across a wide horizonal extent, as well as Euchanhead, Sanquhar II and Cornharrow to the east which are set further back. Magnitude of effect for both Scenarios would be **Substantial**.	**Major (significant)**	**Major (significant)**	**Major (significant)** for Scenarios 2 and 3.
14	**Stroanfreggan Cairn**	**High**	During construction, visibility of activities associated with the installation of 8 turbines (two turbines at tip height) would be seen with the remaining turbines being screened by landform. Magnitude of effect would be **Slight**.	6 turbines would be viewed at 3.8 km with the remainder of turbines being screened by foreground landform and forestry. A combination of forestry and landform would screen the supporting infrastructure. Magnitude of effect is **Slight**.	Scenario 2 developments are mainly screened from this location with the blade tips of Troston Loch and some Glenshimmeroch turbines being visible to the east. The Scenario 3 baseline would lead to Shepherds Rig Wind Farm seen within the foreground of the Proposed Development. The Proposed Development would be viewed within the horizontal extent of Shepherds Rig and would appear as one development with a very slight increase in concentration of turbines. Magnitude of effect would be **Slight** for both scenarios	**Moderate (significant)** due to the distance involved and screening by landform	**Moderate (significant)** due to the distance involved and screening by landform	**Moderate (significant)** due to the distance involved and screening by landform
15	**B7000 Road (South of High Bridge of Ken)**	**Medium**	The installation of all 14 turbines would be visible on the lower slopes of Cairnsmore of Carsphairn. Magnitude of effect is **Substantial**.	All 14 turbines would be visible during operation in front of Cairnsmore of Carsphairn at 3.3 km. Magnitude of effect is **Substantial**.	The consented sites (Scenario 2) of Benbrack to the north, Lorg, Troston Loch and Glenshimmeroch would break the skyline to the east, and Torrs Hill would be visible to the south west. The proposed turbines would be more prominent and viewed within the foreground of the more distant Benbrack scheme. Scenario 3 schemes would result in further sites being visible to the north east including Shepherds Rig in the foreground at a similar distance to the Proposed Development, and beyond	**Major (significant)**	**Major (significant)**	**Major (significant)** for Scenarios 2 and 3.

VP No.	Viewpoint Name	Sensitivity	Visual Magnitude of Effect			Level of Visual Effects		
			During Construction (Scenario 1)	During Operation (Scenario 1)	Cumulative Magnitude of Change	During Construction (Scenario 1)	During Operation (Scenario 1)	Cumulative Assessment
					Sanquhar II, Euchanhead and Cornharrow. The addition of the Proposed Development would extend turbines across Glenkens. Cumulative magnitude of effect for both scenarios is **Substantial**.			
16	**Black Hill**	**High**	The installation of all 12 turbines would be visible on the lower slopes of Cairnsmore of Carsphairn. Magnitude of effect is **Slight**.	The Proposed Development would be viewed below this viewpoint to the west of Cairnsmore of Carsphairn and backclothed by the distant hills. This would be viewed at a distance of 8.9 km where 12 turbines would be visible (10 hubs). Magnitude of effect would be **Slight**.	This viewpoint would receive close views of Lorg wind farm to the north with the remaining consented sites of Twentyshilling, Pencloe, Enoch Hill, Windy Standard III and Torrs Hill being partially visible above the horizon the introduction of the Proposed Development to this baseline would increase turbine development further to the west where the Proposed Development would appear as a standalone development. Scenario 3 schemes would result in a large increase in turbines viewed from this location. This would include Shepherds Rig to the west which would be situated in the foreground of the Proposed Development. Elsewhere, Euchanhead and Sanquhar Six would be prominent in views to the north. The Proposed Development would lead to a higher number of turbines appearing alongside Shepherds Rig where both developments would appear as one with a slight increase in horizontal extent. Cumulative magnitude of effect would be **Slight**.	Moderate (not significant) due to distance and partial screening of the Proposed Development.	Moderate (not significant) due to distance and partial screening of the Proposed Development.	Moderate (not significant) for Scenario 2 and 3.
17	**A762 Road (North of New Galloway)**	**Medium**	Construction activities would be partially screened from this location by intervening woodland. Magnitude of effect would be **Slight.**	During operation, the proposed turbines would be partially screened by vegetation and viewed at a distance of 14.2 km. Magnitude of effect would be **Slight**.	Several consented sites would be visible on either side of Cairnsmore of Carsphairn breaking the horizon. These include Benbrack and Windy Standard III, and Lorg, Glenshimmeroch and Troston Loch to the north east. The addition of the Proposed Development to this baseline would extend turbines across the front of Cairnsmore of Carsphairn in front of the Scenario 2 developments which are not as prominent. Scenario 3 sites would add Shepherds Rig (in front of Windy Standard) and Euchanhead and Sanquhar to the north east (all partially screened by landform). Magnitude of change would remain as Scenario 1 of **Slight**, due to partial screening and distances involved.	Minor (not significant)	Minor (not significant)	Minor (not significant) for both cumulative scenarios.
18	**A713 Road (South of Carsphairn)**	**High-medium**	The installation of all 14 turbines would be visible on the lower slopes of Cairnsmore of Carsphairn. Magnitude of effect is **Substantial**.	All 14 turbines would be visible during operation in front of Cairnsmore of Carsphairn at 3.3 km. Magnitude of effect is **Substantial**.	Limited views of Scenario 2 baseline developments from this location. Scenario 3 would result in Shepherds Rig being visible in combination with the Proposed Development which would extend turbines in south east of Cairnsmore of Carsphairn massif. Magnitude of effect would be **Substantial**.	**Major (significant)**	**Major (significant)**	**Major (significant)** for cumulative Scenarios 2 and 3.
19	**A713 Road (North of Carsphairn)**	**High-medium**	Obtains close views of 6 turbines during installation with some partial screening occurring from roadside vegetation. Magnitude of effect is **Substantial**	Turbines would be very close to this viewpoint with foreground vegetation providing some screening. Nevertheless, 4 turbines would be prominent from this location at hub height and a further 2 blade tips would	Limited views of Scenario2 and 3 developments from this location due to screening by landform.	**Major (significant)**	**Major (significant)**	**Major (significant)** for Scenarios 2 and 3.

VP No.	Viewpoint Name	Sensitivity	Visual Magnitude of Effect			Level of Visual Effects		
			During Construction (Scenario 1)	During Operation (Scenario 1)	Cumulative Magnitude of Change	During Construction (Scenario 1)	During Operation (Scenario 1)	Cumulative Assessment
				be visible. Magnitude of effect would be **Substantial**.				
20	**Black Shoulder**	**High**	During construction, activities associated with the installation of all 14 turbines would be seen. Magnitude of effect would be **Substantial**.	14 turbines (12 at hubs) would be viewed below this viewpoint Turbines would be backclothed by Glenkens and close at 1.5 km to the south. This would also include the met mast and short sections of access tracks. Magnitude of effect is **Substantial**.	Several consented sites (Scenario 2) would be visible from this viewpoint. The majority of these would occur to the east including, Twentyshilling Hill and Lorg, and to the south east including Glenshimmeroch, Knockman Hill, Troston Loch Sandy Knowe, Sanquhar Six, and Troston Loch. To the south west lies the two-turbine scheme of Torrs Hill in the foreground of the Rhinns of Kells. The Proposed Development would be viewed in the foreground of the view, separate from the operational and consented sites and close. Cumulative magnitude of change would be **Substantial**. Scenario 3 application sites would result in an increase of turbines to the east including Euchanhead, Sanquhar II, Cornharrow, Shepherds Rig and Fell. The Proposed Development would be viewed within the foreground and extend turbines from the Shepherds Rig development closer to the viewpoint. Magnitude of effect is **Substantial**.	**Major (significant)**	**Major (significant)**	**Major (significant)** for Scenarios 2 and 3.
21	**Manquhill Hill**	**High**	During construction 14 turbines would be visible during their installation in views towards Upper Glenkens. Magnitude of effect would be **Substantial**.	Turbines would be visible within the midground beyond the foreground forestry plantations and west of the Cairnsmore of Carsphairn massif. 14 turbines would be visible with some screening occurring from Knockwhirn. Views would also include short sections of access track substation although over time these will be fully or partially screened by the recently consented forestry plantations within the Proposed Development. 4 aviation lights would be directly visible from this viewpoint at light intensities of 200 ca (clear visibility at a distance of 5.1 km. Magnitude of effect would be **Substantial**.	Scenario 2 baseline sites are partially screened from this location but can be viewed breaking the horizon. These include Sanquhar Six, Lorg to the north east, and Troston Loch, Glenshimmeroch and Knockman to the south. Scenario 3 baseline would result in Shepherds Rig being visible in front of the Proposed Development, the latter would not extend the horizontal extent of turbines and would appear a one overall development increasing the concentration of turbines. Magnitude of effect would be **Substantial**.	**Major-moderate (significant)**	**Major-moderate (significant)**	**Major (significant)** for Scenarios 2 and 3.
22	**Maiden's Hill**	**High**	During construction, the majority of the turbines would be partially or fully screened by foreground landform and would be visible at a distance of 17.3 km as the blades were installed. Magnitude of effect would be **Slight**.	During operation, 2 hubs and the blade tips of 11 turbine blade tips would be just visible above the foreground ridgeline. Magnitude of effect would be **Slight**.	Scenario 2 would result in further concentration of turbines around Windy Standard which the Proposed Development would be separate from. Scenario 3 developments would result in Shepherds Rig infilling a gap between operational and consented developments. The Proposed Development would be viewed alongside Shepherds Rig but largely screened. Magnitude of effect would be **Slight**.	Moderate (not significant) due to screening and distance.	Moderate (not significant) due to screening and distance.	Moderate (not significant) due to screening and distance.
23	**Darnaw (Memorial)**	**High**	Construction activities would be limited to distant views of blades	During operation, the Proposed Development would be partially	Scenario 2 developments are located further to the north east and the Proposed Development would not	Minor (not significant) due to screening and distance.	Minor (not significant) due to screening and distance.	Minor (not significant) due to screening and distance.

VP No.	Viewpoint Name	Sensitivity	Visual Magnitude of Effect			Level of Visual Effects		
			During Construction (Scenario 1)	During Operation (Scenario 1)	Cumulative Magnitude of Change	During Construction (Scenario 1)	During Operation (Scenario 1)	Cumulative Assessment
			being installed but would be influenced by a combination of screening from landform and vegetation and distant. Magnitude of effect would be **Slight**.	screened by a combination of screening from landform and vegetation, and distant. Magnitude of effect would be **Slight**.	increase the concentration or size of these clusters, forming a standalone development. Scenario 3 would result in a further concentration of turbines to the east of Cairnsmore of Carsphairn in the form of Shepherds Rig and Euchanhead. The Proposed Development would be seen in the foreground of these developments but partially screened at a lower elevation. Magnitude of effect would be **Slight**.			
24	**Culmark Hill**	**High**	During construction activities would be limited to the installation of 14 turbines although these would be partially screened by landform. Magnitude of effect would be **Moderate**.	During operation, 14 turbines would be visible viewed in front of the Cairnsmore of Carsphairn massif but partially screened by foreground forestry. Magnitude of effect would be **Moderate**.	Cumulative effects would occur due to the addition of the Proposed Development to the Scenario 3 baseline. This would extend turbines across the landscape increasing the horizontal spread from Shepherds Rig. Magnitude of effect would be **Moderate**.	**Major-moderate (significant)** due to proximity.	**Major-moderate (significant)** due to proximity.	**Major (significant)** due to proximity to Shepherds Rig.
25	**Coran of Portmark**	**High**	The installation of all 14 turbines would be visible on the lower slopes of Cairnsmore of Carsphairn. Magnitude of effect is **Moderate.**	During operation, 14 turbines would be visible viewed on the lower slopes of Cairnsmore of Carsphairn massif. Magnitude of effect would be **Moderate**.	Scenario 2 sites would lead to a larger concentration of wind turbines to the south east. The Proposed Development would extend turbines in the foreground of Cairnsmore of Carsphairn Magnitude of effect is **Moderate** for Scenario 2. Scenario 3 would also increase the number of turbines viewed beyond Cairnsmore of Carsphairn leading to a continuous cluster of turbines. Shepherds Rig would extend turbines from Wether Hill towards Cairnsmore of Carsphairn. The introduction of the Proposed Development would further increase the spread of turbines in the foreground of the mountain. Magnitude of effect would be **Moderate**.	**Major-moderate (significant)** due to proximity.	**Major-moderate (significant)** due to proximity.	**Major (significant)** due to proximity to Shepherds Rig.

Effects on Residential Receptors

5.12.4 There are eighteen scattered properties/groups within 2 km of the proposed turbines, the assessment of these properties is set out in Volume 3: Appendix 5.5. These are located to the south of the Proposed Development close to the A713 and B729 roads.

5.12.5 The sensitivity of each property is judged to be **High** as residential receptors represent **High** value receptors with a **High** susceptibility to visual change owing to their fixed position. The visibility of the Proposed Development includes visibility from the property and its curtilage and immediate parts of the access road/drive way to each property.

5.12.6 **Significant** visual effects have been predicted for seventeen properties/groups ranging between **Major** and **Major/moderate** due to their proximity and open views towards the proposed turbines and effects associated with aviation lighting. However, none have been identified to be affected to such a degree that they would become '*widely regarded as an unattractive place where to live and/or the development is inescapably dominant or unpleasantly overwhelming'*, the test applied by many Reporters when considering residential visual amenity. This is due to the partial screening that occurs as a result of adjacent woodland and landform which reduces the vertical extent of the turbines visible from each property. One property, Marscalloch Cottage is not predicted to receive a view on account of forestry being located on the western boundary of the property which would provide screening.

5.12.7 One settlement, Carsphairn was also assessed. The ZTV predicts that theoretical visibility of the proposed turbines would be widespread within the village. However, screening from garden vegetation and from adjacent properties would reduce this to parts of the eastern side of the village where oblique to side-on views would be experienced. From this area, a **Substantial** magnitude of effect would occur resulting in a **Major (significant)** effect. Elsewhere in the village, the degree of screening would reduce effects to non-significant levels and the Proposed Development would not be viewed within the main orientation of view which is north to south.

Effects on Sequential Routes

A713 road

5.12.8 The ZTV indicates theoretical visibility for approximately 3 km to the east of Loch Ken, this this is predicted to be seen at a distances of 1.1 – 45 km and would be influenced by intervening woodland and landform. From St John's Town of Dalry, extending north west to south west of Lamford Hill, theoretical visibility is predicted to be widespread. The Proposed Development would form a prominent feature in views between Dundeugh Hill and to north west of Carsphairn where close views would be experienced. albeit with some partial screening from roadside vegetation. To the north of Carsphairn, turbines would be visible when travelling southwards but the extent would be reduced by landform screening. To the south of Dundeugh Hill, intervening woodland would

provide some partial screening in views when heading north from St John's Town of Dalry. Magnitude of effect is predicted to be **Moderate** reducing to **Slight** and **Negligible** levels as distance and influence of woodland increases. This would result in a localised **Major-moderate** (**significant**) effect for the section directly to the south of the Proposed Development; thereafter, reducing to non-significant levels of **Moderate** and **Minor** (not significant).

5.12.9 Several Scenario 2 and Scenario 3 sites are visible from this road although they are set further back from Glenkens and have less of an influence on views. The Scenario 3 Shepherds Rig development would be prominent for a short section of the road between Carsphairn extending southwards to approximately Dalshangan. The introduction of the Proposed Development to this scenario would result in both schemes being viewed as one wind farm with the proposed turbines extending the view of turbines closer to Carsphairn. As a result of this, there would be an increase in the cumulative magnitude of change to **Substantial** resulting in a **Major** (significant) effect.

5.12.10 Aviation lighting would be limited to short sections at Brockloch and extending between Carsphairn and Dundeugh Hill where lighting intensities would be between 4-1 ca. Magnitude of change would be **Slight** on account of the limited section of the road affected and reduced intensity experienced combined with travelling at speed. This would result in a **Moderate** (not significant) effect.

B729 road

5.12.11 The ZTV shows that the road would receive widespread theoretical visibility of the Proposed Development from Mascalloch Wood to the junction with the A713 road. From this section, close views of turbines would be experienced with some screening occurring from roadside vegetation. Beyond Marscalloch Hill to the east, theoretical visibility of 1-3 turbines is predicted, rising to 10-12 at Stroanfreggan, and 13-14 as the road crosses Fingland Hill. Forestry on Marscalloch Hill would reduce the extent of visibility from the road although turbines would be visible when travelling westwards across Fingland Hill where open views can be obtained. Magnitude of effect would be **Moderate** between Marscalloch Wood to Carsphairn, reducing to **Slight** further to the east on account of screening from adjacent forestry and distance. This would result in a **Major-moderate** (**significant**) effect for a short section of the western extent of the road, reducing to **Moderate** and **Mino**r (not significant) levels thereafter.

5.12.12 Views of Scenario 2 sites would be limited due to screening from adjacent landform. Scenario 3 sites would also be similar, the exception being Shepherds Rig which would be viewed for sections above the tree line near Marscalloch Hill. The addition of the Proposed Development would extend turbines and be more visible from sections of the road which would experience close views. Magnitude of effect would be **Moderate** between Marscalloch Wood to Carsphairn, reducing to **Slight** further to the east on account of screening from adjacent forestry. This would result in a **Major** (**significant**) effect for a short section of the western extent of the road, reducing to **Moderate** and **Minor** (not significant) levels thereafter.

5.12.13 Aviation lighting would be visible between Carsphairn and Marscalloch Forest where lighting intensities would be between 4-1 ca. Magnitude of effect would be **Slight** on account of the limited section of the road affected and reduced intensity experienced. This would result in a **Moderate** (not significant) effect.

Southern Upland Way

5.12.14 The ZTV shows that theoretical visibility would be limited across both stages of the SUW as shown on Volume 2b: Figure 5.8d. A short section of the route is predicted to receive theoretical visibility as it passes through St John's Town of Dalry. This is predicted to be 1-14 turbines at a distance of 13.7 km, intervening screening from woodland would reduce visibility in reality. The main section predicted to experience theoretical visibility would be to the east of Glen Lorg where 1-14 turbines would be visible to the west depending on elevation and foreground landform. Viewpoints 7, 14 and 24 illustrate the different views obtained from the road. To the north east, theoretical visibility of 1-6 turbines is predicted at a distance of 13.3 km.

5.12.15 Magnitude of effect is predicted to be **Moderate** for the section to the east of Glen Lorg, thereafter, reducing to **Slight** and **Negligible** levels due to screening from landform and forestry as well as the distances involved from the Proposed Development. This would result in a **Major-moderate (significant)** effect for the section to the east of Glen Lorg, reducing to **Moderate**, **Minor** and **Negligible** levels (not significant) elsewhere.

5.12.16 The SUW would experience close views of Scenario 2 and 3 sites which would be more prominent than operational sites within the locality due to their proximity to the walking route. The addition of the Proposed Development to this baseline would result in an extension of turbines to the west, which would be a standalone development for Scenario 2, and appear as one development along with Shepherds Rig for Scenario 3. Magnitude of change would increase to **Substantial** for Scenario 3 resulting in a **Major (significant)** effect.

5.12.17 Aviation lights would be viewed from intermittently along the SUW within the study area. This would be seen in the context of lights within Glenkens. The ZTV predicts the highest intensities of 75 – 1 ca (clear visibility). All five aviation lights would be visible, and magnitude of change would be **Slight**, resulting in a **Moderate** (not significant) effect. This would be due to only five lights being visible at various distances where the intensity would reduce with distance.

Scottish Hill Track 76: Bargrennan to Polharrow

5.12.18 The ZTV indicates that theoretical visibility of the Proposed Development would be limited on this route within 15km occurring intermittently at Polharrow, the eastern slopes of Stranfasket Hill, covering forestry on Bennan Hill and at Sabbed Craigs. This would be seen at distances of 8.7 – 13.3 km of 1-14 turbines depending on elevation. Magnitude of effect would be **Slight** resulting in a **Moderate** not significant) effect.

5.12.19 Scenario 2 sites would lead to a larger concentration of wind turbines to the north east and south east but further back from this footpath. Scenario 3 would also increase the number of turbines viewed beyond Cairnsmore of Carsphairn leading to a continuous line of turbines. Shepherds Rig would extend turbines from Wether Hill towards Cairnsmore of Carsphairn. The introduction of the Proposed Development would further increase the spread of turbines in the foreground of the mountain. Magnitude of effect would be **Slight** for Scenarios 2 and 3 due to the small section of the route affected by the Proposed Development. This would result in a **Moderate** (not significant) cumulative effect.

5.12.20 Visibility of aviation lights would be experienced from a very short section of the path at distances of 8.7 – 13.3 km. Intensities would vary depending on elevation with the highest sections predicted to be 200 ca (clear visibility) although distance would reduce this intensity. Elsewhere, intensities are predicted to be between 75 – 1 ca (clear visibility) of all five aviation lights. Magnitude of effect would be **Slight**, resulting in a **Moderate** (not significant) effect. This would be due to only five lights being visible at various distances where the intensity would reduce with distance.

Scottish Hill Track 77: Bargrennan to Carsphairn or Dalmellington

5.12.21 The ZTV shows theoretical visibility of the Proposed Development for a short section to the west of Loch Doon where 1-12 turbines would be visible. Thereafter, theoretical visibility would be limited to a section of the path extending directly to the west towards the Rhinns of Kells where 1-14 turbines would be visible for approximately 12 km as far as Corserine.

5.12.22 The proposed turbines would be a prominent feature to the west of Carsphairn appearing in the foreground of the Cairnsmore of Carsphairn massif. As the distance and elevation increases, the proposed turbines would be back clothed and viewed in a larger-scale landscape reducing their prominence. Magnitude of effect is predicted to be

Moderate reducing to **Slight** levels as the distance increases. This would result in a **Major-moderate** (**significant**) effect reducing to **Minor** (not significant) levels as distance increases. This would be long-term and reversible.

5.12.23 Scenario 2 sites would lead to a larger concentration of wind turbines to the north east and south east but set back from this footpath. Scenario 3 would also increase the number of turbines viewed beyond Cairnsmore of Carsphairn leading to a continuous line of turbines. Shepherds Rig would extend turbines from Wether Hill towards Cairnsmore of Carsphairn. The introduction of the Proposed Development would further increase the spread of turbines in the foreground of the mountain. Magnitude of effect would be **Moderate** reducing to **Slight** as the distance increases from the Proposed Development. This would result in a **Major-moderate** (significant) effect for Scenario 3.

5.12.24 Aviation lights would be visible from a section of the path extending between the A713 road and Corserine on the Rhinns of Kells. Intensities would vary depending on elevation and as the footpath crosses the Rhinns of Kells where 200 (clear visibility) being experienced at a distance of 7.4 km where intensity would reduce with distance. Elsewhere, intensities are predicted to be between 750 – 10 (poor visibility) and 75 – 1 ca (clear visibility) of all five aviation lights. Magnitude of effect would be **Slight**, resulting in a **Moderate** (not significant) effect. This would be due to only five lights being visible at various distances where the intensity would reduce with distance.

Scottish Hill Track 80: Barr to Carsphairn

5.12.25 Within 15 km, the ZTV shows that theoretical visibility of 1-14turbines would occur extending from the A713, westwards to Bow located to the south of Coran of Portmark. From this section of track, the proposed turbines would be prominent from Upper Glenkens in views towards the Cairnsmore of Carsphairn massif. As distance and elevation increases, their prominence would reduce in views on account of the landscape becoming larger in scale.

5.12.26 Magnitude of effect is predicted to be **Moderate** reducing to **Slight** levels as the distance increases. This would result in a **Major-moderate** (**significant**) effect reducing to **Moderate** (not significant) levels as distance increases.

5.12.27 Scenario 2 sites would lead to a larger concentration of wind turbines to the north east and south east but set further back from this footpath. Scenario 3 would also increase the number of turbines viewed beyond Cairnsmore of Carsphairn leading to a continuous line of turbines. Shepherds Rig would extend turbines from Wether Hill towards Cairnsmore of Carsphairn. The introduction of the Proposed Development would further increase the spread of turbines in the foreground of the mountain. Magnitude of effect would be **Moderate** reducing to **Slight** as the distance increases from the Proposed Development. This would result in a **Major-moderate** (significant) effect for Scenario 3.

5.12.28 Aviation lights would be visible from a section of the path extending between the A713 road and the Bow to the south of Coran of Portmark on the Rhinns of Kells. Intensities would vary depending on elevation as the footpath crosses the Rhinns of Kells where 200 (clear visibility) being experienced at a distance of 7.4 km where intensity would reduce with distance. Elsewhere, intensities are predicted to be between 75 – 1 ca (clear visibility) of all five aviation lights. Magnitude of effect would be **Slight**, resulting in a **Moderate** (not significant) effect. This would be due to only five lights being visible at various distances where the intensity would reduce with distance.

Scottish Hill Track 84: New Cumnock to St John's Town of Dalry

5.12.29 This route follows the SUW north from St John's Town of Dalry and the ZTV predicts theoretical visibility of the Proposed Development as the footpath crosses elevated ground. This would generally occur on open land as the track heads north from the SUW at Viewpoint 7 and passes through forestry on Auchrae Hill, before emerging at Strahanna in Glen Lorg. Continuing northwards, 1-6 turbines are predicted to be visible as well as on the summit of Alhang, see Viewpoint 5. Magnitude of effect would be **Moderate** for a short section of the track as it passes over the Round Craigs from the SUW, reducing to **Slight** and **Negligible** levels. This would result in a **Major-moderate** effect for a short section close to the SUW, reducing to **Moderate** and **Minor** (not significant) levels due to a combination of screening from topography, forestry, and the small extent of the overall development visible.

5.12.30 This track would experience close views of Scenario 2 and 3 sites which would be more prominent than operational sites within the locality due to their proximity to the walking route. The addition of the Proposed Development to this baseline would result in an extension of turbines to the west, which would be a standalone development for Scenario 2, and appear as one development along with Shepherds Rig for Scenario 3. Magnitude of effect would increase to **Substantial** for Scenario 3 resulting in a **Major (significant)** effect.

5.12.31 Aviation lights would be viewed from intermittently along the track within the study area. This would be seen in the context of lights within Glenkens. The ZTV predicts the highest intensities of 75 – 1 ca (clear visibility). All five aviation lights would be visible, and magnitude of effect would be **Slight**, resulting in a **Moderate** (not significant) effect. This would be due to only five lights being visible at various distances where the intensity would reduce with distance.

Polmaddy Pack Road Heritage Trail

5.12.32 The ZTV indicates widespread theoretical visibility of the Proposed Development extending from the A713 road westwards, then south east towards Bardennoch Hill. Thereafter, limited to a short section of track east of Braidenoch with the remainder being predicted in an area of forestry on Barlae Hill as far as Dundeugh. This section visibility would be limited by forestry if the tree crop is present. Magnitude of effect is predicted to be **Moderate** reducing to **Slight** levels as the distance increases. This would result in a **Major-moderate** (**significant**) effect reducing to **Minor** (not significant) levels as distance increases.

5.12.33 Scenario 2 sites would lead to a larger concentration of wind turbines to the north east and south east but further back from this footpath. Scenario 3 Shepherds Rig would increase the number of turbines viewed in front of Cairnsmore of Carsphairn. The introduction of the Proposed Development would further increase the spread of turbines in the foreground of the mountain. Magnitude of effect would be **Moderate** reducing to **Slight** as the distance increases from the Proposed Development. This would result in a **Major-moderate** (**significant**) effect for Scenario 3.

5.12.34 Visibility of aviation lights would be visible from a section leading from the A713 road to forestry south east of Bardennoch Hill. Intensities would vary depending on elevation between 750 – 40 ca (poor visibility) and 50-40 (clear visibility) being experienced at 1.6 – 3.8 km. Magnitude of change would be **Slight**, resulting in a **Moderate** (not significant) effect. This would be due to only five lights being visible at various distances where the intensity would reduce with distance.

Sanquhar to Stroanpatrick Heritage Path

5.12.35 This route is predicted to receive theoretical visibility in the vicinity of Stroanfreggan Cairn and as it crosses north from the SUW through forestry on Auchrae Hill of 12-14 turbines, before descending into Glen Lorg where 1-6 turbines are predicted to be visible. As the path passes around Altry Hill to the north 1-3 turbines are predicted although adjacent forestry would influence views from this section. Magnitude of change would be **Moderate** for a short section of this track, thereafter, **Negligible**. This would result in a **Major-moderate** (**significant**) effect reducing to **Minor** (not significant) levels as distance increases.

5.12.36 This track would experience close views of Scenario 2 and 3 sites which would be seen in proximity to operational sites. The addition of the Proposed Development to this baseline would result in an extension of turbines to the west, which would be a standalone development for Scenario 2, and appear as one development along with Shepherds Rig for Scenario 3. Magnitude of effect would increase to **Substantial** for Scenario 3 resulting in a **Major** (significant) effect for a short section of the track.

5.12.37 Aviation lights would be viewed from intermittently along the track within the study area. This would be seen in the context of lights within Glenkens. The ZTV predicts the intensities of 75 – 1 ca (clear visibility). All five aviation lights would be visible, and magnitude of effect would be **Slight**, resulting in a **Moderate** (not significant) effect. This would be due to only five lights being visible at various distances where the intensity would reduce with distance.

Core Paths with 5 km

5.12.38 The ZTV indicates that all of the Core Path would receive theoretical visibility of the Proposed Development. Magnitude of effect would be **Substantial** for CP182 which is located within the Proposed Development. Core Paths CP164 and CP16 would also experience close-up views towards the Proposed Development as they pass through Upper Glenkens resulting in a **Substantial** magnitude of effect and a **Major** (**significant**) effect.

5.12.39 CP487 which forms the main route towards the summit of Cairnsmore of Carsphairn would also receive theoretical visibility of 1-12 turbines to the east, reducing to 1-3 as higher ground to the east provides screening. Nevertheless, this route would experience close views during both construction and operation resulting in a **Moderate** magnitude of effect resulting in a **Major** (**significant**) effect.

5.12.40 CP504 covering the SUW is discussed previously in the assessment of the SUW of having a **Moderate** magnitude of effect and a **Major-moderate** effect (**significant**).

5.12.41 Core Path CP23 is predicted to receive theoretical visibility as it circumnavigates the northern side of Dundeugh Hill and from the summit as shown in Viewpoint 13. From here, the Proposed Development would be close and occasionally visible from gaps in tree cover resulting in a **Moderate** magnitude of effect and a **Major-moderate** (**significant effect**).

5.12.42 Core Path CP594 is not anticipated to receive an effect as long as the forestry is present.

5.12.43 Scenario 2 sites would be located further back from the Core Paths within 5 km and therefore have less of an influence on the baseline and would not result in an additional level of effect assessed for Scenario 1.

5.12.44 Scenario 3 sites would result in Shepherds Rig being located to the west of Glen Lorg. This development is likely to be prominent from the majority of Core Paths in 5 km. The addition of the Proposed Development would extend wind turbines and appear as one larger development rather than two separate schemes. Magnitude of effect would be **Substantial** resulting in a **Major** (**significant**) effect.

5.12.45 Visibility of aviation lights would be visible from sections of the Core Paths within 5 km varying between 750 – 10 ca (poor visibility) and 75-1 (clear visibility) Magnitude of effect would be **Slight**, resulting in a **Moderate** (not significant) effect. This would be due to only five lights being visible at various distances where the intensity would reduce with distance.

5.13 CONCLUSIONS

Landscape Fabric

5.13.1 The Proposed Development would be located within two LCTs as follows:

- LCT 160: Upper Dale – Dumfries & Galloway; and
- LCT 177: Southern Uplands – Dumfries & Galloway.

5.13.2 The construction and decommissioning stages of the Proposed Development would result in ground disturbance operations, track upgrades and new track/crane pad/hardstanding construction and decommissioning removal, construction of wind turbines and removal during decommissioning and general reinstatement works, together with vehicular/personnel movements on site. Such operations would result in direct effects on the landscape fabric of the development site area. This will include ground vegetation and soil removal and the introduction of new elements into the rough pasture/moorland context. It is considered the magnitude of effect on the landscape resource of the site would be **Substantial**, resulting from a large geographical area being affected and the major size and scale of proposed changes occurring over a short period of time. This results in a **Major** (**significant**) effect on the landscape resource of the Proposed Development area during the construction and decommissioning stages of the Proposed Development.

5.13.3 Following reinstatement post construction, the site area would enter the operational stage. The magnitude of effect on the landscape resource of the site would remain **Substantial**, resulting from the large geographical extent of the site area affected, the size and scale of proposed changes including the introduction of 14 vertical elements into the landscape which would be long-term, theoretical reversible nature of the changes. This is considered to result in a **Major (significant)** effect on the Proposed Development area during the operational stage of the Proposed Development.

Wider Landscape

5.13.4 Of the 51 LCTs identified within the 45 km study area, 7 were assessed in detail and a total of 5 LCTs predicted to receive significant effects as a result of the Proposed Development as follows:

- LCT 165: Upper Dale – Dumfries & Galloway;
- LCT 176: Foothills with Forest – Dumfries & Galloway;
- LCT 177: Southern Uplands – Dumfries & Galloway;
- LCT 178: Southern Uplands with Forest – Dumfries & Galloway; and
- LCT 180: Rugged Uplands – Dumfries & Galloway.

5.13.5 All of the above LCTs are predicted to receive localised **Major** or **Major-moderate** (**significant**) effects as a result of the Proposed Development. This is due to the small part of the overall LCT that would be affected within 8 km from the Proposed Development. This would result in a locally **Substantial** or **Moderate** magnitude of effect for **High** sensitivity receptors. Thereafter, potential effects would reduce as a result of distance, and screening from landform, woodland, and forestry.

5.13.6 Two LCTs were assessed as not receiving a significant effect due to the limited extent of the Proposed Development due to distance, screening from landform and forestry, and limited extent of theoretical visibility predicted.

Protected & Designated Landscapes

5.13.7 36 landscape designated were identified within the 45 km study area, of these 2 were taken forward to detailed assessment as follows:

- Galloway Hills RSA; and
- Loch Doon SLCA.

5.13.8 The Proposed Development would be located within the Galloway Hills RSA and it is predicted that the special qualities would be affected both directly and indirectly within the Proposed Development extending out to around 5 - 8 km. Magnitude of effect would be **Substantial** for a **High** sensitivity receptor resulting in a **Major** (**significant**) effect.

5.13.9 The Loch Doon SLCA was assessed as not receiving a significant effect due to a combination of distance and the small extent of the local designation affected.

Visual Amenity

Viewpoints

5.13.10 Of the 25 selected viewpoints that were identified to represent the general visual amenity throughout the study area, 19 were identified as receiving a **Major** or **Major-moderate significant** effect on account of the close and open views obtained resulting in **Substantial** and **Moderate** magnitude of effects to **High** sensitivity receptors.

Residential Receptors

5.13.11 Of the 18 residential receptors/groups assessed, 17 residential receptors are predicted to receive a **significant** effect. This would be due to the openness of the view obtained from each property within 2km of the proposed turbines. None were identified as receiving an effect to the extent that the Proposed Development would be overbearing and result in it being an unattractive place to live.

5.13.12 One settlement is predicted to receive **significant** effect, Carsphairn. This would mainly occur in the eastern part of the settlement where views towards the Proposed Development can be obtained. Elsewhere, a combination of adjacent properties and garden vegetation would reduce effects to non-significant levels.

Route Receptors

5.13.13 Of the 17 route receptors assessed, 8 of which are Core Paths located within 5 km of the Proposed Development, a total of 15 would receive **Major-moderate** or **Major significant** effect) due to their proximity to the Proposed Development which would become a prominent feature within views. This would cover short sections of each route where open views are available and within close proximity to the Proposed Development. Thereafter, levels of effect would reduce to non-significant levels as distance and screening from vegetation increases

Cumulative

5.13.14 Cumulative Scenario 2 sites would be located further back within the uplands reducing their prominence from Upper Glenkens and potential to lead to significant cumulative effects. Where significant cumulative effects do occur for the Scenario 2 baseline, it is as a result of consented sites to the north east at Lorg, and to the south east at Troston Loch, Margree and Glenshimmeroch.

5.13.15 The effects of Scenario 3 sites are similar to Scenario 2 with the exception of Shepherds Rig which would be viewed alongside the Proposed Development. For some landscape and visual receptors, this would lead to an increase in horizontal extent of turbines and would appear as one large wind farm. For other receptors, the Proposed Development would be viewed within the footprint of Shepherd Rig and would have limited cumulative effect.

Conclusion

5.13.16 The assessment has identified that significant landscape and visual effects of the Proposed Development would be relatively contained within the surrounding landscape of Upper Glenkens and the Southern Uplands. Significant landscape character effects have been assessed to occur within the upland areas of the Galloway Hills, Southern Uplands and from the northern reaches of Upper Glenkens. Due to this containment by the surrounding uplands, landscape effects would be restricted to the landscape within 8 km of the Proposed Development where the perceptual change to key characteristics would be experienced. This would affect a small part of the overall 45 km study area where 5 of 51 LCTs identified would receive a significant effect to their key characteristics as a result of the Proposed Development.

5.13.17 Similarly, a total of 36 landscape designations were identified within 45 km study area, a total of 1, the Galloway Hills RSA was identified as receiving significant effects to its special qualities due to the Proposed Development being located within the designation.

5.13.18 The majority of significant visual effects are identified as typically occurring within approximately 8 km from the nearest proposed turbine. This includes a small number of residential receptors, nearby route receptors and surrounding hill tops to the north, and south west along the Rhinns of Kells.

5.13.19 Cumulative effects would arise mainly from the addition of the Proposed Development in combination with the Shepherds Rig development (application site). This would increase the concentration of turbines and in some cases increase the horizontal extent of turbines across the landscape and appear as one development.

5.13.20 The LVIA has considered landscape and visual receptors within a 45 km study area and established that there would be several significant effects to both landscape and visual receptors which would occur in a localised area. These would affect a relatively small number of landscape and visual receptors situated within 8 km of the Proposed Development.

VATTENFALL

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Chapter 6

Ecology & Biodiversity

Contents

Glossary

Term	Definition
Assemblage	A group of species found in the same location.
Avoidance	Prevention of impacts occurring, having regard to predictions about potentially negative environmental effects (e.g. project decisions about site location or design).
Baseline conditions	The conditions that would pertain in the absence of the proposed project at the time that the project would be constructed / operated / decommissioned. The definition of these baseline conditions should be informed by changes arising from other causes (e.g. other consented developments).
Biodiversity	The variability among living organisms from all sources, including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part: this includes diversity within species, between species and of ecosystems.
Biodiversity offsets	Measurable conservation outcomes resulting from actions designed to compensate for unavoidable significant negative effects on biodiversity. The goal of biodiversity offsets is to achieve no net loss, or preferably a net gain, of biodiversity.
Compensation	Measures taken to offset the loss of, or permanent damage to, ecological features despite mitigation. Any replacement area should be similar in terms of biological features and ecological functions that have been lost or damaged, or with appropriate management can reproduce the ecological functions and conditions of those biological features. Compensation addresses negative effects which are residual, after avoidance and mitigation have been considered. It is this objective of compensation, and not its location, that distinguishes compensation from 'mitigation'. Depending on circumstances, compensation measures may be located within or outside the project site.
Connectivity	A measure of the functional availability of the habitats needed for a particular species to move through a given area. Examples include the flight lines used by bats to travel between roosts and foraging areas or the corridors of appropriate habitat needed by some slow colonising species if they are to spread.
Conservation objective	Objective for the conservation of biodiversity (e.g. specific objective within a management plan or broad objectives of policy).
Conservation status	The state of a species or habitat including for example, extent, abundance, distribution and their trends.
Cumulative impact / effect	Additional changes caused by a proposed development in conjunction with other developments or the combined effect of a set of developments taken together.
Distribution	The geographical presence of a feature. This can depend on factors such as climate and altitude.
Ecological feature	Habitats, species or ecosystems.
Ecological network	An interconnected system of ecological corridors.
Ecosystem	A dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit.
Ecosystem services	Ecosystem services are the benefits that people derive from the natural environment. The natural environment can be considered as a stock of 'natural capital' from which many benefits flow – social, health-related, cultural or economic.
Effect	Outcome to an ecological feature from an impact. For example, the effects on a fish population from aquatic pollution arising from construction works. See also 'Impact'.
Enhancement	Improved management of ecological features or provision of new ecological features, resulting in a net benefit to biodiversity, which is unrelated to a negative impact or is 'over and above' that required to mitigate/compensate for an impact.
Environmental Impact Assessment (EIA)	Assessment of projects carried out under the EIA Regulations.
Environmental Impact Assessment Report (EIAR)	A document describing the effects of a project on the environment prepared during EIA.

Term	Definition
Favourable condition / status	Satisfactory condition of an ecological feature. In some cases, favourable condition is specifically defined (e.g. for some designated sites). In relation to populations, that the population is self-sustaining in the long-term.
Fragility	The degree of sensitivity of habitats, communities and species to environmental change.
Fragmentation	The breaking up of a habitat, ecosystem or land-use type into smaller parcels with a consequent impairment of ecological function.
Geographic scale	The geographic context for evaluation.
Habitat	The place or type of site where an organism or population naturally occurs. Often used in the wider sense referring to major assemblages of plants typically found together.
Habitats Regulations Appraisal	An assessment of projects (or plans) potentially affecting European sites in the UK, required under the Habitats Regulations.
Impact	Actions resulting in changes to an ecological feature. For example, the construction activities of a development removing a hedgerow. See also 'Effect'.
Important ecological features	Ecological features requiring specific assessment within EIA. Ecological features can be important for a variety of reasons (e.g. quality and extent of designated sites or habitats, habitat / species rarity).
Local sites	'Non-statutory' sites of nature conservation value that have been identified 'locally' (i.e. excluding SSSIs, SPAs, SACs, and Ramsar sites). Local Nature Reserves are included as they are a designation made by the Local Authority rather than statutory country conservation bodies. Local Sites are often called Wildlife Sites, Local Nature Conservation Sites, Sites of Importance for Nature Conservation or other, similar names.
Mitigation	Measures taken to avoid or reduce negative impacts and effects. Measures may include locating the development and its working areas and access routes away from areas of high ecological interest, fencing off sensitive areas during the construction period, or timing works to avoid sensitive periods. Depending on circumstances, mitigation measures may be located within or outside the project site.
Net ecological gain	The point at which the quality and quantity of habitats or species improves compared to their original condition (i.e. improvements over and above those required for mitigation/compensation).
No net loss	The outcome resulting from losses being offset by gains.
Operational phase	The period when the Proposed Development is operating, assumed to be 30-35 years.
Population	A collection of individuals (plants or animals), all of the same species and in a defined geographical area.
Precautionary Principle	The principle that the absence of complete information should not preclude precautionary action to mitigate the risk of significant harm to the environment.
Proposed Development	The project that is the focus of the impact assessment
Rarity	A measure of relative abundance that can apply at a range of geographical scales.
Replacement	The creation of a habitat that is an acceptable substitute for the habitat which has been lost.
Restoration	The re-establishment of a damaged or degraded system or habitat to a close approximation of its pre-degraded condition.
Scoping	The determination of the extent of an assessment (for an EIA).
Screening	Determination of whether or not an EIA is necessary.
Significant effect	An effect that either supports or undermines biodiversity conservation objectives for 'important ecological features'
Synergistic effect	Occurs when the sum of two effects together is greater than the sum of the effects separately.
Zone(s) of Influence	The area(s) over which ecological features may be affected by the biophysical changes caused by the proposed project and associated activities.

List of Abbreviations

List and describe your abbreviations here.

Abbreviation	Description
BAP	Biodiversity Action Plan
BSBI	Botanical Society of the British Isles
ECoW	Environmental / Ecological Clerk of Works
eDNA	Environmental DNA (Deoxyribonucleic Acid)
CEMP	Construction Environmental Management Plan
DGC	Dumfries & Galloway Council
EcIA	Ecological Impact Assessment
FWPM	Freshwater Pearl Mussel
GFT	Galloway Fisheries Trust
GCN	Great Crested Newt
GWDTE	Groundwater Dependent Terrestrial Ecosystems
IEF	Important Ecological Feature
LNCS	Local Nature Conservation Site
LNR	Local Nature Reserve
NNR	National Nature Reserve
NVC	National Vegetation Classification
PMP	Peat Management Plan
SBL	Scottish Biodiversity List
SBS	Scottish Biodiversity Strategy
SWT	Scottish Wildlife Trust
SSSI	Site of Special Scientific Interest
SAC	Special Area of Conservation

6.1 STATEMENT OF COMPETENCE

6.1.1 This assessment, and the baseline surveys that have informed it, were completed by a team of experienced ecologists from MBEC environmental consulting, a CIEEM Registered Practice based in Scotland. MBEC has extensive experience with onshore wind farm development including ecological survey, wind farm design advice, impact assessment, mitigation, construction supervision and monitoring. The lead assessor for the ecology & biodiversity chapter has contributed to over 20 onshore windfarm EIAs during 20 years as a professional ecological consultant.

6.2 INTRODUCTION

6.2.1 This Chapter of the EIA Report (EIAR) provides an assessment of the effects of the proposed Quantans Hill wind farm ('the Proposed Development') on sensitive habitats and species of conservation concern and vulnerability to adverse effects from onshore wind farm development. These sensitive habitats and species (i.e. populations) are referred to in this assessment as 'important ecological features'. The Proposed Development is described in Chapter 3 of this EIAR.

6.2.2 The assessment identifies potential effects arising from the construction, operation, and decommissioning of the Proposed Development on all ecological features except for bird populations sensitive to the effects of onshore wind far development, which are considered separately in Chapter 7 'Ornithology'.

6.2.3 This assessment considers all potentially significant effects that could occur during the construction, operation, and decommissioning of the Proposed Development, broadly summarised as follows:

- Loss / degradation of sensitive habitats arising from the construction of the wind turbine foundations, access tracks, borrow pits, compounds, and other ancillary infrastructure.
- Disturbance to sensitive species during construction, operation, and decommissioning.
- Pollution of terrestrial and aquatic habitats during construction, operation, and decommissioning.
- Bat mortality during the wind farm operational phase.
- Potential for significant cumulative effects with other plans or projects.

6.2.4 The main objectives of this Chapter are to:

- Set out the legislative and policy context for the assessment.
- Describe the methods followed in the collation of baseline data to inform the assessment and in undertaking the EIA.
- Describe the habitats, flora and fauna within and adjacent to the 'Proposed Development Area' (as defined in Chapter 1).
- Identify the ecological features that are the focus of the assessment.
- Evaluate the sensitivity of each ecological feature.
- Identify and assess the effects of the Proposed Development on ecological features.
- Define mitigation measures to avoid, reduce and offset adverse effects; and
- Assess the level and significance of residual effects (that is, following consideration of the proposed mitigation measures).

6.2.5 The assessment has concluded that the Proposed Development could result in significant adverse effects on surface waters and fish (from pollution during construction) and on certain bat species (from operational mortality). However, providing that the measures proposed to address these effects during the construction and operation of the Proposed Development are implemented, significant residual effects would be avoided.

6.2.6 The proposed habitat enhancement measures, described in an outline Habitat Management Plan (HMP), are intended to offset the direct and indirect effects on sensitive habitats and species. These measures have the potential to result in a net positive effect, in the long-term, on the nature conservation value of the Site and are also intended to make appreciable contributions to achieving local and national nature conservation and biodiversity policy goals.

6.2.7 The assessment presented in this Chapter is supported by additional information provided in various Technical Appendices (Technical Appendices 6.1-6.7), as follows:

- Technical Appendix 6.1 – Botanical / Habitat Desk Study & Survey Results;
- Technical Appendix 6.2 – Protected / Notable Fauna Desk Study & Survey Results;
- Technical Appendix 6.3 – Bat Activity Survey Results;
- Technical Appendix 6.4 – Fish Population and Fish Habitat Survey Results;
- Technical Appendix 6.5 – Outline Species Protection Plans;
- Technical Appendix 6.6 – Outline Habitat Management Plan; and
- Technical Appendix 6.7 – Outline Water Quality and Fish Monitoring Plan.

6.2.8 A separate Confidential Annex to this Chapter provides the full results of the badger survey and the confidential records from the desk study (i.e. location details related to sensitive sites for protected and/or scarce species that are at risk of persecution or illegal exploitation).

6.3 LEGISLATION, POLICY AND GUIDANCE

6.3.1 This assessment has been undertaken with regard to the following legislation, national and local nature conservation and planning policy:

- The Conservation (Natural Habitats etc.) Regulations 1994 (as amended) (called "The Habitats Regulations") transposed from the EC Council Directive 92/43/EEC on the Conservation of Natural Habitats and Wild Fauna and Flora[1];
- Nature Conservation (Scotland) Act 2004 (as amended);
- Wildlife and Natural Environment (Scotland) Act 2011;
- The Conservation of Habitats and Species Regulations 2017;
- Wild Mammals (Protection) Act 1996;
- Protection of Badgers Act 1992;
- Wildlife and Countryside Act 1981 (as amended);
- The Convention for the Conservation of European Wildlife and Natural Habitat (The Bern Convention) 1979;
- The Scottish Biodiversity Strategy[2];
- The Scottish Biodiversity List[3]; and
- Dumfries & Galloway Biodiversity Action Plan (i.e. the Local Biodiversity Action Plan, LBAP)[4].

6.3.2 Table 6.1 provides a summary of the legal protection of the species (or taxonomic groups) which are the focus of this assessment. This is provided for general information purposes only; the original legislation should be referred

[1] Despite the UK's exit from the European Union, domestic legislation that has been derived from, or modified by, the provisions of the Birds Directive remain in effect.

[2] The Scottish Biodiversity Strategy [online]. Available at: https://www.gov.scot/policies/biodiversity/scottish-biodiversity-strategy/

[3] Scottish Biodiversity List [online]. Available at: https://www.nature.scot/scotlands-biodiversity/scottish-biodiversity-strategy/scottish-biodiversity-list

[4] Dumfries & Galloway Local Biodiversity Action Plan available from: https://swseic.org.uk/resource/dglbap-part1/

to for definitive guidance (copies of the original, as enacted, and revised versions of UK and Scottish Government legislation are available from The National Archives[5]).

Table 6.1 Legal protection for species / taxonomic groups that are considered in this assessment

Species / Taxon	Key Legislation, Directives, Conventions	Summary of Relevant Protections
Badger	Bern Convention (Appendix 3) Protection of Badgers Act (1992)	Badgers and their setts are fully protected.
Bats (all species)	Habitats Regulations 1994, Schedule 2 (as amended) EC Habitats Directive Annex IV Bern Convention (Appendices 2 & 3) Convention on Migratory Species (Appendix 2 and EUROBATS)	All wild native bat species are European Protected Species (EPS). Bats and their roosts are fully protected.
Otter	Habitats Regulations 1994, Schedule 2 (as amended) EC Habitats Directive Annex IV Bern Convention Appendix 2	Otters and their breeding sites and resting places are fully protected.
Pine marten	Wildlife and Countryside Act 1981, as amended (Schedule 5) Bern Convention (Appendix 3)	Pine martens and any structure or place which they use for shelter or protection are legally protected.
Red squirrel	Wildlife and Countryside Act 1981, as amended (Schedule 5) Bern Convention (Appendix 3)	Red squirrels and any structure or place which they use for shelter or protection are legally protected.
Reptiles	Wildlife and Countryside Act 1981, as amended (Schedule 5) Bern Convention (Appendix 3)	All native reptile species are protected against killing / injury.
Water vole	Wildlife and Countryside Act 1981, as amended (Schedule 5)	Water vole is partially protected in Scotland. Water vole burrows are protected from damage, destruction, obstruction, and disturbance when a water vole is occupying a burrow.
Great crested newt	Habitats Regulations 1994, Schedule 2 (as amended) EC Habitats Directive Annex IV	Great crested newts and their supporting habitats, including resting places and breeding ponds are protected.
Freshwater pearl mussel	Wildlife and Countryside 1981, as amended (Schedule 5) EC Habitats Directive Annex V	Freshwater pearl mussels are protected as is their habitat.

Summary of Relevant Planning Policy and Guidance

6.3.3 Scottish planning policy and guidelines of relevance include National Planning Framework 3 and the Planning Advice Note 60 entitled 'Planning for Natural Heritage'.

6.3.4 Scotland's National Planning Framework (NPF) 3 (Scottish Government 2014) provides a strategic level framework for the spatial development of Scotland as a whole (Note: NPF4 has now been approved and will be adopted in February 2023) whereas the Planning for Natural Heritage: Planning Advice Note 60 (Scottish Government 2000) outlines development control processes and provides case studies for good management of the natural heritage, including vegetation restoration following development. The relevant national biodiversity frameworks, action plans, other connected policies and associated supporting documents are described below.

UK Biodiversity Action Plan

6.3.5 Relevant biodiversity policies were originally based on the UK Biodiversity Action Plan (UK BAP) which listed 65 Priority Habitats and 1150 Priority Species and created action plans for the recovery of these priority habitats and species. The UK BAP formally ended in 2010 and was replaced by the UK Post-2010 Biodiversity Framework published by JNCC and Defra in 2012[6]. The UK Post-2010 Biodiversity Framework sets out the priorities for UK-level work to support the Convention on Biological Diversity's (CBD's) Strategic Plan for Biodiversity 2011-2020 as well as its five strategic goals and 20 'Aichi Targets' agreed at the CBD meeting in Nagoya, Japan, in October 2010. In addition, it also considers the EU Biodiversity Strategy (EUBS) launched in May 2011 (JNCC and Defra 2012).

The Scottish Biodiversity Strategy

6.3.6 In 2004 the document ‘Scotland’s Biodiversity – It’s in Your Hands’ was published. This outlined a 25-year strategy for conserving and enhancing biodiversity in Scotland and halting the decline in species of conservation concern. This was supplemented in 2013 by the '2020 Challenge for Scotland's Biodiversity: A Strategy for the Conservation and Enhancement of Biodiversity in Scotland'. These two documents provide the overview of Scottish biodiversity policies set within the UK framework (Scottish Government 2012) and are supplements to the Scottish Biodiversity Strategy (SBS) published in 2004. Together, these form the complete SBS (Scottish Government 2013[7]).

6.3.7 The SBS outlines desirable outcomes for 2020 and lists the principles and approaches that should be undertaken to achieve these outcomes. The 2020 Challenge places an emphasis on tackling the key pressures placed on Scotland’s biodiversity from the effects of climate change, non-native species and habitat fragmentation.

6.3.8 The SBS emphasises the need to take account of how ecosystems work, particularly across landscapes. It states that both the broad and local scales need to be considered, that the capacity of ecosystems to respond to impacts is not infinite and that resilience is to be built into ecosystems using an adaptive, integrated approach at the scale of river catchments. An update to the SBS is currently at draft stage and seeks to build on the previous version of the national strategy with the ambition for Scotland to be ‘Nature Positive’ by 2030 and to have restored and regenerated biodiversity across the country by 2045[8].

6.3.9 The UK BAP list of priority habitats and species (as defined in UK Post-2010 Biodiversity Framework) remain an important reference point for the SBS and the Scottish Biodiversity List (SBL).

The Scottish Biodiversity List

6.3.10 Since the original publication of the SBL in 2005, there are now four categories of habitats and species[9]:

- Conservation action needed - this includes habitats and species that have undergone a significant decline in Scotland and / or are rare or have a restricted distribution and are under threat (e.g. species protected Under the Wildlife and Countryside Act 1981, as amended);
- Avoid negative impacts - this includes habitats and species that are protected through international obligations (e.g. European protected species or habitats), those that are rare or have a restricted distribution and / or have undergone a significant decline in Scotland (e.g. species protected Under the Wildlife and Countryside Act);
- Watching brief only - this includes species on the UK BAP list but not considered to be at particular risk in Scotland as well as species with international obligations not identified in the other two categories for action

[5] https://www.legislation.gov.uk

[6] JNCC and Defra (2012). UK Post-2010 Biodiversity Framework. Available at: http://data.jncc.gov.uk/data/587024ff-864f-4d1d-a669-f38cb448abdc/UK-Post2010-Biodiversity-Framework-2012.pdf

[7] Scottish Government (2013). 2020 Challenge for Scotland’s Biodiversity [online]. Available at: https://www.gov.scot/publications/2020-challenge-scotlands-biodiversity-strategy-conservation-enhancement-biodiversity-scotland/

[8] Biodiversity strategy to 2045: tackling the nature emergency, Scottish Government (2022). Available at: https://www.gov.scot/publications/scottish-biodiversity-strategy-2045-tackling-nature-emergency-scotland/

[9] Scottish Natural Heritage: Scottish Biodiversity List [online]. Available at: https://www.nature.scot/scotlands-biodiversity/scottish-biodiversity-strategy/scottish-biodiversity-list

(e.g. 'near threatened' category of the Red-List criteria drawn up by the International Union for Conservation of Nature (IUCN), a list that provides information on the status of flora and fauna that is of conservation concern); and

- Communicating with the public - these are non-domestic species and habitats voted as being of importance to the Scottish public in 2005 and are designed to be used to inspire and engage the public on biodiversity conservation.

6.3.11 As a result, the habitats and species are listed on eight SBL schedules:

- Schedule 1 - on the UK BAP list;
- Schedule 2 - are protected under an international obligation;
- Schedule 3 - rare in the UK (less than sixteen 10 km squares);
- Schedule 4 - less than six Scottish 10 km squares;
- Schedule 5 - greater than 25% Scottish decline (over 25 years or other appropriate time period);
- Schedule 6a - endemic to Scotland;
- Schedule 6b - endemic subspecies/race (and must meet at least one other criterion); and
- The Social Criteria List.

6.3.12 Table 6.2 provides a list of the national conservation policies relevant to the key protected species considered in this assessment, along with a summary of the most recent assessments of species population trends and conservation status.

Table 6.2 Summary of nature conservation policy status of protected species considered in this assessment

Species / Taxon	UK / Scottish Biodiversity Policy	UK / Scottish Conservation Status[10]
Badger	n/a	• Current UK-wide assessment - Not assessed. • IUCN Red List status - 'Least Concern' (Scotland). • Not currently of conservation concern but badgers remain at risk of human persecution.
Bats (all relevant species)	• UK Post-2010 Biodiversity Framework - Priority Species • Scottish Biodiversity List	• Current UK-wide assessments -'Favourable' (applies to all established species in Scotland with the exception of Nathusius' pipistrelle which has a status of 'Unknown'). • IUCN Red List status for Scotland: Daubenton's bat - 'Least Concern' Natterer's bat - 'Least Concern' **Leisler's bat** - 'Near Threatened' Noctule - 'Least Concern' Common pipistrelle - 'Least Concern' Soprano pipistrelle - 'Least Concern' **Nathusius' pipistrelle** - 'Vulnerable' Brown long-eared bat - 'Least Concern'
Otter	• UK Post-2010 Biodiversity Framework - Priority Species • Scottish Biodiversity List	• Current UK-wide assessment - 'Favourable'. • IUCN Red List status - 'Vulnerable' (Scotland). • Widespread in Scotland, with the population having reoccupied most if not all catchments previously lost within its range.
Pine marten	• UK Post-2010 Biodiversity Framework - Priority Species • Scottish Biodiversity List	• Current UK-wide assessment - 'Favourable'. • IUCN Red List status - 'Least Concern' (Scotland). • Was once found throughout Britain, suffered dramatic declines during the 19th century. Since legal protection came into force in the 1980s the population has made a significant recovery with an expansion south and eastwards from the core areas in the northwest Highlands. There is a population present in Dumfries and Galloway centred on Galloway Forest Park.
Red squirrel	• UK Post-2010 Biodiversity Framework - Priority Species • Scottish Biodiversity List	• Current UK-wide assessment - Not assessed. • IUCN Red List status - 'Near Threatened' (Scotland). • Long-term decline in population size and range in the UK. Strongholds are in the Highlands and southern Scotland south of the Central Belt.
Water vole	• UK Post-2010 Biodiversity Framework - Priority Species	• Current UK-wide assessment - Not assessed. • IUCN Red List status - 'Near Threatened' (Scotland). • Very large declines in population size and in species distribution in the UK and Scotland in the 1980s and 1990s, without recovery. Due to habitat loss/change and predation by American mink (*Neovison vison*).
Reptiles	• UK Post-2010 Biodiversity Framework - Priority Species • Scottish Biodiversity List	• The conservation status of national reptile populations is unclear. There are believed to be general long-term declines in most of the reptile species present in Scotland, including adder (*Vipera berus*), common lizard (*Zootoca vivipara*) and slow worm (*Anguis fragilis*). • The declines are thought to be due to a combination of factors including habitat fragmentation, land management and site disturbance.
Great crested newt	• UK BAP Priority Species • Scottish Biodiversity List	• Great crested newt has suffered significant declines and is under threat in several European countries.
Freshwater pearl mussel	• UK BAP Priority Species • Scottish Biodiversity List	• Critically Endangered in Europe • Scotland supports internationally important populations, however, there have been dramatic declines due to a combination of human exploitation, habitat damage and poor water quality.

6.3.13 This assessment also considers the potential implications of the Proposed Development on habitats of international, national, or regional nature conservation/biodiversity value. For example, those listed in Annex I of Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora, including: blanket bog and dwarf shrub heath communities; bryophyte and sedge rich flushes; and unimproved grasslands. Also included are other habitats of local importance highlighted for conservation action within the Local Biodiversity Action Plan.

Local Biodiversity Action Plan

6.3.14 Originally under the UK BAP, and now under the SBS, local authorities have a responsibility to produce their own list of priority habitats and species and associated actions for conservation. These are called Local Biodiversity

[10] Mammals species assessments from: Mathews, F., Kubasiewicz, L.M., Gurnell, J., Harrower, C.A., McDonald, R.A. & Shore, R.F. (2018). A Review of the Population and Conservation Status of British Mammals. A report by the Mammal Society under contract to Natural England, Natural Resources Wales and Scottish Natural Heritage. Natural England, Peterborough.

Under the IUCN Red List criteria, each species is allocated to one of the following categories, in order of relative severity of risk of extinction: Critically Endangered (CR); Endangered (EN); Vulnerable (VU); Near Threatened (NT); Least Concern (LC); and Data Deficient (DD). The categories CR, EN and VU are collectively described as 'Threatened'. NT indicates that the species is close to qualifying as threatened, or is likely to qualify as threatened in the near future (Mathews *et al.* 2018).

Action Plans (LBAP). The most recent version available for Dumfries & Galloway was published by the Dumfries & Galloway Biodiversity Partnership in April 2009. The LBAP outlines a vision for different habitats / landscape settings, incorporating a list of key species for each. Additionally, the Scottish Biodiversity List and the Dumfries & Galloway LBAP identify other locally important species that are rare or under threat at a local level. These species have also been taken into consideration, where relevant, in this assessment.

Scottish Planning Policy

6.3.15 The Scottish Planning Policy (SPP, 2014[11]), alongside the National Planning Framework (see below), sets out national policies for operation of the planning system and for the development and use of land. The SPP applies to the preparation of development plans, the design of development and the determination of planning applications and appeals. The SPP presumes in favour of development that contributes to sustainable development.

6.3.16 In relation to ecology and EIA, the SPP sets out broad polices that are relevant to the focus of this Chapter, which have been taken into consideration in the design and assessment of the Proposed Development. The SPP states that policies and decisions should be guided by a set of 'Principal Policies', including: "protecting, enhancing and promoting access to natural heritage, including green infrastructure, landscape and the wider environment".

6.3.17 Under the 'Subject Policies' of the SPP, the policy principals set out for the planning system which are of relevance to this assessment include the following, under the heading Valuing the Natural Environment:

- 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;
- promote protection and improvement of the water environment, including rivers, lochs, estuaries, wetlands, coastal waters and groundwater, in a sustainable and co-ordinated way;
- protect and enhance ancient semi-natural woodland as an important and irreplaceable resource, together with other native or long-established woods, hedgerows and individual trees with high nature conservation or landscape value; and
- seek benefits for biodiversity from new development where possible, including the restoration of degraded habitats and the avoidance of further fragmentation or isolation of habitats.

6.3.18 The SPP also states (in para. 202) that "*developers should seek to minimise adverse impacts through careful planning and design, considering the services that the natural environment is providing and maximising the potential for enhancement*".

6.3.19 In relation to development and protected species, the SPP states (in para. 214) that "*The presence (or potential presence) of a legally protected species is an important consideration in decisions on planning applications. If there is evidence to suggest that a protected species is present on site or may be affected by a proposed development, steps must be taken to establish their presence. The level of protection afforded by legislation must be factored into the planning and design of the development and any impacts must be fully considered prior to the determination of the application*".

National Planning Framework 3

6.3.20 The current National Planning Framework (NPF3, 2014[12]) sets out the spatial aspects of the Scottish Government's Economic Strategy over a 20-30 year period. In relation to the delivery of the NPF it includes reference to national and regional strategies and objectives of relevance to this assessment. For example, NPF3 refers to the 2020 Challenge for Scotland's Biodiversity and the objective of promoting and enhancing ecosystems. NPF3 also emphasises the importance of a landscape-scale approach to environmental planning and management in addressing declines in ecosystem services. The Scottish Biodiversity Strategy and the objective of completing a suite of protected places and improving their connectivity through a national ecological network centred on these sites is also referred to in NPF3. This includes the objective to "*increase new woodland creation to an average of 10,000 hectares per year from 2015, and ...increase the rate of peatland restoration to 22,000 hectares per year*".

Draft National Planning Framework 4

6.3.21 Consideration has also been given in this assessment to the relevant policies set out in the draft National Planning Framework 4 (NPF4)[13].

6.3.22 NPF4 was not approved at the time this document was drafted. NPF4 was initially laid before the Scottish Parliament in November 2021 and has subsequently been the subject of consultation and Parliamentary Committee scrutiny. A revised version of NPF4 2022, which reflects the Scottish Government's consideration of the responses received as part of the consultation, was laid before the Scottish Parliament on 8 November 2022 for approval.

6.3.23 NPF4 2022, received final approval from the Scottish Parliament on 11 January 2023 and awaits adoption by the Scottish Ministers. Regulations have now been laid before the Parliament enabling the Scottish Ministers to adopt the plan, and this is scheduled to happen in February 2023.

6.3.24 Under 'Policy 3: Nature crisis', NPF4 seeks to ensure that "*development proposals contribute to the enhancement of biodiversity, including restoring degraded habitats and building and strengthening nature networks and the connections between them*". Also, that any potential adverse impacts of development proposals on biodiversity, nature networks and the natural environment should be minimised through careful planning and design. Design should consider the need to reverse biodiversity loss, safeguard the services that the natural environment provides and build the resilience of nature by enhancing nature networks and maximising the potential for restoration.

Dumfries & Galloway Local Development Plan

6.3.25 The Dumfries & Galloway Local Development Plan 2 (LDP2), adopted in October 2019, provides guidelines for development proposals in the region. The policies and Supplementary Guidance relating to the protection of natural heritage and biodiversity, which are potentially relevant to this assessment are listed as follows:

- Policy OP1: Development Considerations;
- Policy NE4: Sites of International Importance for Biodiversity;
- Policy NE5: Species of International Importance;
- Policy NE6: Sites of National Importance for Biodiversity and Geodiversity; and
- Policy NE7: Forestry and Woodland.
- Policy NE11: Supporting the Water Environment
- Policy NE15: Protection and Restoration of Peat Deposits as Carbon Sinks

6.3.26 The purpose and objectives of these policies have been taken into consideration, where applicable, in the design and assessment of the Proposed Development.

Impact Assessment Guidance

6.3.27 The following guidance has been referred to, and followed as appropriate, in this assessment:

- Chartered Institute of Ecology and Environmental Management (2018). Guidelines for Ecological Impact Assessment in the UK and Ireland;
- Scottish Natural Heritage (NatureScot, 2018). Environmental Impact Assessment Handbook. A Handbook on Environmental Impact Assessment: Guidance for Competent Authorities, Consultation Bodies, and others involved in the Environmental Impact Assessment Process in Scotland. 5th Edition;

[11] Available online from: https://www.gov.scot/publications/scottish-planning-policy/. [Accessed 16.01.2023]
[12] Available online from: https://www.gov.scot/publications/national-planning-framework-3/. [Accessed 16.01.2023]
[13] Available online from: https://www.gov.scot/publications/scotland-2045-fourth-national-planning-framework-draft/. [Accessed 16.01.2023]

- Bats and Onshore Wind Turbines: survey, assessment and mitigation Version: August 2021. Guidance prepared jointly by Scottish Natural Heritage, Natural England, Natural Resources Wales, RenewableUK, Scottish Power Renewables, Ecotricity Ltd, the University of Exeter and the Bat Conservation Trust (BCT);
- Scottish Renewables, Scottish Natural Heritage, Scottish Environment Protection Agency and Forestry Commission Scotland (2019) Good Practice during Wind Farm Construction, 4th Edition;
- Scottish Environment Protection Agency (SEPA, 2017). Guidance on Assessing the Impacts of Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems. Land Use Planning System SEPA Guidance Note 31 (LUPS - GN31). Version 3 Issued 11 September 2017;
- NatureScot (2016) Planning for development: What to consider and include in Habitat Management Plans. Version 2 issued March 2016; and
- NatureScot (2018) General pre-application/scoping advice to developers of onshore wind farms. Dated February 2018.

6.3.28 Additional reference material which is relevant to the baseline surveys and assessment is referred to within the assessment and the Technical Appendices.

6.4 METHOD OF ASSESSMENT

Introduction

6.4.1 This assessment follows a standard, systematic approach to EcIA which is informed by the best available scientific evidence and experienced professional judgement. Where there are uncertainties, reasonable worst-case assumptions are made to minimise the risk of effects being under-estimated. The assessment method draws on guidance produced by NatureScot, SEPA and the Chartered Institute of Ecology and Environmental Management (CIEEM), such as CIEEM's Guidelines for Ecological Impact Assessment in the UK (2018) and NatureScot's Environmental Impact Assessment Handbook (2018)[14].

6.4.2 Ecological impact assessment is a process that can be summarised as a series of stages, as follows:

- Identifying the ecological features that could be significantly affected by the proposals (effectively part of scoping);
- Evaluating the 'importance' (i.e. importance for biodiversity / nature conservation at the relevant geographical scales, also referred to as feature 'sensitivity') of the feature informed by data from baseline surveys and other appropriate sources;
- Identifying and systematically characterising impacts and their effects (wherever possible based on best available scientific evidence), noting any uncertainties and taking a precautionary approach as appropriate;
- Incorporating measures to avoid and mitigate negative impacts and effects;
- Assessing the significance of any residual effects after any proposed mitigation has been taken into account;
- Identifying appropriate compensation measures to offset significant residual effects; and
- Identifying opportunities for ecological enhancement.

6.4.3 In this assessment the terms 'impact' and 'effect' have the following meanings:

- Impacts – arise from the construction or operation/implementation of the Proposed Development and result in a material change to a feature; and
- Effects – are the consequences of the impact, which may be varied, for the ecological feature under consideration.

[14] NatureScot (2018). Environmental Impact Assessment Handbook. A Handbook on Environmental Impact Assessment: Guidance for Competent Authorities, Consultation Bodies, and others involved in the Environmental Impact Assessment Process in Scotland. 5th Edition. Available at: https://www.nature.scot/handbook-environmental-impact-assessment-guidance-competent-authorities-consultees-and-others

Desk Study

6.4.4 The desk study and survey areas adopted for baseline data gathering for this assessment are defined by the potential 'zone of influence' of the Proposed Development (i.e. the area over which the ecological features could be adversely affected). This area can vary considerably depending on which potential effects and features are being considered. For example, effects on acid grassland, as a habitat feature, can be highly localised to the areas of construction which are physically disturbed by the works. At the other end of the scale, there is the potential for impacts on surface water quality to affect aquatic habitat features some distance from construction locations, therefore requiring consideration in the assessment at the appropriate catchment or sub-catchment scale. Consequently, the boundaries of the desk study and survey areas reflect this variation in the extent of potential effects from the Proposed Development.

6.4.5 The desk study extended to an area up to c. 10 km from the Site boundary, as illustrated on Figure 6.2. The main aim of the desk study was to obtain information regarding statutory and non-statutory natural heritage designations, from various online sources, as well as request details of any records of notable flora and fauna from a range of relevant organisations and data holders. An initial desk study was carried out in 2019 and this was updated in June 2021.

6.4.6 Information relating to sites designated for nature conservation was collated from various sources including the NatureScot website (https://sitelink.nature.scot), Scottish Wildlife Trust (SWT) and DGC websites. The latest version of the NatureScot Ancient Woodland Inventory (AWI) was used to identify areas with ancient woodland within the desk study area.

6.4.7 Records of protected and/or notable species were requested from the following organisations:

- The Botanical Society of the British Isles (BSBI);
- Scottish Badgers;
- South West Red Squirrel Officer (Scottish Red Squirrels);
- Scottish Wildlife Trust; and
- South-West Scotland Environmental Information Centre (SWSEIC, collates information from a wide range of recorders).

6.4.8 In addition, the National Biodiversity Network (NBN) Atlas online database [https://nbnatlas.org/] was also searched for records of rare or notable species within the desk study area (NB only those records which were listed as open access for commercial use or where MBEC had the express permission of the original data provider were downloaded from the NBN Atlas website and considered in this assessment).

6.4.9 Published Environmental Statements/EIA Reports for previously proposed wind farm developments within the Site or same general location were reviewed for any relevant information (e.g. records of notable species). In addition, published assessments for other wind farm developments in the surrounding area that are in the planning process, were consulted in relation to collating relevant information for the assessment of potential cumulative effects.

Baseline Surveys

6.4.10 The main survey area (i.e. for Phase 1 habitats and protected species) is defined by a potential development area within the red-line boundary (as shown on Figure 6.1). More detailed survey and mapping of vegetation communities, following the NVC methodology, was completed within a buffer zone of c. 250 m around each deep excavation (e.g. turbine bases, borrow pits) and c. 100 m of all proposed access tracks, in compliance with Scottish Environment Protection Agency (SEPA) guidance with respect to the identification and assessment of potential

Groundwater Dependent Terrestrial Ecosystems (GWDTEs). References to the 'Site' within this Chapter denotes the red line boundary as shown on Figure 6.1.

6.4.11 The baseline ecological surveys carried out to inform this assessment were as follows:

- Extended Phase 1 habitat survey (September 2020, updated July/August 2021);
- Targeted NVC survey, including the identification of potential GWDTEs (September 2020, July/August 2021);
- Badger (*Meles meles*) survey (September 2020, updated July/August 2021);
- Bat activity surveys (automatic monitoring June to September 2020, June to September 2021);
- Survey for potential bat roosts (September 2020, updated July/August 2021);
- Otter (*Lutra lutra*) survey (September 2020, updated July/August 2021);
- Water vole (*Arvicola amphibius*) survey (September 2020, updated July/August 2021);
- Great crested newt (*Triturus cristatus*) habitat suitability assessment and environmental DNA testing (May/June 2021);
- Electrofishing survey (September 2020);
- Freshwater Pearl Mussel Survey (June 2021); and
- Fish habitat suitability survey (July 2021).

6.4.12 Details of the methodologies followed for the various ecological surveys undertaken to provide the baseline data for this assessment are provided in Technical Appendix 6.1 (Phase 1 habitat and NVC surveys), Technical Appendix 6.2 (Protected species surveys) and Technical Appendix 6.3 (Bat activity surveys).

6.4.13 The initial survey area (i.e. where habitat and protected species surveys were focused in 2020) is shown on Figure 6.1. During 2021, once the emerging layout of the Proposed Development (i.e. including all elements of required infrastructure, temporary compounds, works areas, borrow pits) was more clearly defined, the 2020 surveys were updated, as necessary, to ensure that appropriately detailed survey data was available to inform the impact assessment. Habitat and species-specific focal survey areas varied, in relation to precautionary zones of potential effect relative to the Proposed Development, following current NatureScot[15] and SEPA guidance[16].

6.4.14 All surveys were undertaken by suitably experienced ecologists (with the necessary protected species survey licences where required). Standardised fieldwork recording forms and maps were used and handheld Global Positioning System (GPS) were used to accurately record the locations of any important features and field signs to an accuracy of ±6 m.

Assessment Methodology

Ecological Feature Sensitivity

6.4.15 Defining the importance of each ecological feature (also referred to as 'sensitivity' in this assessment) can involve consideration of a wide range of factors (e.g. habitat naturalness, extent, quality, importance in ecosystem function, processes and in supporting important populations that are of conservation importance at various geographical scales, or at the edge of their natural range). In practice, contribution to biodiversity, conservation status and rarity are often the most important criteria to consider although the range of factors varies in relation to the feature being considered. Ecological feature sensitivity is often defined by rarity at different geographical scales (e.g. local, regional, national, international). This is also useful in placing the feature in the context of nature conservation designations which tend to be selected and ranked according to the rarity of the qualifying species or habitats at different geographical scales, e.g. habitats or species that are rare at a global or European level are usually covered by European legislation and protected within designated sites defined by the European legislation, namely Special Areas of Conservation (SACs). Definitions of ecological feature sensitivity are outlined in Table 6.3.

6.4.16 Where there is uncertainty about the accuracy of the available information used to inform judgements on ecological feature sensitivity a precautionary approach has been adopted to minimise the risk of under-valuing any feature.

Table 6.3 Defining ecological feature sensitivity

Feature sensitivity	Example Definitions
Very High (e.g. international importance)	Habitats or species that form part of the cited interest within an internationally protected site or candidate site (for example, Special Area of Conservation (SAC), Special Protection Area (SPA), or Ramsar site). This includes European protected habitats and species, and internationally important wetlands. A habitat or species which is either unique or sufficiently unusual (in terms of distribution and/or abundance) to be considered as being an area or population of the highest quality example in an international/national context that the site is likely to be designated as an SAC/SPA.
High (e.g. national importance)	Habitats or species that form part of the cited interest within a nationally designated site (for example, a Site of Special Scientific Interest (SSSI) or a National Nature Reserve (NNR)). A habitat which is either unique or sufficiently unusual (in terms of distribution and/or abundance) to be considered as being one of the highest quality examples in a national context for which the site could potentially be designated as an SSSI. This includes Annex I habitats and UK BAP priority habitats. A population of a species which is either unique or sufficiently unusual (in terms of distribution and/or abundance) to be considered as being of nature conservation value at up to a country context. This includes European protected species, 'Nationally Scarce' species, and priority UK BAP species.
Medium (e.g. regional importance)	Viable areas of internationally- or nationally-important habitats (i.e. Annex I habitats and priority UK BAP habitats) present in quality and extent at a regional (e.g. biogeoclimatic zone as partially defined by the NatureScot Natural Heritage Futures[17]) level of importance. Sites supporting a regularly occurring, regionally significant number of internationally (or nationally) important species. This includes European protected species, 'Nationally Scarce' species and priority UK BAP species.
Low (Local High)	Sites that are a Local Nature Reserve or Wildlife Site. Sites containing viable area(s) of any priority UK BAP habitat or presence of species identified in the UK BAP or Local BAP. Sites supporting viable breeding populations of species known to be Scottish Local Authority rarities and/or supplying critical elements of their habitat requirements.
Low (Local Medium)	Habitats which are not considered extensive and/or of good enough quality to qualify for non-statutory designation but which provide locally important semi-natural habitats within an approximate radius of 15-20 km from the site. Populations of any species of conservation importance in the context of the local area within an approx. radius of 15-20 km from the site. However, any such population would not be of a significant number to deem it as being of 'regional' importance.
Low (Local Low)	Habitats which are not considered to qualify for non-statutory designation but which provide locally-important semi-natural habitats in the context of the immediate surrounding area, such as species-rich hedgerows or small ponds. Populations of any species of conservation importance in the context of the immediate surrounding area.
Negligible	Commonplace habitat or species with very little or no nature conservation importance, the loss of which would not be detrimental to the ecology of the area.

[15] NatureScot (2020). Protected Species Advice for Developers. Available at: https://www.nature.scot/professional-advice/planning-and-development/planning-and-development-advice/planning-and-development-protected-species

[16] Guidance on Assessing the Impacts of Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems. Land Use Planning System SEPA Guidance Note 31 (LUPS - GN31). Version 3 Issued 11 September 2017. Available at: https://www.sepa.org.uk/media/144266/lups-gu31-guidance-on-assessing-the-impacts-of-development-proposals-on-groundwater-abstractions-and-groundwater-dependent-terrestrial-ecosystems.pdf

[17] NatureScot (2002). Natural Heritage Futures – Western Southern Uplands and Inner Solway. Available at: https://www.nature.scot/natural-heritage-futures-western-southern-uplands-and-inner-solway

Effect Characterisation

6.4.17 The overall character of an effect is a function of a wide range of variables acting on the feature, which include the following:

- Direction - whether the effect benefits (positive) or harms (negative) the ecological feature;
- Extent - the area affected or potentially affected by a particular impact (e.g. distance over which artificial lighting may affect bat behaviour);
- Magnitude - the amount of a habitat or population affected (quantified, where possible, as the proportion of the ecological feature lost or affected);
- Complexity - relating to whether an effect is direct or indirect, proximal or distal, immediate or delayed;
- Reversibility - can the effect be reversed, within a reasonable timescale and with a reasonable expectation of recovery, or is it permanent and irreversible;
- Frequency - is the effect acting constantly or intermittently (e.g. occasional noise disturbance in comparison to a longer-term change to the existing baseline levels of disturbance);
- Timing - is the effect occurring during a more or less sensitive period for the ecological feature (e.g. relative to the breeding season);
- Duration - the length of time that the effect is acting on the ecological feature, this may be longer than the associated impact is occurring for and may be short, medium, long-term or permanent (indicative periods for these categories are given in Table 6.4 below. In relation to faunal ecological features duration may also be defined relative to the lifecycle of the species); and
- Confidence - certain/near-certain, probably, unlikely or extremely unlikely.

6.4.18 The overall effect, considering all of the above factors, for each ecological feature is categorised for each phase of the Proposed Development (i.e. the construction phase, the operational phase and the decommissioning phase). To help illustrate this, summary descriptions of the various effect levels (primarily considering effect magnitude and duration with the relevant geographical context for the ecological feature) are provided in Table 6.4 below.

Table 6.4: Categorisation of the level of an effect on IEFs

Level	Description
High	Major effects on the feature/population (i.e. ecological feature), which would have a sufficient effect to alter the nature of the feature in the short-long term and affect its long-term viability. For example, more than 20% habitat loss or damage.
Medium	Effects that are detectable in short and long-term, but which should not alter the long-term viability of the feature/population. For example, between 10 - 20% habitat loss or damage.
Low	Minor effects, either of sufficiently small-scale or of short duration to cause no long-term harm to the feature/population. For example, less than 10% habitat loss or damage.
Negligible	Minimal change on a very small scale.
Duration	Permanent (>30 years) Long-term (15-30 years or longer) Medium-term (5-15 years) Short-term (<5 years)

Defining Effect Significance

6.4.19 Significance is a measure of the importance that should be given to an effect in relation to the consideration of appropriate mitigation and the overall environmental impact of the proposals and in the development consenting process. Whether an effect is assessed to be 'Significant' has a specific implication in the context of the EIA Regulations and is of key importance in terms of consent decision-making. Effects can be significant at a wide range of geographical scales (i.e. from the local level to effects that are of international importance for the ecological feature under consideration) but which result in important consequences for the functioning and/or conservation status of the ecological feature. In general terms, significance is determined through the interaction between ecological feature sensitivity and the categorised effect level (i.e. taking into account effect extent, duration, reversibility etc.).

6.4.20 For consistency across the EIAR, effect significance is reported in categories, from None to Major, through Negligible, Minor and Moderate. For the purposes of this assessment, effects are considered Significant if they are reported as greater than Moderate. Further detail is provided in the assessment of effects for each ecological feature as to whether effects are potentially significant and at which geographical scale. For illustrative purposes only, a matrix is provided as Table 6.5 to indicate how effect level (between Negligible to Major) and ecological feature sensitivity relate to judgements of effect significance. As was stated at the being of this section, whilst following the systematic assessment process, as set out here, informed professional judgement plays a critical role in the determinations of effect level and significance.

6.4.21 Where significant adverse effects are predicted then mitigation measures are usually recommended, where feasible, to reduce effect severity. Mitigation measures are actions to prevent, reduce or ameliorate adverse effects on ecological features. This might include alternative construction methods, the timing of works and effective habitat restoration. In some cases, mitigation measures may also be specified where effects are not considered to be significant as part of a best practice approach to development. Following consideration of the proposed mitigation then the residual effect and significance is reported in the assessment.

Table 6.5 Matrix illustrating how effect significance relates to effect level and ecological feature sensitivity

Ecological Feature Sensitivity	Effect Level			
	High	**Medium**	**Low**	**Negligible**
Very High	Major	Major	Major - Moderate	Negligible
High	Major	Major - Moderate	Moderate	
Medium	Major-Moderate	Moderate	Moderate-Minor	
Low (Local High)	Moderate	Moderate-Minor	Minor	
Low (Local Med.)	Moderate-Minor	Minor	Minor-Negligible	
Low (Local Low)	Minor	Minor-Negligible	Negligible	
Negligible	Negligible			

Mitigation and Residual Effects

6.4.22 In relation to the Proposed Development, appreciable reduction or avoidance in potential impacts has been achieved through the design process. However, as design changes have been incorporated into the Proposed Development at an early stage they are therefore not considered as mitigation measures in the context of the assessment of residual effects. Chapter 2: Site Design Evolution summarises how the Site layout evolved in response to a range of issues, including habitat sensitivity.

6.4.23 Where potentially significant effects are predicted, further mitigation measures have been proposed to reduce their severity. Mitigation measures are actions to prevent, reduce or compensate for any likely significant effect on ecological features. The assessment, therefore, considers the potential effects in the context of the proposed mitigation measures to determine the significance of the residual effect. This requires careful consideration of the

effectiveness of the proposed mitigation and the likelihood of it being achieved and the timescale required. Some measures may not always achieve the desired outcomes. Additionally, habitat creation can also require long timescales for the objectives to be achieved (e.g. replacement of ancient woodland, creation of active blanket bog). A realistic assessment of the suitability and efficacy of the proposed mitigation measures needs to be undertaken with reference to available industry guidance and case study reports, and direct experience of implementing similar mitigation measures on other projects.

Cumulative Effects

6.4.24 The potential for cumulative impacts with other wind farm proposals has also been assessed where relevant. For (non-avian) ecological features, cumulative impacts are only likely to be significant for other developments within the same hydrological catchment(s) or located within the regular range of more mobile species, e.g. bats. As such, the cumulative assessment has been restricted to other potential developments within the same sub-catchments of the Water of Deugh. The cumulative assessment has included consideration of operational projects; projects under construction; consented projects which are not yet under construction; and projects for which consent applications have been submitted and for which ecological impact assessment information is available.

Statement of Significance

6.4.25 At the end of the Chapter, a statement of significance is provided. This is a summary of the complete assessment, taking into consideration any proposed mitigation measures, and reports the significance of the residual effects in compliance with the EIA Regulations.

6.5 CONSULTATION

6.5.1 During the EIA scoping process, the opinions of various statutory and non-statutory consultees were requested in relation to the main effects that might arise from the Proposed Development, the list of ecological features, what information they would expect to be provided in the EIAR and whether the proposed desk study, survey and assessment methodologies were appropriate.

6.5.2 Those statutory consultees relevant to the EcIA included NatureScot, SEPA, DGC and Marine Scotland.

6.5.3 Responses to the scoping report were collated and provided by the Energy Consents Unit (ECU) in October 2020. A summary of the key points arising from the EIA scoping process is provided in Table 6.6.

Table 6.6 Summary of the points raised by consultees with respect to the Ecological Impact Assessment

Subject	Summary of Points Raised	Response
Habitats	NatureScot advised that: They will accommodate, as far as possible, the effect the Covid-19 pandemic restrictions have had on the completion of site surveys. SEPA advised that: GWDTE are protected under the Water Framework Directive and therefore the layout and design of the development must avoid impact on such areas. The following information must be included in the submission: a) A map demonstrating that all GWDTE are outwith a 100m radius of all excavations shallower than 1m and outwith 250m of all excavations deeper than 1m and proposed groundwater abstractions. b) If the minimum buffers above cannot be achieved, a detailed site specific qualitative and/or quantitative risk assessment will be required. We are likely to seek conditions securing appropriate mitigation for all GWDTE affected.	Potential GWDTE have been identified based on Phase I habitat and NVC surveys completed in 2020 and 2021. The extent to which these habitats are supported by groundwater, taking into account geological and hydrological site conditions, is considered in Chapter 8. Habitats considered to be highly groundwater dependant have been avoided as much as possible through the wind farm design process. For those features it has not been possible to avoid, measures have been proposed, to be refined during the detailed design process (i.e. pre-construction) to further reduce impacts on these habitats. This issue is considered further in Chapter 9: Hydrology.
Fish / Fisheries	Marine Scotland Science (MSS) provided standing advice only. Applicants should specifically discuss and assess potential impacts and appropriate mitigation measures associated with the following: • any designated area, for which fish is a qualifying feature, within and/or downstream of the proposed development area; • the presence of a large density of watercourses; • the presence of large areas of deep peat deposits; • known acidification problems and/or other existing pressures on fish populations in the area; and • proposed felling operations. MSS recommended that a water quality and fish population monitoring programme is carried out to ensure that the proposed mitigation measures are effective. The Scottish Ministers recommended that the Applicant discuss and agree baseline fish surveys with the Galloways Fisheries Trust and the Kirkcudbrightshire Dee District Salmon Fishery Board. The GFT commented that the proposed development area was sensitive with regards to fish populations. The watercourses within the Site, including the Benloch Burn, Knockgray Burn, Marbrack Burn, Polhay Burn and Furmiston Lane could all support important brown trout populations which could be impacted by the proposed development and should be considered fully in the EIA. The GFT advised that fish population surveys are completed as part of the baseline data collection and to ensure that the trout populations can be considered accurately during the design and planning of the wind farm. The GFT agreed that a post-consent fish population monitoring plan covering three years is required. With the monitoring plan being guided by the findings of a baseline fish survey. The GFT also expressed an interest in discussion with the Applicant of habitat enhancement opportunities that could be delivered under a proposed HMP as part of the Proposed Development.	Baseline fish population surveys were completed in September 2020 by the GFT. Fish habitat surveys (focused on the locations of the proposed watercourse crossing points) were completed in July 2021. An outline Fish Monitoring Plan has been prepared and is provided as Appendix 6.7.
Freshwater Pearl Mussel	NatureScot recommended that a Freshwater Pearl Mussel survey is carried out where there is suitable habitat present.	A FWPM survey was completed in 2021 and the results are reported and considered in this chapter.
Non-native Invasive Species	SEPA commented on the potential for American signal crayfish (an invasive non-native species) to be present on Site. SEPA advised that this species is present in the Loch Ken catchment and there is a risk that it might be present in the upper catchment. A survey was recommended.	No evidence of the presence of American signal crayfish was found during the electrofishing survey in 2020 or fish habitat and FWPM surveys in 2021. GFT have advised that although this species is known to be present near to the Site they were aware of no records in this part of the River Dee catchment[18].

[18] Email from Samantha Beck (GFT Fisheries Biologist) dated 30th August 2021.

6.5.4 Based on the initial desk study, consultation responses and the range of potential effects of the Proposed Development, this assessment considers the following:

- Relevant statutory designated natural heritage sites:
  - Cleugh Site of Special Scientific Interest (within 5 kilometres of the Proposed Development);
  - Loch Doon Site of Special Scientific Interest (within 8 kilometres of the Proposed Development); and
  - Merrick Kells Special Area of Conservation and Site of Special Scientific Interest (within 7 kilometres of the Proposed Development).
- Habitats of international conservation value such as those listed on Annex I of Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora;
- Other habitats identified for protection and/or conservation action in national and local biodiversity / nature conservation policies;
- Non-avian species subject to special legal protection;
- Salmonid fish populations / habitats; and
- Other non-avian species of national or regional conservation concern (e.g. as identified within the SBS, LBAP) are also considered within the desk study process.

6.6 BASELINE

Introduction

6.6.1 This section provides a summary of the results of the desk study and baseline field surveys. Further details are provided in the relevant Technical Appendices.

6.6.2 The type, extent and condition of the habitats present are briefly described, with a focus on those habitats of nature conservation importance at a national / local authority level, which are ecological features in this assessment. The nature and quality of habitats for the relevant non-avian fauna, with a focus on protected species, is also described along with the results of surveys to determine their presence and distribution across the Site. At the end of this section, the evaluated sensitivities of the study area for the ecological features relevant to this assessment are summarised in Table 6.8.

Baseline Data Limitations

6.6.3 There are generic technical and methodological limitations (i.e. not specific to this assessment) with respect to various ecological surveys, which are also set out and acknowledged in Technical Appendices 6.1-6.4. The following is a summary of the main generic limitations.

6.6.4 Baseline faunal surveys for EIA are typically undertaken during one or perhaps two field seasons, providing 'snapshots' of the level of activity and use of an area within a relatively short timescale. This is particularly relevant in cases where, for various reasons, use of an area is variable and evidence of presence, or population size, may vary on longer timescales than 1-2 years. The survey results, without interpretation, may give a false impression of the importance of the survey area. For example, in the absence of evidence of a species being present it should not be treated as evidence of absence, particularly where there is suitable habitat within the current known geographical range of the species. In such cases, the potential importance of an area can also be inferred from an assessment of habitat extent / suitability and from data provided by third-party sources (e.g. local biological records centre). This can give a more reliable assessment of the longer-term importance of the area for the species in question.

6.6.5 In the absence of evidence of the presence of a species, it cannot be assumed, where suitable habitat is present, that the species is entirely absent or that the use of the area could not change in the future. There is also the potential for the baseline to change with time, particularly given the commercial conifer plantations which have recently been established within the Site (see Figure 12.2). The potential changes to the use of the site by species that are likely to be influenced by these changes (e.g. bats) has been taken into consideration in the assessment.

6.6.6 In relation to the bat detector surveys, it is also important to recognise the limitations of the data that these types of surveys generate. For example, automated bat detectors do not provide information on the number of bats using a location. It is not possible to determine if a relatively large number of separate bat passes were made by the same individual circling the detector location or by several bats flying past. The data they generate gives an estimate of the level of activity only. Further discussion on the limitations of bat activity data is provided in Technical Appendix 6.3.

6.6.7 In relation to limitations specific to this assessment:

- During the baseline survey period (2020-21) a section of the central part of the site (on the Marbrack landholding) was planted with trees (primarily Sitka spruce saplings at typical commercial forestry densities). The location of the plantation area is shown on Figure 12.2. It is not expected that the works associated with this (e.g. track construction, fencing, tree planting) appreciably affected the baseline data with respect to protected species, but there may have been some degree of disturbance in that area which may have influenced behaviour by species sensitive to human disturbance such as otter. The potential implications of the establishment of this new forest and a similar planting scheme proposed for the landholding within the site to the east of this plantation (Furmiston) in the long-term for ecological features have been taken into consideration in the impact assessment.
- The Scottish Government measures to control the Covid-19 pandemic constrained travel for fieldwork during 2020, particularly during the spring/summer. This resulted in some adjustments being made to the number and timing of survey visits. For example, the number of data collection periods for the bat activity survey was reduced to one or two rather than three sampling periods as would ordinarily be appropriate for this Site. However, additional survey was completed in summer 2021 to account for this.

6.6.8 Overall, taking the above limitations into consideration, the baseline data collated to inform the assessment is considered to accurately represent the key habitats and species present and is sufficiently detailed and current to allow a realistic and reliable assessment of feature sensitivity and the potential significant effects of the Proposed Development.

General Site Description

6.6.9 The Site is in Dumfries & Galloway, towards the northern end of the historic county of Kirkcudbrightshire, approximately 2 km to the northeast of the settlement of Carsphairn, on the eastern side of a wide glen that forms part of the northern end of The Glenkens. This is the valley of the Water of Ken, Loch Ken and the River Dee, an extensive topographical feature that passes in an approximate northwest-southeast orientation through a large section of the western Southern Uplands. For a detailed site description see Chapter 1: Introduction.

Designated Sites

6.6.10 The locations of statutory and non-statutory natural heritage designated sites within 10km of the Proposed Development Area are shown on Figure 6.2.

6.6.11 There are no statutory designated sites (e.g. Special Protection Areas, Special Areas of Conservation, Sites of Special Scientific Interest) within the Proposed Development Area or adjacent to it.

6.6.12 There is a biological Site of Special Scientific Interest (SSSI) within 5 km of the Proposed Development (Cleugh) and a further two SSSI's within 7 km (Loch Doon and Merrick Kells, which is also a SAC).

6.6.13 Cleugh SSSI is on the east shore of Carsfad Loch and is designated for the extent and quality of the unimproved neutral grassland and associated uncommon plant species that the site supports. It is c. 5 km south of the Proposed Development. Given the physical separation of the SSSI from the Proposed Development and that the potential for any hydrological connectivity to the SSSI is negligible given the intervening position of Kendoon Loch (controlled by a hydroelectric dam), this SSSI and its notified natural features are not at any risk of adverse impacts from the Proposed Development (including the potential off-site accommodation works along the public road route for Site materials and component deliveries) and is therefore not considered further in this assessment.

6.6.14 Loch Doon SSSI is approximately 7.5 km west of the Proposed Development. Loch Doon supports the last 'naturally occurring' population of Arctic charr (*Salvelinus alpinus*) in south-west Scotland. Given the physical separation of the SSSI from the Proposed Development and that there is no hydrological connectivity to the SSSI (Loch Doon lies within a different catchment), this SSSI and its notified natural features are not at any risk of any direct or indirect adverse impacts from the Proposed Development (including the potential off-site accommodation works) and is therefore not considered further in this assessment.

6.6.15 Merrick Kells SAC/SSSI is approximately 7 km south-west of the Proposed Development. Merrick Kells is the most extensive un-afforested upland area in Galloway including a diversity of upland habitats of high conservation importance including areas of patterned blanket bog, dry heath, wet heath, acid grassland, acidic scree, oligotrophic and mesotrophic lochans. The SAC is also designated for the important otter population that the site supports. Given the physical separation of the SSSI from the Proposed Development and that there is no hydrological connectivity to the SAC/SSSI (the designated area lies within a different sub-catchment to the Site), these designations and their qualifying features are not at any risk of any direct or indirect adverse impacts from the Proposed Development (including the potential off-site accommodation works) and are therefore not considered further in this assessment.

6.6.16 There are no non-statutory sites designated for their natural heritage within or adjacent to the site (e.g. Local Nature Reserves, Local Nature Conservation Sites, Wildlife Sites, Provisional Wildlife Sites).

6.6.17 The Site is located within the Galloway and Southern Ayrshire Biosphere Reserve. This is a non-statutory designation conferred by the United Nations Educational, Scientific and Cultural Organization (UNESCO) in recognition of the special natural qualities of the area. Galloway and Southern Ayrshire Biosphere Reserve was designated in 2012, it includes areas within Dumfries & Galloway, East Ayrshire and South Ayrshire and is comprised of three zones: Core; Buffer and Transition. The Site is located within the Transition zone, which is the largest zone of the Biosphere Reserve. The Core zone is formed by sites with statutory nature conservation designations and includes the Merrick Kells SSSI and SAC and the Cairnsmore of Fleet SSSI and NNR. The Buffer Zone corresponds approximately with the boundary of Galloway Forest Park.

6.6.18 There are no AWI sites within or adjacent to the Proposed Development Area (see Figure 6.2).

Notable Species Records

6.6.19 A summary of the desk study findings with respect to protected species is provided in Table 6.7 below with the locations of non-confidential records shown on Figure 6.3 (further details are presented in Technical Appendix 6.2). Sensitive records relating to species that are at risk from human disturbance, persecution or exploitation have been fully considered in this assessment and are detailed in a separate Confidential Annex to this Chapter.

Table 6.7: Protected Species Records within Desk Study Area (source: SWSEIC)

Ref.	Record	Years	Location	Location Relative to the Site
1-57	Various records from bat detector surveys including Bat species (1); Myotis species (13); Leisler's bat (9); Noctule (3); Pipistrelle species (9); Common pipistrelle (11); Soprano pipistrelle (11);	2016-18	Along the minor road to the east of Marscalloch Hill	c. 1-2 km east of the Site
58-59	Badger: road casualty and sighting of an individual	2006, 2018	West of Carsphairn along the A713	c. 1 km west of the Site
60-62	Adder (*Vipera berus*): three sightings of indiviuals	2005	Carsphairn, Bridge at Carminnows; Kendoon Loch, by Deugh Dam	1-5 km west and south of the Site

6.6.20 The 'Saving Scotland's Red Squirrels' website, most recently checked in August 2021, had no records of red squirrel within the Proposed Development area, however the are several records along the corridor of the B729. There are very few records of grey squirrel for this general area.

6.6.21 Searches of the NBN Atlas (www.nbnatlas.org[19]), most recently completed in August 2021, revealed no recent records for the Site (i.e. within the past 25 years) of any nationally notable flora or fauna (i.e. species whose populations, under a range of definitions, are considered to be of conservation concern at a national or international level and/or species that for various reasons receive special legal protection).

6.6.22 It is important to note that the absence of such records does not mean that a species is not present. Where there is suitable habitat, and the Site is located within its distributional range, the absence of observations may simply be due to under-recording. Additionally, the location details for some records are only reported at the hectad scale (i.e. 10x10km square, based on the OS National Grid system) and therefore could potentially apply to the Site.

6.6.23 During baseline surveys for the original Quantans Hill wind farm evidence of the presence of several protected species was recorded including otter and bat species. The survey area for that proposal included most of the area of the current Proposed Development. The key findings, with respect to protected species, are provided in Technical Appendix 6.2.

Phase 1 Habitats and NVC Communities

6.6.24 Phase 1 habitat and targeted NVC surveys (focusing on the proposed wind turbine areas, based on the Scoping Report layout) were completed in September 2020, with further surveys carried out in August/September 2021, to ensure that there was sufficient data coverage to inform the emerging wind farm design and subsequent EIA process.

6.6.25 A map showing the type and extent of Phase 1 habitat types recorded within the survey area and the location of the associated target notes (TNs) is provided as Figure 6.4a-b. A map showing the results of the NVC surveys is provided as Figure 6.5a-b.

6.6.26 The Phase 1 habitat survey target notes, NVC quadrat locations and results, botanical species lists, and descriptions of each of the habitats identified are provided in Technical Appendix 6.1. An overview of the survey results is provided below.

[19] Only those records which were listed as open access for commercial use, or where MBEC had the express permission of the original data provider, were downloaded from the NBN Atlas website and considered in this assessment.

Survey Area Overview

6.6.27 Proposed Development is located in an area comprised of a mosaic of blanket mire, wet heath, marshy grassland and semi-improved grasslands. In describing the type and condition of habitats within the Site it can be usefully sub-divided, by the boundaries of three landholdings, as the western, central and eastern areas (see Figure 6.1).

6.6.28 The botanical composition and condition of habitats within all three areas has been strongly influenced by land use practice over many decades (i.e. primarily sheep and cattle farming, along with artificial drainage and burning to improve conditions for grazing stock). Livestock type, grazing intensity and management has varied between the three areas. These differences, combined with natural variation in aspect, topography, hydrology, geology and peat accumulation have resulted in a highly varied mosaic of apparent NVC communities, and transitional zones between communities, and vegetation condition apparent across the Site.

6.6.29 Other board terrestrial habitat types present in the Site include stands of bracken (*Pteridium aquilinum*) and a number of small plantation woods (primarily comprising non-native conifers) that were established for livestock shelter (i.e. protecting sheep and cattle from bad weather and acting as wind breaks).

6.6.30 A new commercial conifer plantation has been recently (i.e. during 2020) established within the central part of the Site and plans for further planting, of primarily commercial conifers, are in place for the majority of the eastern part of the Site. These plantations will result in large habitat changes during the next 10-15 years as the growth of the trees, consequent changes in soil moisture levels and gradual shading out, will alter the existing ground flora significantly. The influence of these changes on the species and habitats of conservation value that could be affected by the Proposed Development has been taken into consideration in this assessment.

6.6.31 A list of each of the Phase 1 habitat types and their approximate extents within the Phase 1 habitat survey area (as shown on Figures 6.4a-c) is provided in Table 6.8.

Table 6.8: Phase 1 habitat types and their approximate extents within the survey area

Phase 1 Habitat Type (NVC community codes)	Area (ha)	Cover (%)
Marsh / marshy grassland (M23, MG10)	434.98	39.73
Wet modified bog (M15, M25)	283.03	25.85
Semi-improved acid grassland (U4, U5)	133.69	12.21
Blanket bog (M17, M19)	113.81	10.40
Wet dwarf shrub heath (M15)	59.54	5.44
Continuous bracken (U20)	27.06	2.47
Semi-improved neutral grassland (MG9-10)	24.15	2.21
Coniferous plantation woodland (n/a)	5.59	0.51
Acid flush (M4, M6)	3.57	0.33
Wet heath / acid grassland mosaic (M15, U4-5)	3.40	0.31
Scattered bracken (U20)	1.87	0.17
Mixed plantation woodland (n/a)	1.75	0.16
Broad-leaved plantation woodland (n/a)	1.26	0.12
Other habitat (n/a)	0.68	0.06
Running water (n/a)	0.33	0.03
Basic flush (M10)	0.03	0.00
Total	1094.74	100.00

Groundwater Dependent Terrestrial Ecosystems

6.6.32 The majority of the NVC communities within the survey area are not considered to be GWDTEs. This includes the bog, wet and dry heath communities, and the areas of acid grassland. However, there is one community present that is potentially highly groundwater-dependent, and a further three are potentially moderately groundwater-dependant, depending on the hydrological situation in which they are present (SEPA 2017). Further discussion and assessment of potential impacts on GWDTEs is provided in Chapter 8 Hydrology (see Section 8.5).

6.6.33 M6 *Carex echinata-Sphagnum fallax/denticulatum* mire can be highly groundwater dependent. This habitat relates to areas of more extensive cover and several more discrete acidic flushes, often associated with springs or diffuse flow at the sources of the numerous minor watercourses that drain the Site. This habitat was recorded across the survey area. These often relatively small and linear habitats also occurred where there was slow surface water movement and were often associated with natural and artificial drainage features, indicating that they were also supported, to some extent, by surface water. They are generally species-poor habitats in terms of their botanical diversity and in many locations have also been impacted by livestock tramping.

6.6.34 M15 *Trichophorum cespitosum-Erica tetralix* wet heath can be moderately groundwater dependent. However, in this context most of the examples are on areas of blanket peat (sometimes relatively shallow) where the vegetation has been impacted by the long-term effect of livestock grazing resulting in a modified community that would, under a lighter grazing regime, revert to a more characteristic bog or wet heath community. These habitats are not considered to be particularly groundwater dependant within this Site.

6.6.35 M23 *Juncus effusus/acutiflorus-Galium palustre* rush pasture (both sub-communities) has the potential to be highly groundwater-dependent vegetation community. However, most examples of this community across the survey area have arisen as a result of surface water movement and occur on sloping ground where there is a limited influence from groundwater.

6.6.36 M25 *Molinia caerulea-Potentilla erecta* mire may be moderately groundwater dependent. This community is common within the Site, occurring over much of the survey area where there is blanket peat, often in level or gently sloping areas. It is a community resulting from the long-terms effects of management and livestock grazing of what historically would have been a wetter and less modified blanket blog (e.g. NVC communities M17, M19). As this habitat occurs on blanket peat that is typically more than 1 m deep, it is primarily supported by rainwater and therefore has very limited dependency on groundwater on this Site.

Protected Species

6.6.37 Protected species surveys were initially undertaken in September 2020 and updated in July/August 2021 to ensure that the baseline data was current and that there was sufficient coverage of the Site following the completion of most of the design process. The non-confidential results of the protected species surveys are outlined below, with key locations shown on Figure 6.6. Further detail is provided in Technical Appendix 6.2. Records from the survey relating to badger are provided in a separate Confidential Annex to this Chapter.

6.6.38 Bat activity surveys, automatic acoustic monitoring at various sampling locations across the Site, were completed during June to September 2020 and June to October 2021.

Badger

6.6.39 Evidence of badger activity was recorded in a small number of locations within the survey area. Most habitats within the Proposed Development area are sub-optimal for this species and not suitable for sett excavation. Due to the risk of human persecution to this species the results of the badger survey are provided in a separate Confidential Annex to this Chapter. The survey results have been fully considered in this assessment. The key locations for this species have been taken into consideration in the wind farm design process to minimise the potential for any impacts to badger setts.

Bats

6.6.40 Figure 6.7 shows the locations of the automated bat detectors (SM2 Bat+ model, Wildlife Acoustics Inc.) that were deployed for bat activity monitoring in 2020. Some additional surveys were completed in 2021 focused on locations where the survey effort during 2020 had been affected by the Covid-19 pandemic restrictions or due to equipment failure. The full details of the bat activity surveys, including methods, detector locations, weather conditions, timings, data analysis and results are provided in Technical Appendix 6.3.

6.6.41 Generally, the exposed upland parts of the survey area are considered to be of low overall habitat quality for bats in comparison to the lower-lying areas of sheltered mature woodland, riparian habitats and farmland to the south of the Proposed Development area. However, some areas and features within the Proposed Development area were considered likely to provide comparatively good foraging habitat and suitable commuting routes for a range of bat species. This included the conifer plantation edges, the main watercourses / riparian zones and areas of sheltered damp marshy grassland.

6.6.42 Most of the small, isolated conifer-dominated woodlands offered poor roosting habitat for bats. The trees were of a uniform height and age and were generally lacking in suitable features that could support a bat roost. However, a small copse located on the south-facing slope of Furmiston Craig, which is a mixed, long-established, plantation, did have some standing deadwood and live trees with potentially suitable roost features (e.g. woodpecker holes, bark slabs, knot holes, splits and crevices associated with old tear-outs). This copse is located c. 200 m east from the proposed location of turbine 14 (see Figure 6.6). The results from automated monitoring of bat activity in 2020 and 2021 near to this location indicated that a bat roost may be present in the general area (which can be inferred by comparing the timing of bat activity relative to sun-set and the peak roost emergence times of different bat species). Monitoring of bat activity within the copse during 2020 showed a concentration of activity by common pipistrelle before the peak dusk emergence period indicating that there may be a roost close by.

6.6.43 The various farm buildings and private houses near to the southern end of the Site have the potential to provide a wide range of potential roosting opportunities for pipistrelle bats. These buildings were not inspected or assessed in any detail for potential bat roost features as they were sufficiently separate to the proposed wind turbine locations that the risk of appreciable impact on any roosts associated with these buildings would be negligible.

6.6.44 In conclusion, there was no evidence from the bat surveys to indicate that the Proposed Development (i.e. the wind turbine positions) are located close to any bat roosts. However, based on the timing of bat passes relative to the peak emergence times, there may be common and/or soprano pipistrelle roosts present in the local area, potentially associated with the various buildings near to the Site or a small, isolated copse c. 200 m east of T14, which has some trees with potentially suitable roost features (see Figure 6.6).

6.6.45 Bat activity (recorded as 'bat passes', i.e. discrete echolocation call sequences) was sampled, using automated bat detector equipment located across the Site, during summer and late-summer 2020 and 2021 (see Figure 6.7). Sampling locations for the 2020 survey were selected based on the Scoping layout. The 2021 survey effort was focused on locations where either the survey effort (i.e. number of detector nights) was affected by equipment failure in 2020 or where the temporal spread of data was limited due to logistical constraints resulting from the Covid-19 pandemic. A summary of the results of the 2020 survey is provided in Table 6.9. below.

6.6.46 Bat activity (passes/night) is often highly variable between nights and does not necessarily reflect the number of bats active near the sampling location. Because of the highly variable nature of bat activity data (i.e. it typically has a highly skewed distribution) the median is often a more appropriate summary statistic than the mean. Median bat passes per night is the metric that has been used in the comparative assessment of bat activity levels recorded within the Site against a national dataset (see below). The mean value for bat passes per night are provided in Table 6.9 to summarise and highlight 'within-Site' variation in activity levels.

Table 6.9: Summary of Bat Activity Data (2020/2021)

Ref	Habitat	Detector Nights (Year)	Mean bat passes/night (max passes/night) [i]					
			MYOSP	NYCLEI	NYCNOC	PIPPIP	PIPPYG	PLEAUR
Q01[ii]	Rush pasture, edge of conifer plantation	13 (2020)	2.6 (12)	1.8 (23)	1.2 (14)	48.0 (206)	20.2 (92)	0.0 (0)
Q02	Blanket mire	36 (2020)	0.2 (1)	0.7 (6)	0.3 (3)	0.6 (5)	1.2 (8)	0.0 (0)
Q03	Rough grass / heath	38 (2020)	0.2 (2)	0.3 (6)	0.2 (2)	1.6 (29)	1.3 (12)	0.1 (1)
Q04	Rough grass / degraded mire	36 (2020)	0.3 (2)	1.4 (10)	0.6 (3)	2.2 (20)	3.1 (25)	0.0 (1)
Q06	Rush pasture	31 (2020)	0.6 (4)	0.6 (6)	0.2 (2)	4.8 (47)	5.1 (54)	0.1 (2)
Q08	Rough grass / rush pasture	36 (2020)	0.4 (3)	0.7 (6)	0.3 (2)	3.9 (26)	4.8 (40)	0.2 (1)
Q09	Rush pasture, conifer copse	31 (2020)	0.4 (2)	2.9 (19)	0.7 (7)	7.6 (71)	11.8 (66)	0.2 (3)
Q10[iii]	Rush pasture, conifer copse	16 (2020)	0.3 (1)	4.2 (20)	0.4 (2)	5.8 (18)	3.4 (11)	0.2 (1)
		99 (2021)	0.9 (4)	3.5 (64)	1.4 (32)	5.6 (21)	6.2 (54)	0.4 (5)
Q11	Rush pasture, small stream	31 (2020)	0.4 (4)	1.8 (19)	0.1 (2)	7.7 (44)	4.6 (19)	0.2 (2)
Q13a	Acid grassland, mire edge	35 (2020)	0.0 (0)	0.4 (4)	0.4 (4)	0.7 (8)	0.6 (8)	0.0 (0)
Q13b[iv]	Acid grassland, mire edge	72 (2021)	0.2 (3)	0.8 (8)	0.6 (4)	1.2 (11)	2.4 (25)	0.1 (3)
Q14[v]	Blanket mire / acid flush	100 (2021)	0.9 (8)	0.5 (5)	0.6 (5)	1.3 (11)	2.8 (31)	0.1 (2)
Q15	Blanket mire / acid flush	35 (2020)	0.0 (0)	0.4 (3)	0.2 (2)	0.7 (4)	0.7 (7)	0.0 (0)
Q17	Molinia mire	35 (2020)	0.2 (2)	0.5 (6)	0.3 (2)	1.3 (8)	0.4 (4)	0.0 (1)
Q19	Molinia mire	35 (2020)	0.1 (1)	0.3 (4)	0.3 (2)	0.8 (12)	0.2 (3)	0.0 (0)
Q21[vi]	Bracken, mire, rush pasture	35 (2020)	0.3 (3)	1.4 (11)	0.2 (2)	5.5 (31)	3.1 (13)	0.1 (1)
		100 (2021)	0.6 (4)	0.9 (14)	2.2 (55)	3.7 (29)	6.0 (34)	0.2 (2)

i. MYOSP (*Myotis* species); NYCLEI (Leisler's bat); NYCNOC (Noctule); PIPPIP (Common pipistrelle); PIPPYG (Soprano pipistrelle); PLEAUR (Brown long-eared bat).

ii. Equipment failed; not re-surveyed in 2021 as the location was no longer relevant to the emerging wind farm layout.

iii. Equipment failed for part of the survey period; re-surveyed in 2021.

iv. Q13b is in similar location to Q13a but closer to the nearest proposed wind turbine (T12).

v. Q14 is at the location of proposed wind turbine T13 (located between Q13b and Q21)

vi. Q21 is close to the position of proposed wind turbine T14. This location was re-surveyed in 2021 due to proximity to a woodland copse with several trees that have potential bat roost features (located c. 200 m east of T14).

6.6.47 Analysis of the automated bat detector recordings indicated the presence of at least seven bat taxa in both 2020 and 2021. In order of frequency of occurrence across the 2020 data: common pipistrelle (45.6% of bat passes); soprano pipistrelle (35.9%); Leisler's bat (10.9%); Noctule (3.5%); Myotis bats (mostly likely to be Daubenton's, *Myotis daubentonii*, or Natterer's bats, *M. nattereri*) (3.4%), a small number of passes identified as brown long-eared bat (0.7%, a species that is generally under-recorded in bat detector surveys due to its low amplitude echolocation calls) and 0.1% of passes were attributed to Nathusius' pipistrelle (*P. nathusii*). Levels of bat activity were, as would be expected, generally lower in the more exposed open areas (such as Q02, Q03 and Q17),

compared to locations near to watercourses and plantation edges/blocks. For example, activity levels were comparatively high for most taxa at Q01 in 2020 (the detector was deployed at the corner of a conifer plantation block) despite this being one of the more elevated locations within the survey area (c. 370 m AOD). Also, at sampling locations Q09, Q10 and Q11, which were also near to a small conifer plantation and/or minor watercourses.

6.6.48 The results of the 2020 and 2021 bat activity surveys were processed using the Ecobat online tool (www.ecobat.org.uk), which was developed by the University of Exeter (Lintott *et al.* 2018[20]) and is run by the Mammal Society. This gives access to comparative database of bat activity survey results collected from similar areas (within 100 km of the Site) and at the same time of year (within 30 days). Ecobat generates a percentile rank (and associated confidence limits) for each night where bat activity was recorded against a reference range. Bat activity levels are divided into categories using the percentiles as follows:

- 0 – 20th percentile = low;
- 21st – 40th percentile = low to moderate;
- 41st – 60th percentile = moderate;
- 61st – 80th percentile = moderate to high; and
- 81st – 100th percentile = high.

6.6.49 Table 6.10 provides a summary of the bat activity survey data based on the results of the Ecobat analysis. It includes the number and percentage of nights (i.e. all detector/nights) where levels of bat activity were assigned to 'high', 'moderate-high' levels of activity. The same data, from 2020 only, is presented on Figure 6.7. The full results of the bat activity survey and Ecobat analysis are provided in Technical Appendix 6.3.

Table 6.10: Percentage nights when bat activity exceeded 'Moderate' levels (i.e. 60th percentile) based on Ecobat comparative analysis (2020 and 2021 data)

Ref.	Year	% Detector Nights at High/Moderate-High Activity Levels (no. nights)					
		MYO sp.	NYCLEI	NYCNOC	PIPPIP	PIPPYG	PLEAUR
Q01	2020	15.4 (2)	7.7 (1)	7.7 (1)	53.9 (7)	38.5 (5)	0
Q02	2020	0	5.6 (2)	0	2.8 (1)	8.3 (3)	0
Q03	2020	0	2.6 (1)	0	5.3 (2)	7.9 (3)	0
Q04	2020	0	11.1 (4)	0	13.9 (2)	30.6 (11)	0
Q06	2020	0	3.2 (1)	0	16.1 (5)	25.8 (8)	0
Q08	2020	0	2.8 (1)	0	27.8 (10)	36.1 (13)	0
Q09	2020	0	16.1 (5)	3.2 (1)	38.7 (12)	64.5 (20)	0
Q10	2020	0	18.8 (3)	0	50.0 (8)	37.5 (6)	0
	2021	0	18.0 (18)	6.0 (6)	46.0 (46)	31.0 (31)	1.0 (1)
Q11	2020	0	6.5 (2)	0	58.1 (18)	45.2 (14)	0
Q13a	2020	0	0	0	5.7 (2)	5.7 (2)	0
Q13b	2021	0	2.8 (2)	0	6.9 (5)	16.7 (12)	0
Q14	2021	3.0 (3)	2.0 (2)	2.0 (2)	10.1 (10)	21.2 (21)	0
Q15	2020	0	0	0	0	2.9 (1)	0
Q17	2020	0	2.9 (1)	0	11.4 (4)	0	0
Q19	2020	0	0	0	2.9 (1)	0	0
Q21	2020	0	11.4 (4)	0	34.3 (12)	28.6 (10)	0
	2021	0	3.0 (3)	14.0 (14)	29.0 (29)	40.0 (40)	0

6.6.50 The Ecobat analysis, as summarised in Table 6.10, broadly reflects the levels of bat activity recorded in 2020 and 2021 (see Table 6.9). Leisler's bat, common and soprano pipistrelle nightly activity above moderate levels (i.e. 60th percentile) occurred across the site with the exception of a small number of sampling locations. Comparatively high numbers of nights with common and soprano pipistrelle activity above moderate levels were associated with locations near to plantation woodland and/or watercourses. Comparatively high levels of nightly Leisler's bat activity were associated with the Q9 and Q10 locations, both of which are near to small conifer plantations. Noctule nightly activity above moderate levels was recorded in fewer locations across the Site in comparison to Liesler's bat. There was a notable increase in Noctule activity in 2021, in comparison to 2020, at location Q21. This was related to a small number of nights in late July and mid-August 2021 where activity levels were elevated for this species at this location, and which also corresponded to relatively warm, dry nights with low wind speeds.

6.6.51 Despite the expected variation in activity between the locations sampled in 2020 and 2021, the assessment of site-wide risk, following NatureScot guidance, is unchanged when considering the 2020 or the 2021 data (see below).

6.6.52 Estimating the vulnerability of bat populations to wind turbine related mortality is based on the consideration relative abundance (nationally); collision risk based on current guidance; and relative level of activity recorded at the Site. Five bat species in Scotland are considered to have a high collision risk (noctule, Leisler's bat, Nathusius' pipistrelle, soprano pipistrelle and common pipistrelle). Of these, three (noctule, Leisler's and Nathusius' pipistrelle) are considered to have high population vulnerability with the other two (soprano and common pipistrelle) having medium population vulnerability.

6.6.53 Table 6.11 below provides a Site-based assessment of collision risk for each bat species considered to be at high risk of collision with wind turbines, in general, based on the guidance and methods in NatureScot *et al.* (2019[21]). It is important to note that the actual risk of bat mortality is likely to vary considerably within the Site in response to a range of variables including habitat, e.g. proximity of a wind turbine to waterbodies or woodland edges and that an overall assessment of Site risk may mask some of these important variations. Consequently, the risk is also reported for the broad habitat types where bat activity was sampled in 2020 and 2021 (see Technical Appendix 6.3).

6.6.54 Following the NatureScot *et al*. (2019) method, the Site-level risk for the Proposed Development is 'Medium', this is a combination of a 'Medium' project size and 'Moderate' habitat risk. The overall risk assessment, for each species that is at high risk of wind turbine mortality (excluding Nathusius' pipistrelle due to the very low levels of activity recorded), is based on the product of the Site-level risk and the Ecobat percentile categorisation of bat activity data. This includes consideration of typical levels of activity (derived from median bat passes per night) and peak levels of activity (from the maximum number of bat passes per night).

[20] Lintott, P.R., Davison, S., van Breda, J., Kubasiewicz, L., Dowse, D., Daisley, J., Haddy, E. and Mathews, F. (2018). Ecobat: An online resource to facilitate transparent, evidence-based interpretation of bat activity data. Ecology and evolution, 8(2), pp.935-941.

[21] NatureScot et al. (2019). Bats and Onshore Wind Turbines: survey, assessment and mitigation. Version: August 2021. Guidance prepared jointly by Scottish Natural Heritage, Natural England, Natural Resources Wales, RenewableUK, Scottish Power Renewables, Ecotricity Ltd, the University of Exeter and the Bat Conservation Trust (BCT)

6.11: Site-wide Risk Level for Nyctalus and Pipistrelle Bat Species based on Activity Recorded at Typical (i.e. median) and Peak (i.e. maximum) Levels.

Species / Genus	Ecobat Activity Level		Site-wide Risk Level (rating)	
	Median	Maximum	Median	Maximum
Leisler's bat	Low/Mod.	High	Medium (6)	High (15)
Noctule	Low	High	Low (3)	High (15)
Common pipistrelle	Mod.	High	Medium (9)	High (15)
Soprano pipistrelle	Mod.	High	Medium (9)	High (15)

6.6.55 This assessment indicates that, in terms of the Site as a whole, there is a Low-Moderate risk, at typical activity levels, for all High collision risk species. At peak activity levels, all species meet the criteria for a High Site-wide risk. This indicates that under certain conditions (e.g. time of year, warm temperatures and relatively low wind speeds) the risk to species, such as Nyctalus bats, from turbine mortality may be significant. Although these conditions may occur on only a relatively few nights in any one year there is the potential for relatively low levels of mortality to be significant for some species due to the vulnerability of their populations.

6.6.56 It is important to emphasise that the analysis of Site-wide risk includes data from some bat detectors located in or near habitat types which will not be typical of conditions once the Proposed Development is constructed. Also, that the wind turbine layout has been adjusted to reduce potential effects on bats, this is discussed further within the impact assessment section of this chapter. For example, by ensuring that all turbines will be located away from the main watercourses and that woodland edges. Trees (mostly plantation non-native conifers) will be removed from the vicinity of the proposed wind turbines prior to the Proposed Development becoming operational. This includes turbines that are proposed for areas of recent woodland establishment at Marbrack and Furmiston. This issue is discussed further within the assessment section of this Chapter and within Chapter 12 (Forestry).

Otter

6.6.57 There is suitable habitat for otter within the survey area, particularly along sections of the Benloch Burn and Marbrack Burn, including several potentially suitable resting site features (i.e. bankside lie-ups). No evidence of recent otter activity was noted during surveys completed in 2020 and 2021. However, old spraints were found, particularly along the banks of the Marbrack Burn. There are brown trout populations present, in most of the larger watercourses draining the site, which can provide an attractive prey source for otter. Otters may also move across dry land and hunt away from watercourses, for example, when foraging for amphibians at small pools in moorland areas during the spring. It is possible that the larger watercourses are located within the wider territory of one or two otters that forage within the Site only occasionally. Currently there is no evidence to indicate that otter is likely to be breeding near to the Proposed Development, but this possibility cannot be ruled out.

Pine Marten

6.6.58 No evidence of pine marten was recorded during baseline surveys or the desk study, however as the Site lies within the potential range of the species, the presence of pine marten cannot be ruled out. The even-aged, densely planted Sitka spruce lacks suitable denning opportunities and much of the thicket and pole-stage plantation, whilst providing good cover for pine marten, does not offer good quality foraging habitat. However, the conifer plantations in the wider area (to the east) may provide more suitable habitat.

6.6.59 Given the absence of evidence of the presence of a population in the area this species is not considered further in this assessment. However, as a protected species of conservation importance, it is proposed that pre-works surveys include pine marten and that appropriate measures are put in place to protect this species and its places of shelter, should surveys reveal the presence of pine marten or confirmed / suspected dens and other resting places (see Appendix 6.5).

Red Squirrel

6.6.60 No evidence of the presence of red squirrel was found within any of the small woodland areas in the main survey area. Overall habitat suitability within the survey area was relatively poor for red squirrel. The conifer plantation areas are small, isolated and consisted primarily of uniform stands of even-aged, thicket and pole-stage Sitka spruce trees. Habitat quality was therefore relatively poor in terms extent, tree species and canopy diversity.

6.6.61 Red squirrel is not considered further in this assessment. However, as a protected species of conservation importance, it is proposed that pre-works surveys include red squirrel and that appropriate measures are put in place to protect its occupied habitat, should these surveys reveal the presence of red squirrel (see Appendix 6.5).

Water Vole

6.6.62 Despite the presence of extensive suitable habitat, no evidence of the presence of water vole was recorded within the survey area. A number of burns and channels appear to provide good quality habitat for the species, in terms of burrowing opportunities, food availability and shelter. However, the levels of poaching by livestock have potentially reduced the likelihood of the species being present and there are no known populations present in the wider area that could recolonise the Site.

6.6.63 Given the absence of evidence of the presence of a population in the area this species is not considered further in this assessment. However, as a protected species of conservation importance, it is proposed that pre-works surveys include water vole and that appropriate measures are put in place to protect its occupied habitat, should these surveys reveal the presence of water vole (see Appendix 6.5).

Great Crested Newt

6.6.64 There are several small ponds within the Site, none of which would be at risk of any direct impact from the Proposed Development. They have been assessed for their potential to support breeding great crested newt (GCN) a European protected species that receives legal protection in the UK under the Habitats Regulations 1994 (as amended). Outside of the breeding season GCN occupy suitable terrestrial habitats away from their breeding ponds and are at risk from construction works affecting those habitats. One pond was considered to have moderate suitability for breeding GCN, the other ponds within the survey area were unsuitable for this species. This was primarily due to the low presence, or absence. of suitable aquatic macrophytes for egg laying, absence of standing water or the marginal / aquatic plant species indicating acidic conditions. Water samples from the one pond with moderate suitability, taken in May 2021, were tested for GCN environmental DNA (eDNA) and returned a negative result. Based on the results of the habitat and eDNA testing it is concluded that GCN are not, currently, at risk from the Proposed Development and therefore this species is not considered further in this assessment.

Reptiles

6.6.65 A formal survey for reptiles was not undertaken. The Site is within the distributional range of adder, common lizard and slow worm and there is some suitable habitat for all three species present. Common lizards were seen during habitat and protected species surveys at various locations within the marshy grassland and mire habitats within the Site. A number of features were identified that could provide suitable refugia or hibernacula for reptiles (see Figure 6.6). These included drystone walls, various old sheep stells and cairns.

Fish & Fish Habitats

6.6.66 None of the watercourses draining the Site are classified as Marine Scotland as Scottish Salmon Rivers, and there is no connectively to such classified areas within the wider Dee catchment due to impassable obstacles for migratory fish at the dams on Loch Kendoon.

6.6.67 Electrofishing surveys were carried out during September 2020 by the GFT. The locations of the electrofishing sampling points are show on Figure 6.8. The full results of these surveys are provided in Technical Appendix 6.4. In summary, a total of seven sites located within the Proposed Development Area and three control sites outside the Proposed Development Area were surveyed using electrofishing techniques. All sites were located within the Dee catchment area. The sites ranged from poor to good quality instream fish habitat. Juvenile salmon were recorded in low densities at one site only, which was a control site (located outside of the potential zone of effect of the Proposed Development) and the only site with access to migratory fish. Seven of the 10 sites held brown trout populations, where juvenile trout were recorded in very low to moderate densities. Minnows and stone loach were the only non-salmonid fish species encountered during the surveys, being present at two sites only.

6.6.68 Data from across the survey area was assessed using a traffic light sensitivity rating to highlight those sites particularly sensitive to construction disturbance. For a watercourse to be classified as having a Low Sensitivity it was found to have no fish present and unsuitable habitat to support fish. Moderate sensitivity was defined as watercourses (sampling locations) found to contain only non-salmonid species and with habitat was not suitable to support salmon or trout populations. The highest sensitivity rating (Very Sensitive) was given to sites where salmonids were found to be present in any density or to display habitats of particular significance.

6.6.69 Four of the sampling locations within the Site were assessed to be 'Very Sensitive', these were on the Furmiston Burn, Polshagg/Marbrack Burn, Marbrack Burn and Benloch Burn. All of the other locations were considered to be 'Not Sensitive'.

6.6.70 Where it was anticipated that water crossings would be required for new access tracks, or existing water crossings would need to be upgraded, a survey, focusing on assessing habitat suitability for salmonid fish, was carried out by GFT in July 2021. The surveys were undertaken to assess the potential of the watercourses within the Site to support brown trout and brook lamprey (*Lampetra planeri*) populations and make recommendations regarding whether additional surveys would be required.

6.6.71 The results of the fish habitat suitability survey are presented in Technical Appendix 6.4. A total of 13 sections of watercourse were surveyed to determine the sensitivity of fish habitats focusing on the main proposed access track crossing points (i.e. this does not include proposed crossings of very minor steams or ditches). Several locations were highlighted for their potential to support brown trout due to the quality of the instream habitats. Table 6.12 provides a summary of the findings of the survey.

Table 6.12 Summary of the fish habitat survey results at the main proposed watercourse crossing locations

Site	Watercourse	Fish Habitat
A	Benloch Burn	Contains a range of good quality instream habitats, with potential to support brown trout.
B	Un-named tributary of the Water of Deugh	Mixed juvenile habitats and spawning substrates for brown trout present at this site
C	Knockgray Burn	Good shading and plenty of instream cover and woody debris but numerous obstructions and very little water makes this site unlikely to support fish currently. May also provide some habitat for brook lamprey. Higher water levels may enable this site to support brown trout.
D	Un-named tributary of the Polhay Burn	No suitable habitat for brown trout or brook lamprey, very low water levels.
E	Un-named tributary of the Polhay Burn	Lack of smaller substrates and multiple dried out sections mean that it is unlikely to support brown trout or brook lamprey
F	Un-named tributary of the Marbrack Burn	Unlikely that habitat at this site will support trout or brook lamprey.
G	Un-named tributary of the Marbrack Burn	Suitable habitat for brown trout exists at this site, but not for brook lamprey.
H	Marbrack Burn	Habitats at this site are likely to support brown trout and potentially brook lamprey.
I	Furmiston Lane	Habitat to support brown trout is present, but it is unlikely to support brook lamprey
J	Furmiston Lane	Habitat is unlikely to support brown trout or brook lamprey
K	Un-named tributary of Furmiston Lane	No suitable habitat for brown trout or brook lamprey at this site
L	Un-named tributary of the Marbrack Burn	No suitable habitat for brown trout or brook lamprey at this site
M	Polhay Burn	Habitat is unlikely to support brown trout or brook lamprey

6.6.72 Based on the 2020 electrofishing survey results and the fish habitat survey (completed in July 2021). The GFT provided advice with respect to proposed watercourse crossings for the wind farm access tracks and recommended that the crossings on the Marbrack Burn and Benloch Burn should be suitably designed bridge structures, spanning over the watercourses and avoiding any direct or indirect loss or degradation of instream habitat. It was also recommended that a Construction / Post Construction Fish Monitoring Plans be developed for the Proposed Development as a condition on any consent coming forward for the Proposed Development. It was also recommended that pre-works fish rescues are carried out the five sites that have the potential to support fish (i.e. Sites A, B, G, H and I).

Freshwater Pearl Mussel

6.6.73 The freshwater pearl mussel is an endangered bivalve mollusc that has been in decline for the last century due to a combination of human exploitation and water pollution, particularly sediment accumulation in river-bed gravels, reducing oxygen supply to juvenile mussels. It is a very long-lived species, with a generation period of 30 years, and many remaining colonies are non-recruiting with no juvenile mussels entering the adult breeding population[22].

6.6.74 FWPM act as an indicator species and have an important role in ecosystems, including particle processing, nutrient release, and sediment mixing. However, this important species is on the brink of extinction, with Scotland being one of the last remaining European strongholds.

6.6.75 The FWPM surveys were undertaken by GFT in June 2021 with survey locations selected based on an assessment of habitat suitability during previous electrofishing and fish habitat surveys. Presence/absence surveys for FWPM were undertaken to determine sensitivity of the surveyed sites to construction works.

6.6.76 A total of six sites were surveyed. Within the Proposed Development area, the Benloch Burn and Marbrack Burn had the most suitable habitat to support FWPM populations. No evidence of FWPM was found during the survey.

Evaluation of Feature Sensitivity

6.6.77 The ecological features evaluated as international, national, regional or local sensitivity (i.e. Local medium and above) are listed in Table 6.13 along with a summary of the rationale for their sensitivity evaluation.

[22] Moorkens, E., Cordeiro, J., Seddon, M.B., von Proschwitz, T. & Woolnough, D. (2017). Margaritifera margaritifera (errata version published in 2018). The IUCN Red List of Threatened Species 2017. https://dx.doi.org/10.2305/IUCN.UK.2017-3.RLTS.T12799A508865.en.

Table 6.13: Summary evaluation of the sensitivity of ecological features within the Site

Ecological Feature (NVC)	Summary of evaluation	Feature Sensitivity
Marshy grassland / rush pasture (M23)	UK BAP Priority Habitat. This habitat type is widespread across the Site, comprising c. 40% of the Phase I habitat survey area, and is typical of land managed under extensive hill sheep farming throughout the region. Some areas of marshy grassland have a relatively high floristic species-richness and provide a locally important semi-natural habitat within the context of the Site.	Low (Local medium)
Blanket bog (M25, M17, M19)	Annex I Habitats (EC Habitats Directive) and a UK BAP / SBL Priority Habitat. Blanket bog habitats comprise c. 36% of the survey area. The type and quality of blanket bog vegetation communities varies across the Site. The majority of the bog vegetation shows evidence of modification as a result of the long-term effects of livestock grazing, trampling, nutrient enrichment and artificial drainage. Areas of less modified bog habitat, with a more characteristic bog flora, are present in only a few locations, most of which lie outside of the Proposed Development area as they have been deliberately avoided during the design process. The majority of blanket bog habitats within the Site have the potential to be improved, in terms of their ecological function and species composition, through changes in grazing intensity and management and the blocking of drains. This potential for ecological enhancement has been taken into consideration in the evaluation of feature sensitivity.	Medium (Regional)
Acid grasslands (U4, U5)	UK BAP Broad Habitat. Acid grasslands within the Site have been sustained but also impacted, to varying degrees, by livestock grazing, trampling and nutrient enrichment. Generally, the grassland in the eastern part of the site displays a more floristically diverse assemblage in comparison to the more heavily grazed areas (which show greater evidence of nutrient enrichment) in the central and western parts of the Site. Extensive areas of this habitat in the eastern part of the Site have recently been planted with trees (primarily non-native conifers) and will be changed / lost due to shading as the trees grow and the canopy closes over.	Low (Local high)
Wet heath (M15)	UK BAP Priority Habitat. Most of the examples of wet heath within the Site are modified, with the dwarf-shrub component lacking or entirely absent. This habitat typically occurs on areas of blanket peat (sometimes relatively shallow) where the vegetation has been impacted by the long-term effects of livestock grazing resulting in a modified community that would, under a lighter grazing regime, revert to a more characteristic bog or wet heath vegetation community.	Low (Local medium)
Acid flush (M6)	UK BAP Priority Habitat. Sphagnum-dominated acid flushes are present across the Site, closely associated with areas of blanket bog, M23 rush pasture, springs and flushed areas at the head of watercourses. Most of the examples within the site are relatively species-poor and impacted by livestock grazing and trampling.	Low (Local high)
Plantation woodland	Lowland mixed deciduous woodland is a UK BAP and SBL Priority Habitat, this type of habitat does not occur within the Proposed Development area. Small shelterbelts and copses of primarily non-native conifers within the Site have limited ecological value. The trees are densely planted such that the ground flora is absent or heavily impacted by shading. There are some small mixed conifer and broadleaved tree copses within the Site, which include a wider range of trees, including native species. There are also recently established, largely commercial coniferous, plantations covering extensive areas within the central and eastern parts of the Site.	Low (Local medium)
Standing water	UK BAP and SBL Priority Habitat. Several small ponds are present within the Site. These have local value for amphibian and invertebrate species.	Low (Local medium)
Badger	This is not currently a species of conservation concern nationally or in the region. Suitable foraging habitat and sett excavating conditions for badgers are very limited within the Site. There is evidence of the presence of at least one social group, which are likely to focus most of their activity in the woodland and enclosed pasture fields to the south of the Proposed Development.	Low (Local medium)

Ecological Feature (NVC)	Summary of evaluation	Feature Sensitivity
Bats	All of Britain's bat species are listed on Annexes II and IV of the EC Habitats Directive and on the UK BAP / SBL priority species list. At least seven bat species were recorded using the Site during the 2020 and 2021 bat activity surveys, including species whose populations are not currently at a favourable conservation status (e.g. Leisler's bat). Bat activity was generally low at the locations that are typical of conditions where wind turbines are proposed. Activity levels were comparatively higher at locations near to watercourses and woodland, including non-native conifer shelterbelts/copses within the Site. The Site is used by at least five species of bat that are at high risk of wind turbine mortality, including Leisler's bat and noctule. No confirmed bat roosts have been identified within 200 m of the proposed wind turbine locations, however there are likely to be roost sites located in the surrounding area, particularly associated with buildings and woodland to the south of the Proposed Development.	Medium (Regional)
Otter	UK BAP - Priority Species, Scottish Biodiversity List There is suitable habitat for otter within the survey area, but no evidence of recent otter activity was noted during surveys completed in 2020 and 2021. The larger watercourses are likely to be within the territory of one or two otters that forage within the Site only occasionally. Currently there is no evidence to indicate that otter is likely to be breeding near to the Proposed Development, but this possibility cannot be ruled out.	Low (Local high)
Reptiles	All native species present in Scotland are included on the UK BAP / SBL priority species list. All open areas of mire, heath and acid grassland within the Site are considered to provide suitable habitat for reptiles, in particular common lizard. A number of potential refugia / hibernacula were also recorded.	Low (Local medium)
Salmonid Fish (and Aquatic Ecology)	Atlantic salmon is listed on Annexes II and V of the Habitats Directive. Watercourses within the Site are tributaries of the Water of Deugh, which is part of the River Dee catchment. The wider catchment supports important populations of Atlantic salmon and brown/sea trout. However, due to impassable barriers to migratory fish downstream from the Site there is currently no access for salmon to the watercourses within the Site. There is suitable habitat for salmonids and brook lamprey within several of the watercourses within the Site and the presence of populations of brown trout was confirmed through electrofishing surveys in 2020.	Medium (Regional)

6.7 CHANGES LIKELY TO OCCUR OVER TIME IN THE ABSENCE OF DEVELOPING THE PROJECT

6.7.1 Under a 'do nothing' scenario (i.e. the Proposed Development is not consented and constructed), the future baseline for the Site would be expected to be as follows:

- On the assumption that livestock grazing levels and management practice do not change, outside of the proposed woodland planting areas (see below), there should be a broadly similar distributions of existing broad habitat types and the presence / density of protected species populations to the current baseline within the Site. Impacts on the heath and mire habitats, due to the long-term effects of grazing and trampling by livestock and from artificial drainage, will be expected to continue.
- Within the two areas where new woodland has been or is likely to be established (Marbrack and Furmiston) there will be gradual change and loss of marshy grassland, wet heath and acid grassland habitats as the trees grow and eventually reach canopy closure. The duration of this change / loss will vary in relation to the ground conditions, tree species and management practice. Most of the new woodland is comprised of young Sitka spruce trees planted at typical commercial densities. In those areas there may be little remaining of the original ground flora after about 10-15 years due to the effects of shading and changes to soil water levels.

6.7.2 It is also important to note that there a several new and extensive tree planting plans (primarily comprising commercial Sitka spruce) on landholdings in the surrounding area. This will further reduce the extent of unenclosed grassland, heath and mire habitats and increase the relative importance of these habitats within the Site in a local context. This wider change in land-use will occur with or without the Proposed Development and has been taken in consideration in the impact assessment.

6.8 ASSESSMENT OF POTENTIAL EFFECTS

Introduction

6.8.1 This section assesses the potentially significant effects on the ecological features listed in Table 6.13. In summary, effects from the construction of the Proposed Development could arise from earthworks, the construction of new access tracks, turbine bases and associated infrastructure, the operation and servicing of the turbines, and from decommissioning. The resulting potential effects include loss of habitat, habitat degradation and fragmentation, disturbance / mortality to fauna and pollution of air, water and soil.

6.8.2 In this assessment 'impacts' are defined as actions associated with the construction or operation/implementation of the Proposed Development that result, directly or indirectly, in a material change to a feature. 'Effects' are defined as the consequences of the impact, which may be varied, for the ecological feature under consideration.

6.8.3 Effects are considered to include those that cause direct, indirect, secondary, cumulative, short-term, medium-term and long-term, permanent and temporary, beneficial and adverse effects on each ecological feature.

6.8.4 The systematic approach used to determine which of the adverse impacts and/or effects are 'likely to be significant' is outlined in Section 6.4.

6.8.5 The impact assessment below is undertaken for the construction phase, the operational phase and the decommissioning phase. It includes an assessment of all components of the Proposed Development including wind turbines and associated infrastructure.

6.8.6 Potentially significant adverse effects that may arise during the construction phase include:

- habitat loss, whether as an important habitat on its own merit or as a habitat supporting protected species, as a result of the construction of wind farm infrastructure;
- habitat degradation such as alterations in botanical composition in response to changes in hydrology as a result of earthworks, which is also recognised as habitat loss;
- loss of connectivity of habitat corridors within the Site and to the wider landscape;
- pollution from hydrocarbons and/or chemical spillages, which includes silt run-off into aquatic habitats;
- reduction in quantity and quality of instream habitat for fish and direct mortality of fish species; and
- disturbance to protected species caused by noise, vibration and artificial lighting.

Potentially significant adverse effects during the operational phase include:

- Bat collision / barotrauma from the moving turbine blades, and the potential increased risk of collision/barotrauma from the presence of aircraft warning lighting on the wind turbine nacelles potentially affecting insect prey or bats directly.

Potential adverse impacts that may occur during the decommissioning phase are similar to those that might occur during the construction phase, although they are anticipated to be smaller in effect magnitude.

Avoidance / Reduction of Potential Effects through Design

6.8.7 The layout of the Proposed Development has been subject to a detailed process of design optimisation, taking into consideration a wide array of environmental constraints including sensitive habitats and features important to the some of the key species that are the focus of this assessment. This has resulted in a reduction in potential loss/damage to sensitive habitats such as blanket bog, flushes, soakaways, watercourses and areas of mature mixed plantation woodland. Further information on the design evolution is provided in Chapter 2: Site Design and Evolution.

Construction Phase Effects

Tree Felling / Clearance

6.8.8 The proposed tree felling associated with the Proposed Development is detailed in Chapter 12. In summary, prior to construction works commencing, small areas of existing conifer plantation would be felled or cleared (in the case of young trees with no merchantable timber) to accommodate the construction works. It is intended that felling / clearance works would occur at the time of construction of the Proposed Development. The area of shelterbelt plantation to be felled is estimated at 0.75 ha (see Technical Appendix 12.1). In addition to this, a total of 13.06 ha of recently planted trees (planted in 2021-22) comprising mostly of non-native conifers would be cleared and the area left unplanted for the lifetime of the Proposed Development. In conclusion, the total area of woodland lost to the tracks, turbine bases and other hardstandings and an area of c. 100 m radius around the proposed wind turbines (shown as 'permanent fell' on Figure 12.3) is 13.81 ha, of which 95% is comprised of non-native conifers.

6.8.9 Planting of suitable native trees, along riparian corridors within the Site, is proposed as part of the outline HMP (total area of c. 29 ha, see Technical Appendix 6.6 for further details). Accounting for tree removal due to the Proposed Development, this would result in an eventual net gain of woodland cover within the Site of c. 15 ha. There would also be an improvement of woodland quality, in terms of the increased ecological value of native woodland planted along riparian corridors, in comparison to the, predominantly, non-native commercial conifer plantation and shelterbelt that it would replace.

Habitat Loss / Change

6.8.10 The estimated combined direct and indirect habitat loss resulting from the construction of the Proposed Development is presented in Table 6.14. The total extent of the development 'footprint' is estimated at c. 29 ha, with the following breakdown:

- Borrow pits (no. 3) – 6.75 ha
- Hardstandings – 7.52 ha
- Access tracks – 7.60 ha
- Temporary batching plant – 3.02 ha
- Substation / control building / battery storage facility – 1.80 ha
- Temporary compounds – 1.65 ha
- Turbine foundations – 0.58 ha (located within the hardstanding areas)
- Turning heads – 0.23 ha
- Met mast hardstanding – 0.11 ha

6.8.11 It is important to note that the estimated percentage loss / change for each habitat type is based on the figures provided in Table 6.8, which are the extents of the different habitat types within the defined survey area. Therefore, habitat loss/change is quantified in a local context, any potentially significant effects at larger geographic scales are discussed in the assessment text where relevant.

6.8.12 The habitat loss calculations encompass two parts:

- Direct habitat loss due to the infrastructure construction: that is, the area of the infrastructure 'footprint' plus an assumed average zone for earthworks associated with construction disturbance, such as embankments, cuttings, bunds and drainage ditches which is 5m wide; and
- Indirect habitat loss or change, defined as disturbance to hydrologically sensitive habitats, such as blanket bog, as a result of adjacent earthworks (i.e. anticipated changes in plant species composition as a result of localised changes to soil/peat saturation).

6.8.13 For these calculations, an additional 5 m zone of potential disturbance was added to the direct habitat loss area for hydrologically sensitive habitats (e.g. including Phase 1 habitat types: blanket bog; flush; wet heath; marshy grassland as described above).

6.8.14 The estimates of habitat loss / change include temporary works that will be subject to restoration (e.g. temporary construction compounds, batching plants, borrow pits). Some habitats are more readily restored than others, the extent to which construction phase losses / changes related to temporary works can be addressed by post-construction restoration is discussed for each broad habitat type below. In addition to the assessment of habitat loss, this section of the assessment also considers other potential effects from the construction of the Proposed Development, such as habitat fragmentation, where relevant to each feature.

Table 6. 14: Estimated habitat loss / change due to the construction of the Proposed Development

Phase 1 Habitat Type*	Habitat loss (ha)	Habitat change (ha)	Loss as % extent in survey area	% of Habitat Loss
Marsh / marshy grassland	21.63	7.86	4.97	44.60
Semi-improved acid grassland	10.18		7.62	20.99
Wet modified bog	9.37	3.76	3.31	19.32
Wet dwarf shrub heath	3.16	1.15	5.31	6.52
Blanket bog	1.28	0.59	1.13	2.64
Continuous / scattered bracken	1.21		4.18	2.50
Semi-improved neutral grassland	0.86		3.56	1.77
Acid / neutral flush	0.08	0.09	2.24	0.17
Mature conifer plantation woodland	0.73		4.11	1.51
Total	**48.50**	**13.45**		100.00

**Excludes areas of existing hardstanding (such as roads and tracks)*

Marshy grassland

6.8.15 An estimated 21.63 ha of marshy grassland habitat would be lost / impacted directly by the construction of the Proposed Development with a further 7.86 ha that may be subject to vegetation change as a result of localised effects on soil hydrology from construction works / excavations. This represents a high proportion of the overall estimated habitat loss (c. 45 %) and a relatively high proportion of the extent of this habitat, in comparison to other habitats, within the wider survey area (c. 5 %). However, this is partly a result of the deliberate avoidance, during the design process, of more ecologically sensitive habitats such as unmodified blanket bog (which comprise 10.4 % of the survey area but only 2.66 % of the development footprint). Additionally, areas of M23 rush pasture vegetation with a comparatively high plant species richness have also been avoided, where possible, through the wind farm design process. Most of the areas that would be affected have been impacted in the long-term by sheep and cattle grazing and trampling and are not particularly species-rich examples of this habitat. Restoration of some of the marshy grassland areas affected by temporary works would be attempted following completion of construction, this is estimated to be a minimum of 4.51 ha.

6.8.16 Without considering further mitigation, the assumed worst-case loss of c. 5 % of this habitat, taking into consideration the ecological importance, quality and abundance of this habitat within the Site and wider local area, is considered to have an overall effect of Low, on a feature of Low (Local medium) sensitivity, resulting in an effect significance level of Minor (**not significant**).

Semi-Improved Acid grassland

6.8.17 An estimated 10.18 ha of semi-improved acid grassland is anticipated to be lost / impacted by the construction of the Proposed Development. This habitat mostly occurs in small patches within the western and central parts of the Site, where it occurs on more freely draining soils and is preferentially grazed by livestock. It is more extensive in the eastern area. Due to the greater importance placed on avoiding areas of deep peat and GWDTEs this habitat type has not been specially avoided during the wind farm design process. Extensive areas of semi-improved acid grassland, that would have been impacted by the construction of the Proposed Development, have been recently planted with trees (during 2021-22), primarily non-native conifers, as part of commercial forestry plantations established in the eastern part of the Site (see Figure 12.2). This has been taken into consideration in the assessment of the potential extent of habitat loss. Restoration of some of the semi-improved acid grassland areas affected by temporary works would be attempted following completion of construction, this is estimated to be a minimum of 5.76 ha.

6.8.18 The assumed worst-case loss of c. 10 ha of this habitat, taking into account the current and future loss of this habitat from the recent/proposed tree planting in the eastern part of the Site, the quality and abundance of this habitat within the Site and wider local area, is considered to have an overall effect of Low, on a feature of Low (Local high) sensitivity, resulting in an effect significance level of Minor (**not significant**).

Modified blanket bog

6.8.19 An estimated 9.37 ha of the modified blanket bog habitat within the Site would be lost directly as a result of the construction of the Proposed Development and there is the potential for degradation to another 3.76 ha as a result of localised changes to peat hydrology (i.e. lowering of water levels) adjacent to new tracks, turbine bases and other excavations.

6.8.20 Without further mitigation, the loss of wet modified bog habitat, taking into account the ecological importance, quality and abundance of this habitat within the Site and wider local area, is considered to have an overall effect of Low (and close to Negligible), on a feature of Medium (Regional) sensitivity, resulting in an effect significance level of Minor (**not significant**).

Wet heath

6.8.21 An estimated 3.16 ha of wet heath habitat within the Site would be directly lost as a result of the construction of the access track to the Proposed Development. This would also lead to indirect effects as a result of localised changes to peat hydrology (i.e. lowering of water levels) adjacent to new tracks, turbine bases and other excavations which is estimated to affect a further 1.15 ha of this habitat type.

6.8.22 Without further mitigation, the loss of wet heath habitat, taking into account the ecological importance, quality and abundance of this habitat within the Site and wider local area, is considered to have an overall effect of Low, on a feature of Low (Local medium) sensitivity, resulting in an effect significance level of Minor (**not significant**).

Blanket bog

6.8.23 Most areas of less modified blanket bog within the Site have been avoided through the wind farm design process. The Proposed Development would result in the unavoidable loss of 1.28 ha of this habitat and potential degradation to another 0.59 ha as a result of localised changes to peat hydrology. However, this would represent a small percentage of the total area of the blanket bog resource within the Site and wider local area (c. 1 % of the extent of this habitat within the survey area) and this loss / area of potential habitat degradation is not considered to be significant at any geographical scale.

6.8.24 Without further mitigation, blanket bog habitat loss is considered to have an overall effect of Low. Although this effect is close to Negligible, in terms of the extent of the habitat directly affected, there is the potential for some loss of hydrological connectivity, resulting in localised drying / habitat degradation in the long-term. The effect of habitat loss/degradation on blanket bog habitats, a feature of Medium (Regional) sensitivity, is considered to have an effect significance level of Minor (**not significant**).

Acid flush

6.8.25 Most areas of acid flush habitat have been preferentially avoided through the wind farm design process. However, in some locations it has not been possible to completely avoid all flush features. An estimated 0.08 ha of acid flush habitat within the Site would be directly lost as a result of the construction of the Proposed Development. This would also lead to indirect effects as a result of localised changes to the hydrological regime supporting this habitat, adjacent to new tracks, turbine bases and other excavations, which is estimated to affect a further 0.09 ha of acid flush habitat.

6.8.26 Without further mitigation, the loss of acid flush habitat, taking into account the ecological importance, quality and abundance of this habitat within the Site and wider local area, is considered to have an overall effect of Low (and

close to Negligible), on a feature of Low (Local high) sensitivity, resulting in an effect significance level of Minor (**not significant**).

Conifer / broadleaved plantation

6.8.27 A small area of mature conifer plantation will require to be felled to accommodate the Proposed Development; the area is estimated at 0.73 ha. This is a habitat of negligible ecological value other than as a feature that may be used by foraging bats and its removal will be beneficial in terms of reducing the potential risk to bats from turbine collision / barotrauma. The effect of this habitat loss is considered to be negligible (**not significant**).

6.8.28 The areas of recent, predominantly, non-native conifer planting near to the Proposed Development would also be cleared of trees. At the anticipated time of construction these plantations would be at pre-thicket / thicket stage. In order to accommodate the construction of the Proposed Development (i.e. tracks, turbine hardstandings and a borrow pit) and to allow a minimum set-back of woodland edge from the turbine blades (as a bat mortality reduction measure) it is estimated that 4.44 ha of conifer planting and 0.34 ha of broadleaved planting would need to be cleared and left unplanted in the central area (Marbrack) and 7.99 ha of conifer and 0.29 ha of broadleaf tree planting in the eastern area (Furmiston). These areas of permanent clearance are shown on Figure 12.3. Without consideration of any mitigation to address this loss, the effect of clearance of primarily non-native pre-thicket/thicket conifer plantation and small areas of young broadleaved tree planting is considered to be negligible (**not significant**).

Aquatic ecology and fish

6.8.29 The construction of new access tracks would result in crossings being required for several of the watercourses within the Site. The number of crossings has been reduced through the design process to the minimum necessary to construct and operate the Proposed Development. A total of 31 crossings are proposed. Details are provided in Technical Appendix 8.1 (Water Crossing Assessment) and the locations are shown on Figure 8.1 of Chapter 8 (Hydrology).

6.8.30 Most of the proposed watercourse crossings are on minor watercourses / drainage ditches where suitably sized culverts would be installed. However, two of the crossing points (on the Benloch Burn and on the Marbrack Burn) are large enough to require larger single span structures.

6.8.31 All infrastructure, with the exception of tracks, has been designed to be at least 50 m from any surface waterbody marked on a 1:50,000 scale Ordnance Survey map. The need for new watercourses crossings has also been reduced, as much as possible, through the design process. Consequently, direct loss of any aquatic or riparian habitats as a result of the construction of the Proposed Development has been minimised. There would be some unavoidable disturbance to aquatic habitats during the construction of the proposed watercourse crossings. However, this is expected to be minimal and would not result in the direct loss of any particularly sensitive habitats (e.g. spawning gravels for salmonids).

6.8.32 Surface run-off from construction areas (e.g. mobilising fine sediments from exposed peat, clay and mineral soils from excavations and disturbed ground) and accidental chemical pollution (for example, from concrete, oils or fuels) can significantly adversely affect freshwater ecosystems. Such habitats can also be affected by dust from aggregate brought in to create access tracks and concrete for turbine foundations.

6.8.33 Clear-felling of conifer plantation forest can result in the acidification and siltation of watercourses due to ground disturbance and there is also the potential for acidification of watercourses draining the felled area. The effect usually lasts for two to five years after felling, depending upon the rate at which vegetation re-establishes (Forestry Commission 2011[23]). However, given the very small areas involved and the young age of most of the trees at the anticipated time of construction this is not considered to be a potentially significant effect in this case.

6.8.34 Without providing any further mitigation, i.e. in addition to the mitigation embedded within the design of the Proposed Development, surface water pollution is assessed as a Medium level effect collectively on the watercourses/sub-catchments within and draining the Site. Following a precautionary approach, taking into consideration the potential for adverse effects to propagate downstream and into sensitive habitats of Medium (Regional) sensitivity, this has the potential to result in an overall effect of Medium-High, and a significance level of Moderate-Major (i.e. potentially **significant**).

6.8.35 Construction works for the Proposed Development could potentially impact fish populations associated with the Water of Deugh, part of the River Dee catchment. Potential impacts of fish populations during construction could have a range of adverse effects such as fish mortality, decreases in aquatic invertebrate prey abundance, habitat damage (e.g. siltation of spawning gravels), habitat fragmentation and blocking of migration routes.

6.8.36 Any appreciable freshwater pollution incidents arising from the proposed construction works have the potential to affect fish species of conservation concern supported by aquatic habitats within and downstream of the Proposed Development.

6.8.37 Without consideration of further mitigation, over and above that embedded within the design of the Proposed Development, the potential overall effect level of potential fish mortality (direct and indirectly as a result of construction works) is assessed as Medium-High for salmonid fish, as a feature of Medium (Regional) sensitivity, a significance level of Moderate-Major (i.e. potentially **significant**).

6.8.38 There is the potential for new, poorly designed and installed, culverts to create a barrier to the free movement of fish (including consideration of within-catchment movements by species such as brown trout) and result in scouring of sensitive instream habitats. Without considering further mitigation, fish habitat loss and fragmentation due to construction is assessed as a Low effect with a significance level of Minor and **not significant**.

Badger

6.8.39 The areas where most of the badger activity has been recorded during the baseline surveys would not be directly affected by the Proposed Development. The risk to any direct effects on badger setts is considered to be Negligible. There would be some loss of foraging habitat, however, given the comparatively small area affected and large extent of suitable foraging habitats present in the survey area this is not significant.

6.8.40 Without consideration of further mitigation, the effect of construction works on badgers and badger habitats is considered to be Negligible, which is **not significant**.

Bats

6.8.41 There are no known bat roost sites or potentially suitable features (e.g. associated with trees, buildings or other artificial structures) within the Site that could be directly or indirectly affected by the construction of the Proposed Development. No trees with potential bat roost features were recorded in the areas that are proposed to be felled. Therefore, there are anticipated to be no effects on bat roost resource within the Site from the proposed tree felling and construction works.

6.8.42 Without considering further mitigation, the loss, or change to, foraging habitats and commuting features in the landscape are considered to have an overall Negligible effect on bat populations (**not significant**).

Otter

6.8.43 Without further mitigation, loss of habitat and/or habitat connectivity would be unlikely to cause a significant effect on otter because of the low levels of otter activity within the vicinity of the Proposed Development. Otter evidence is scant within the wider survey area and what has been recorded is closely associated with the two main watercourses (Benloch Burn and Marbrack Burn) where bridges are proposed. Otter may move across and forage within wetland and bog habitats away from watercourses at certain times of the year (particularly during the spring).

[23] Forestry Commission (2011). Forests and water: UK Forestry Standard Guidelines. Forestry Commission, Edinburgh.

There is some potential for localised habitat disturbance at the proposed watercourse crossing construction points. However, no appreciable loss of otter habitat is anticipated. Loss of habitats from the Proposed Development is therefore considered to be Negligible for the otter population (**not significant**).

Reptiles

6.8.44 The estimated loss of suitable reptile habitats to the Proposed Development is considered to be negligible for the assumed populations within and near to the Site (i.e. local-scale) in the context of the extent of similar habitats that would be unaffected within the wider area. Without considering additional measures, this is considered to have no greater than a Low effect, on a feature of Low (Local medium) sensitivity, which would result in a significance level of Minor (**not significant**).

Construction Phase Effects - disturbance to protected species

6.8.45 The anticipated duration of the construction of the Proposed Development is 18 months. Refer to Chapter 3: Detailed Project Description for these tasks with the estimated timing relative to the commencement of works and durations.

6.8.46 The following provides the results of the assessment of potential effects on the relevant protected species features from construction-related disturbance and the risk of killing/injury by construction vehicles and plant.

Badger

6.8.47 There is the potential for felling and construction works to temporarily disturb badgers at their setts, along their paths and from important foraging areas. There is also the potential for badgers to be killed or injured by vehicle / plant movements. Without considering further mitigation, and notwithstanding the legal protection afforded to badgers and their setts, effects from disturbance, and the risk of killing and injury to badger arising from construction activities, has been assessed conservatively as a Low overall in the short-term, on a feature of Low (Local high) sensitivity, resulting in a potential effect significance level of Minor (**not significant**).

Bats

6.8.48 Construction activities are not predicted to result in any appreciable disturbance to roosting bats. However, unrestricted working hours and associated lighting could potentially affect commuting and/or foraging bats.

6.8.49 Without considering further mitigation, and notwithstanding the legal protection afforded to bats and their roosts, effects from sources of disturbance from felling and construction activities has been assessed conservatively as a Low overall in the short-term, as a collective feature of Medium (Regional) sensitivity, resulting in a potential effect significance level of Minor (**not significant**).

Otter

6.8.50 Otters are highly mobile and can move away from the immediate vicinity of sources of disturbance associated with construction works. The effects of short-term disturbance are unlikely to be significant, providing that breeding sites or resting places are unaffected. Prolonged disturbance to otter habitat may displace animals from important foraging habitats which may affect body condition and breeding success.

6.8.51 There are no confirmed resting sites near to the Proposed Development and none of the potentially suitable resting sites are considered likely to be suitable as a natal holt (i.e. a breeding site). Additionally, there is a legal requirement to ensure that impacts on otter and their resting places are avoided. However, some degree of disturbance, should otter be present in the area, would be unavoidable during the works.

6.8.52 There is a risk of killing or injury to otter from collisions with moving construction vehicles. No resting places are considered to be at risk from the works. Although it appears to be the case that otter are only infrequently present along the minor watercourses that drain the Site and generally unlikely to be encountered during works other than at the proposed watercourse crossings upgrades on the access tracks. However, some risk from vehicle collision would be unavoidable.

6.8.53 Without considering further mitigation, and notwithstanding the legal protection afforded to otters and their breeding sites or resting places, the effect of disturbance from construction activities has been assessed as a Low overall, resulting in a potential effect significance level of Minor (**not significant**).

Reptiles

6.8.54 Reptiles are also at risk of being killed during construction, particularly during the initial vegetation clearance and soil strip but also from vehicle movements along access tracks etc. Without considering additional measures, related to the prevention of killing or injuring reptiles (as legally protected species), on a precautionary basis this is considered to have no greater than a Low effect, on a feature of Low (Local medium) sensitivity, which would result in a significance level of Minor (**not significant**).

Potential Off-site Accommodation Works

6.8.55 Construction of the Proposed Development requires delivery to the Site of large components (such as turbine blades) transported on long trailers (i.e. abnormal loads). An Abnormal Load Access Assessment has been completed to assess the load delivery route from Glasgow to the Proposed Development site (see Appendix 11.1). This assessment has identified 60 points of interest requiring further consideration, including engineering works, to create areas of overrun to negotiate the pinch points. These locations do not form part of the Proposed Development as they lie outside of the Site. However, they have been reviewed, via desk study, in relation to their potential to result in significant adverse effects on important ecological features, including sites designed for nature conservation and protected species.

6.8.56 The results of this review are provided in Technical Appendices 11.3. In summary, it was concluded that the potential roadside works, providing that they are undertaken following standard practice with respect to environmental protection and management, should not result in any appreciable adverse effects on any statutory designated sites. Impacts on habitats outside of designated sites should be negligible as the majority of the work would affect small areas of the existing road-side verge, which is already subject to regular vegetation management. The risk to protected species is considered to be low, but not negligible, and it is recommended that ecological surveys (including a Phase 1 habitat and protected species survey) are completed for some of the locations to ensure that the potential risk to protected species can be fully assessed prior to works commencing.

Construction Phase – Outline of Best Practice Methods & Mitigation

6.8.57 The design of the Proposed Development has taken into account a range of factors related to Site ecological constraints (e.g. watercourses, sensitive terrestrial, wetland and aquatic habitats and important areas for protected species) and as a result the turbines and associated infrastructure have avoided areas that are considered to have comparatively high sensitivity (e.g. areas of less modified blanket bog, GWDTEs, watercourses).

6.8.58 With the exception of the potential for pollution to watercourses arising from construction works, no significant construction phase effects are predicted for any ecological feature. However, measures are proposed to help ensure that potential adverse effects on all sensitive features are further reduced during the construction phase and that the proposed works proceed lawfully with respect to the legislation protecting the relevant species.

6.8.59 The following provides a summary of the mitigation and species protection measures proposed to further reduce (or avoid) potential adverse effects from construction works. Further detail with respect to proposed approach to construction environmental management is provided in Chapter 8 (Hydrology) and associated technical appendices, as referenced below.

Environmental Protection Measures during Construction

6.8.60 The environmental protection measures during construction works would be detailed within a project Construction and Environmental Management Plan (CEMP). The outline content of the CEMP is provided in Chapters 3and 8 of the EIAR. The CEMP would be prepared following the determination of the application and would include details of the proposed approach to construction methods and environmental protection during all aspects of construction works. The detailed CEMP documents would be approved in advance of construction commencing with DGC, in consultation with SEPA and NatureScot.

6.8.61 The CEMP would include detailed Method Statements based on current best practice for:

- Micro-siting (where possible, under guidance from the Ecological Clerk of Works) during detailed design / construction to further avoid areas of particularly sensitive habitat;
- Pollution prevention measures during tree felling/clearance, site clearance and construction works;
- Pollution spill kits would be made available at suitable locations across the Site and would be maintained. All site workers would be briefed on the location of the spill kits and how to use them effectively, and what further actions to take should a significant pollution incident occur;
- Site drainage, water monitoring and sensitive habitat protection (including buffers around GWDTEs);
- Appropriate use and storage of excavated soils and vegetation turfs for track verges and batters, wind turbine bases and crane pad batters;
- Implementation of a Peat Management Plan (Technical Appendix 8.3: Peat Management Plan); and
- Site restoration plan and methods, re-vegetation and monitoring methods.

6.8.62 Tree felling/clearance operations would follow all applicable and current best practice guidance to avoid / minimise impacts on sensitive habitats (e.g. Forests and Water Guidelines).

6.8.63 A suitably experienced and qualified ECoW would be appointed for the duration of the pre-works, construction and Site restoration phases. The ECoW would oversee the implementation of ecological mitigation/ environmental protection measures during construction. The ECoW would be impartial and have the authority to stop works immediately should any environmental issues arise.

6.8.64 The appointment of the individual(s) covering the ECoW role would be approved in advance in with DGC (in consultation with NatureScot). The ECoW would provide monthly reports on the progress of the works in relation to the implementation of the environmental protection measures and a final report at the end of the construction and Site restoration works. Copies of the reports would be provided to NatureScot, SEPA and DGC.

6.8.65 The ECoW would be integral in the successful implementation of the CEMP and the Species Protection Plans (see below).

6.8.66 Additionally, there would be ecological input to the detailed design of the Proposed Development. This will include consideration of locations where further reduction in impact on habitats sensitive to changes to local hydrology, such as spring and flush features, might be achieved through micro-siting and the detailed design process. This will include consideration of the wind turbine hardstanding and crane pad design, where there is scope to modify the detailed layout to further reduce impacts on sensitive habitats. For example, at T13, which is located near to some acid flush features and where there is potential to reduce impacts on this habitat further through the detailed design of the turbine hardstanding areas.

Species Protection Plans

6.8.67 Species Protection Plans (SPPs, for each relevant species) would be developed by a suitably experienced ecologist and approved with DGC (in consultation with NatureScot), in advance of works commencing on the Site. The SPPs would set out in sufficient detail the measures and procedures that would be followed to ensure the protection of sensitive species as well as legally protected species during construction.

6.8.68 The SPPs would detail the pre-works survey methods for each species that could potentially be affected by the construction works. To ensure that the baseline information for all potentially affected protected species is up-to-date, surveys would be undertaken not more than 12 months prior to the commencement of works. The pre-works surveys would be completed in all areas of suitable habitat up to 250 m around proposed turbine locations, access tracks and other wind farm infrastructure.

6.8.69 The SPP would also detail the measures to ensure that the effects of construction works are avoided or minimised as far as is practically possible and that the works proceed lawfully with respect to the legislation protecting the relevant species.

6.8.70 Outline SPPs are provided in Technical Appendix 6.5. The following provides a summary of the proposed approach for each species that could potentially be affected by the felling and construction works.

Badger

6.8.71 A pre-construction survey would be completed not more than 12 months ahead of the proposed works to search for any badger setts near to any of the proposed tree felling or construction works. If works have to be undertaken within 50 m of any sett a survey / assessment report and protection plan would be produced by the ECoW. A licence for the works would be sought from NatureScot as required.

6.8.72 Additional best practice measures would be undertaken where construction occurs in areas that the ECoW believes badger could be present. These would include: no activity to be undertaken at night or dawn/dusk periods; no lighting affecting setts or well-used badger paths; covering of all open excavations or providing suitable escape ramps for badgers (and other animals) to use.

Bats

6.8.73 No bat tree roosts have been identified within or near to the Proposed Development. The potential for any roosts to be present in areas which could be directly affected by the proposed tree felling and construction works is considered to be low due to the general lack of trees with potentially suitable roost features. However, a pre-construction survey would be completed not more than 12 months ahead of the construction works to identify any potential bat roost near to any works. Works would preferentially be micro-sited to avoid any confirmed roost site. If works have to be undertaken within 50 m of any roost a survey / assessment report and protection plan would be produced by the ECoW. An appropriate EPS development licence would be sought from NatureScot.

Otter

6.8.74 A pre-construction survey would be undertaken for otter by a suitably experienced ecologist not more than 12 months before the start of construction. Otter breeding is largely non-seasonal, and a breeding holt may contain a nursing female with young at any time of the year. Depending on the circumstances, micro-siting of the works would be considered in the first instance to avoid damage or disturbance to the site. Alternatively, construction activities would be halted, waiting until it was certain that the site was no longer in use. If avoidance was not possible an EPS licence would be sought from NatureScot and a specific assessment and mitigation plan would be developed. Protection zones for otter would be at least 200 m for breeding sites (including suspected breeding sites during the period of monitoring to determine the status of the site). For sites where otters are not breeding, the exclusion zone will be 30 m.

6.8.75 If construction were to be undertaken within 50 m of any otter shelter and there was no likelihood of this being a breeding holt, and the shelter could not be avoided by a suitable buffer zone, a location-specific assessment report and protection plan would be produced by the ECoW. An appropriate EPS development licence would be sought from NatureScot.

6.8.76 Additional best practice measures would be undertaken where construction occurs in areas that the ECoW believes otter could be present. These would include: no activity to be undertaken at night or dawn/dusk periods; no lighting adjacent to watercourses; and covering of all open excavations and pipes.

Pine Marten

6.8.77 No evidence of the presence of pine marten has been found but the Site provides limited suitable habitat but is located near to areas where pine marten is known to occur. A pre-construction survey would be undertaken for pine marten by a suitably experienced ecologist not more than 12 months before the start of construction. If active resting places are identified within 100-200 m of a construction area, micro-siting of the works would be considered, particularly if there was a possibility of a breeding site being affected. Alternatively, construction activities would be halted, waiting until it was certain that the site was no longer in use.

6.8.78 If construction were to be undertaken within 50 m of a pine marten den, and monitoring had confirmed that this was not an active breeding site, and the location could not be avoided by a suitable buffer zone, a location-specific assessment report and protection plan would be produced by the ECoW. An appropriate development licence would be sought from NatureScot.

Red Squirrel

6.8.79 No evidence of the presence of red squirrel was found during the baseline surveys for this EIA but the Site provides very little suitable habitat. However, as some limited felling of mature plantation is required an outline SPP for red squirrel has been included, on a precautionary basis, in Technical Appendix 6.5.

Reptiles

6.8.80 All reptile species which could be present within the Site are legally protected from killing or injury. Reptile populations, if present, are anticipated to be at a low density within the Site. Common lizard is the most likely species to occur, primarily within open moorland and rough grassland habitats. There are some features within the Site that could provide suitable refugia and winter hibernacula for reptiles.

6.8.81 Appropriate measures will be taken to minimise the risk to reptiles from the works. The ECoW will make an assessment of reptile habitats and any suitable refugia/hibernacula features, during pre-works checks of the proposed construction areas. The detailed approach to minimising the risk to reptiles from the works will depend on the circumstances and time of year. This may include, for example, by-hand destructive searching by a suitably experienced ecologist of any sections of dry-stone wall that may need to be dismantled to allow for access track construction. The detailed approach to the protection of reptiles will be approved in advance with DGC (in consultation with NatureScot) prior to works commencing, as part of the development and consultation process for the SPPs.

Fish / Watercourses

6.8.82 A Fish Monitoring Plan (FMP) will be approved with DGC, in consultation with relevant regulators and stakeholders (e.g. Marine Scotland, the Dee District Salmon Fishery Board and the Galloway Fisheries Trust). The FMP would be developed in detail, in consultation with the Board/Trust, well in advance of works commencing on the Site. An outline document is provided as Technical Appendix 6.7. The FMP would set out in sufficient detail the proposed fish and water quality monitoring regime prior to, during and following construction. It would also set out the measures and procedures that would be followed to ensure the protection of fish and fish habitats during the works. Water quality monitoring is also proposed prior to and during the construction phase, this is outlined in the Pollution Prevention & Incident Plan (see Technical Appendix 8.6 for further details).

6.8.83 The detailed design of all new, and any up-graded, culverts/watercourse crossings would be approved with DGC, in consultation with SEPA and the Board/Trust to ensure that any potential adverse effects on fish are minimised. Pre-works fish rescues would also be completed at the watercourse crossing locations highlighted in Table 6.2 and in Technical Appendix 6.4.

Site Restoration

6.8.84 Reinstatement of areas of disturbed ground, outside of the plantation areas, would be carried out. This would include re-use of suitable turves and soil, from areas stripped prior to construction works, and native plant seed mixes (appropriate to the habitats affected and the soil conditions) to encourage rapid revegetation and stabilisation of areas of exposed peat and mineral soils along the edges of the tracks, turbine bases, crane platforms, temporary compounds, borrow pits etc.

6.8.85 There are proposals to carry out habitat enhancement, particularly with regard to blanket bog and wet heath habitats within the Site that have been subject to long-term modification by livestock grazing, trampling and artificial drainage. This is discussed further under the Outline Habitat Management Plan heading, below, and within Appendix 6.6 (Outline Habitat Management Plan). The residual long-term effects on blanket bog habitats as a result of the habitat improvement measures proposed under the HMP are reported under the operational phase assessment,

Residual Effect Assessment

6.8.86 The residual effects of the construction phase are summarised in Table 6.15. All effects are adverse unless otherwise stated.

Table 6.15: Summary of Residual Effects for the Relevant Habitat and Faunal IEFs during the Construction Phase

Feature	Effect without mitigation	Summary of mitigation measures	Residual effect / confidence / duration
Marshy grassland (including associated GWDTEs)	Minor – Habitat loss / degradation	• ECoW supervision of the works. • Micro-siting during detailed design to further avoid areas of particularly sensitive habitat. • Follow the best practice measures detailed in the CEMP to protect sensitive habitats during construction. • Implement site restoration plan, seeding to encourage re-vegetation where appropriate. • Re-use of suitable excavated peat and vegetated turves for bog restoration within the Site (see the Peat Management Plan for further details). • Monitor recovery and take action to address any significant issues with revegetation.	Minor Certain Long-term
Blanket bog (including modified areas)	Minor – habitat loss / degradation		Minor Certain Long-term
Other terrestrial habitats	Minor-Negligible – habitat loss / degradation		Minor-Negligible Certain Long-term
Aquatic Ecology and Salmonid Fish	Moderate-Major – Pollution (siltation, acidification, hydrocarbons)	• ECoW supervision of the works. • Tree felling/clearance operations to follow best practice detailed in the Forest & Water Guidelines. • Pollution prevention measures, including silt management and spillage procedures, as detailed in CEMP, carefully implemented and monitored. • Effective construction drainage design and management.	Minor Near-certain Short to medium-term
	Minor – Habitat loss / degradation / fragmentation		Negligible Certain Long-term

Feature	Effect without mitigation	Summary of mitigation measures	Residual effect / confidence / duration
		• Monitoring of water quality during the works, rapid and effective reaction to exceedances. • Implementation of the Fish Monitoring Plan. • Pre-works fish rescues completed where required.	
Badger	Negligible – habitat loss / degradation / fragmentation for foraging	• Pre-works survey, appropriate measures to be implemented should any badger setts be at risk of disturbance or damage. • ECoW supervision of the works. • Follow SPP protocol for the protection of badgers and their setts. • Vehicle speed restrictions of <15 mph on Site would be strictly imposed. • No lighting near to setts or known paths. • Providing escape ramps in deep excavations.	Negligible Certain Long-term
	Minor – disturbance from construction activities and lighting		Negligible Near-certain Short-term
	Minor – killing / injury		Negligible Near-certain Short-term
Bats	Negligible – habitat loss / degradation / fragmentation for commuting and foraging	• Pre-construction bat roost survey to be carried out. Appropriate measures to be implemented if roosts are present and are likely to be affected. • ECoW supervision of the works. • No lighting near to roosts or known commuting routes. • Follow SPP protocol for the protection of bats and any identified roosts. • Pollution prevention measures for watercourses (as detailed above).	Negligible Certain Long-term
	Negligible – roosting habitat loss		Negligible Near-certain Long-term
	Minor – Disturbance from noise and lighting		Negligible Near-certain Short-term
Otter	Negligible – habitat loss / degradation / fragmentation for commuting and foraging	• Pre-construction otter survey to be carried out. Appropriate measures to be implemented if resting sites are present and are likely to be affected. • ECoW supervision of the works. • No lighting near to resting sites or known commuting routes (main watercourses). • Follow SPP protocol for the protection of otter and any identified resting sites. • Pollution prevention measures for watercourses (as detailed above). • Vehicle speed restrictions of <15 mph on Site would be strictly imposed.	Negligible Certain Long-term
	Minor – Disturbance from noise and lighting, risk of killing/injury		Negligible Near-certain Short-term
Reptiles	Minor – habitat loss / degradation / fragmentation.	• ECoW supervision of the works • Pre-works survey / assessment of reptile habitats affected by the works. • Follow SPP protocol to protect reptiles during the works.	Negligible Certain Long-term
	Minor – killing / injury		Negligible Near-certain Short-term

Operational Phase Effects - Pollution

Watercourses

6.8.87 There is a potential risk associated with all vehicle and plant use (e.g. fuel, oil, hydraulic fluid spills) near to watercourses during day-to-day Site operations and during track repairs, drainage maintenance and larger works that may need to be carried out periodically such as turbine blade replacement. However, the potential for such incidents would be expected to be much more limited in extent, duration and frequency in comparison to the construction phase.

6.8.88 Without further mitigation, the effects of freshwater pollution during the operational phase are assessed as Medium on watercourses, resulting in a potential effect significance level of Moderate (**not significant**).

Salmonid Fish

6.8.89 Without further mitigation, the effects of freshwater pollution incidents during the operational phase are conservatively assessed (i.e. on a reasonable 'worst case' scenario) as a potential Medium level effect on salmonid fish, as a feature of Medium (Regional) sensitivity, resulting in a potential effect significance level of Moderate (**not significant**).

6.8.90 Systematic annual monitoring of salmonid fish populations and water quality is proposed during the operational phase of the Proposed Development. This would be detailed within the FMP, which would be developed and approved with DGC, in consultation with the relevant stakeholders, well in advance of the start of works on the Site.

Operational Phase Effects – Disturbance & Displacement

Badger

6.8.91 Following the completion of construction and site restoration works, reduction in the number of people on the Site and cessation of other sources of disturbance, it is anticipated that badgers will habituate to the presence of the Proposed Development over time. They will have access to and use suitable habitats within the Site in a manner similar to the situation prior to works commencing. The presence of new access tracks increases the risk of vehicle collision mortality for the badger population present in the area, in comparison to current levels. However, vehicle movements during the operational phase would be infrequent and mostly during the day when badgers tend not to be active. Without mitigation, vehicle collision risk and potentially disturbing activities during the operational phase of the Proposed Development on badger are conservatively assessed as collectively having a Low impact on badger, as a feature of Low (Local high) sensitivity, resulting in a Minor adverse effect which is **not significant**.

Bats – collision risk and barotrauma

6.8.92 Bat fatalities at wind farms have been attributed to both direct collision and barotrauma. Barotrauma involves tissue damage to air-containing structures in the body caused by rapid or excessive pressure change which occurs near to rotating turbine blades. Due to the long lifespan and slow reproductive rate of bats, a possible increase in mortality due to wind turbines has the potential to have a significant effect on local populations. Bat mortality from wind turbines has been reported from a large number of operating wind farms in Europe and North America with mortality rates varying considerably from site to site. An extensive study of operating wind farms in the UK found bat fatality rates similar to those reported for wind farms elsewhere in Europe, ranging from 0 to 5.25 bats per turbine per month (Mathews *et al*. 2016[24]).

6.8.93 Studies of bat mortality on wind farms in north-west Europe have revealed that the estimated number of bats killed annually was lower on flat, open farmland away from the coast, higher in more complex agricultural landscapes, and highest at the coast and on forested hills and ridges (Rydell *et al* 2010[25]). The species most affected were pipistrelle spp., Leisler's bat and noctule, as these species are adapted for foraging in open areas. Additionally, mortality was associated with low wind speeds in late July to early October, with mortality increasing with turbine tower height and rotor diameter but not associated with the distance of the lowest rotor from the ground or the number of turbines.

6.8.94 Bat mortality at wind farms does not appear to be the result of chance events, however, the key elements that result in some sites posing a relatively high risk to bats are still not fully understood. In a review of published studies of bat and wind farm interactions Arnett *et al.* (2016[26]) highlighted a number of factors are potentially important influences on the risk that individual wind farms present to bat populations:

- there is no clear evidence that specific turbines within a wind farm are more 'risky' for bats than others. therefore targeted mitigation at the individual turbine scale is unlikely to be effective, measures must be applied to the wind farm as a whole (NB there is some evidence from Vattenfall's monitoring of operational wind farms that individual turbines can be more hazardous and a turbine-specific approach could be appropriate where such mitigation is needed);
- most bat fatalities, in temperate regions of North America and Europe, occur during late summer and early autumn;
- bats may be attracted to wind turbines and/or their insect prey may be attracted resulting in an increased risk to bats that would not be evident during pre-construction monitoring;
- there is weak or contradictory evidence for the influence of topography or habitat type on bat mortality risk; and
- most bats are killed on nights with relatively low wind speeds (e.g. <6 m/s) and relatively warm air temperature. This is likely related to an associated increase in aerial insect activity at height.

6.8.95 Recent published studies and reviews of the issue of bat wind farm mortality (e.g. Arnett *et al*. 2016, Lintott *et al*. 2016[27], Mathews *et. al* 2016, Richardson *et al.* 2019[28]) have highlighted issues with the highly variable nature of pre-construction bat activity data, and the relatively infrequent occurrence of bat fatalities at most wind farms that have been monitored (and for which there is data available). At afforested sites the baseline survey data is also unlikely to be representative of bat activity once the trees have been felled and the wind farm is operational. In this case, the survey methods have been adapted to try to address this, but it is not possible to entirely account for this effect. It is therefore important that the interpretation of pre-construction data and in the assessment of potential impacts there is recognition of the limitations of pre-construction monitoring studies and the uncertainties about the risk to bats from individual wind farm developments.

6.8.96 Bats species adapted to fly in open, less cluttered air-space (i.e. away from vegetation) are considered to be most vulnerable to wind turbine mortality. Several species that have been recorded using the Site during the baseline surveys, in particular, Nyctalus and Pipistrelle species, are considered to be at a comparatively high risk from wind turbine mortality (NatureScot *et al*. 2019) due to their behaviour and flight capabilities (i.e. being able to exploit open habitats and potentially hunting for insects within the height band that the wind turbines would be operating within).

6.8.97 Although the Proposed Development is not located within an area defined as being of high-risk to bats (Newson *et al.* 2017[29]), the analysis of Site-wide risk, following the current guidance (NatureScot *et al*. 2019[21]), determined that at typical activity levels the Proposed Development presents a Medium risk to Leisler's bat and Pipistrelle bat species and at maximum activity levels the risk is High. Given the uncertainties about the potential effects on bat populations (an industry–wide issue) and the sensitivity of the species / populations that could be affected a precautionary approach to the assessment of this impact is considered to be appropriate.

6.8.98 The Proposed Development has been designed to reduce, where possible, the potential for operational bat mortality by avoiding features that are likely to attract high levels of bat activity (e.g. woodland edges and riparian zones along the main watercourses). The wind turbines would mostly be located in open, exposed locations, away from mature woodland. The proposed tree felling/clearance would ensure that woodland edges are at least c. 100 m from the proposed wind turbine locations. Which will ensure a minimum 50 m offset from the blade tips to the woodland edge up to the anticipated tree heights. This follows current best practice guidance to reduce the risk of wind turbine bat mortality.

6.8.99 There is also the potential for the proposed aircraft warning lighting, required to be fitted to wind turbine nacelles, to influence bat behaviour (either directly or indirectly, e.g. by influencing insect prey behaviour) and potentially increase the risk of collision/barotrauma. The proposed aircraft warning lighting is detailed in Chapter 13 (Other Issues), section 13.4. In summary, the amount lighting had been reduced to the minimum necessary to comply with civil and military aviation safety requirements. Medium intensity steady red lights (2000 candela) would be fitted to turbines 1, 3, 10, 12 and 14 and infra-red lighting fitted to all turbines. The lights would be on during hours of darkness (defined as when natural light levels fall below 500 lux). In addition to reducing the number of turbines fitted with visible lighting, the Applicant is also exploring the potential for an aircraft proximity detection system to be installed which would switch on the five visible spectrum lights only when an aircraft approaches the Proposed Development at low altitude.

6.8.100 The proposed aircraft warning lighting has the potential to increase the risk to bats from the operating wind turbines by acting as an attraction to the bats or to their aerial insect prey. Some bat species are drawn to artificial light (e.g. mercury-vapour street lights in particular) but, unlike birds, the purpose of this behaviour is to increase foraging efficiency due to the high density of aerial insects that can gather around bright lights at night. There is no evidence that artificial lights disorientate bats to the same extent as can be the case for nocturnal migrant birds. Therefore, in relation to the proposed wind turbine lighting, the primary potential concern for bats is for the lights to attract insects and thereby increase bat foraging activity and at the same time the risk of blade collision or barotrauma from the rotating blades.

6.8.101 From the few monitoring studies that have considered lighting as a factor in bat deaths at wind turbines, lighting of turbines does not appear to appreciably affect mortality risk (e.g. Bennett & Hale 2014[30]). However, most studies

[24] Mathews, F., Richardson, S., Lintott, P., & Hosken, D. (2016). Understanding the Risk to European Protected Species (bats) at Onshore Wind Turbine Sites to inform Risk Management. Final Report to Defra [available from: http://randd.defra.gov.uk]

[25] Rydell, J., Bach, L., Dubourg-Savage, M.J. et al. (2010) Mortality of bats at wind turbines links to nocturnal insect migration?. Eur J Wildl Res 56, 823–827.

[26] Arnett, E.B., Baerwald, E.F., Mathews, F., Rodrigues, L., Rodríguez-Durán, A., Rydell, J., Villegas-Patraca, R. & Voigt, C.C. (2016). Impacts of Wind Energy Development on Bats: A Global Perspective. In: Voigt C., Kingston T. (eds) Bats in the Anthropocene: Conservation of Bats in a Changing World. Springer, Cham.

[27] Lintott, P.R., Richardson, S., Hosken, D., Fensome, S., & Mathews, F. (2016). Ecological impact assessments fail to reduce risk of bat casualties at wind farms. Current Biology, (26) 1135–1136.

[28] Richardson, S. M., Lintott, P. R., Hosken, D. J. & Mathews, F. (2019). An evidence-based approach to specifying survey effort in ecological assessments of bat activity. Biological Conservation, (231) 98-102.

[29] 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.

[30] Bennett, V.J. & Hale, A.M. (2014). Red aviation lights on wind turbines do not increase bat turbine collisions. Animal Conservation, 17, 354-358.

are from North America where flashing red aviation warning lights have been deployed rather than solid burning red lights. Most aerial insects that are attracted by light directly (i.e. display phototaxis) are particularly responsive to lights that emit in ultraviolet A wavelengths (i.e. 400 - 320 nm). Consequently, the attractiveness of the proposed visible spectrum red lights and the infrared lights would be expected to be poor for most insect species in comparison to UV lights or bright white lights.

6.8.102 There is no widely accepted guidance on the issue of turbine lighting and bats in the UK. On the basis of currently available information, which provides no evidence of an effect from lighting from the few studies that have been published to date, it is reasonable to conclude than the proposed aircraft warning lights should have no appreciable additional effect in relation to bat mortality risk.

6.8.103 Without considering further mitigation, the mortality risk to bats (particularly Leisler's bat) form blade collision or barotrauma, is assessed on a precautionary basis as a Medium-High effect overall, on a collective feature of Medium sensitivity, resulting in a significance level of Moderate-Major (**significant**).

Otter

6.8.104 Otter are not anticipated to be at risk of any significant effects during the operational phase. Overall, the risk to this species is considered to be low in comparison to the construction phase. There is, however, the theoretical potential for otter mortality from vehicle movements on access tracks near to watercourses in particular. Overall, potential operational phase effects on otter are considered to be no greater than Low, on a feature of Low (Local medium) sensitivity, resulting in a significance level of Minor (**not significant**).

Reptiles

6.8.105 Reptiles are not anticipated to be at risk of any significant effects during the operational phase. There is, however, the theoretical potential for mortality from vehicle movements on access tracks. There is also the potential for some habitat disturbance during significant maintenance operations, such as turbine blade replacement. Overall, potential operational effects on reptiles are considered to be no greater than Low, on a feature of Low (Local medium) sensitivity, resulting in a significance level of Minor (**not significant**).

Operational Phase - Mitigation

General Best Practice Measures during the Operational Phase

6.8.106 During the operational phase, periodic maintenance would be required on the wind turbines and tracks. Access to areas requiring maintenance would be confined to areas previously used for construction activities with no new access tracks constructed.

6.8.107 Method statements for all potential maintenance and emergency maintenance works would be developed in accordance with environmental best practice to ensure that the risk of appreciable physical damage or pollution to sensitive terrestrial and freshwater habitats during operational Site activities are minimised.

6.8.108 Site operational drainage would be designed and implemented to best practice standards and would be regularly checked and maintained.

6.8.109 Pollution spill kits would be made available at suitable locations across the Site and would be maintained. All site operatives would be briefed on the location of the spill kits and how to use them effectively with clear steps on any further actions to take should a significant pollution incident occur.

Outline Habitat Management Plan

6.8.110 An outline Habitat Management Plan (HMP) is provided as Appendix 6.6 to this Chapter and the indicative habitat creation and enhancement areas are shown on Figure 6.9. It is intended that the HMP document would be developed, in consultation with NatureScot and other key stakeholders (e.g. GFT), well in advance of works commencing on the Proposed Development, should it receive approval.

6.8.111 The HMP would detail the proposed drain blocking plan, management prescriptions, management programme, long-term vegetation and hydrological monitoring of the bog restoration area and proposals for the restoration of dwarf shrub-heath and planting of suitable native broadleaved trees, particularly along riparian corridors within the Site. The scope of the proposed habitat enhancement is intended to achieve a net biodiversity gain within the Site in the long-term.

6.8.112 The Proposed Development has been designed to minimise the loss of sensitive habitats of importance for nature conservation such as blanket bog. However, some impact on these habitats is unavoidable. The existing blanket bog habitats within the Site have become modified, to varying extents, through the effects of artificial drainage and grazing by livestock over the long-term. There are opportunities to improve the quality of blanket bog habitats to both compensate for the areas of similar habitat directly affected by the Proposed Development and to also contribute to wider biodiversity / nature conservation policy objectives, at the Local Authority and Scottish Government level. For example, the restoration of degraded peatland habitats is one of the key objectives of Scotland's National Peatland Plan (NatureScot 2015[31]). It is also Scottish Planning Policy (see para. 202, Scottish Government 2014, reinforced by the recently approved NPF4, Policy 3) to seek opportunities for enhancement of biodiversity as part of new development, through the restoration of degraded habitats of conservation importance. The proposed HMP is intended to achieve, in the long-term, biodiversity enhancement through measures proposed to improve blanket bog and wet heath habitat quality and the establishment of new native woodland.

Bog Restoration

6.8.113 Blanket bog restoration would be achieved through a combination of the careful blocking of artificial drainage ditches (also referred to as 'grip blocking') and reducing sheep and cattle stocking rates to counteract the adverse effects of grazing and trampling on blanket bog vegetation. Suitable peat, and vegetated turves, excavated for the construction of the Proposed Development could be used to block drains within the bog restoration area. The plan would also include the removal of encroaching trees and scrub to reduce water loss to the bog through evapotranspiration.

6.8.114 Blocking drainage ditches allows the gradual restoration of more natural water levels in the upper layers of the peat (also referred to as 're-wetting'). This encourages the recovery of *Sphagnum* mosses, which helps to retain water and to create a more 'active', peat-building bog habitat. This will result in benefits for a wide range of plant and animal species that are dependent on bog habitats. There would also be several wider environmental benefits, such as the improved capacity for carbon-capture within the bog and some degree of flood-water attenuation and flood risk alleviation within the catchment downstream from the Site.

6.8.115 Blanket bog restoration plans would be developed and implemented in two main areas to the west and east of the Proposed Development (see Figure 6.9) comprising:

- (Area C) Knockgray Mire (c. 27 ha)
- (Area E) Furmiston Mire (c. 72 ha)

6.8.116 In addition, there is the potential for bog restoration on an area of Molinia dominated mire towards the northern end of the site (Area B, Riders Knowe).

6.8.117 The main objectives for blanket bog enhancement areas will be to:

- Restore and maintain peat-building conditions.
- Increase the cover of peat forming species, i.e. *Sphagnum* mosses.
- Raise and maintain the height of the water table.
- Monitor condition regularly.

[31] Available from: https://www.nature.scot/scotlands-national-peatland-plan-working-our-future

6.8.118 The proposed actions are outlined as follows:

- Reduce grazing pressure by initially lowering the stocking rate and off-winter all stock.
- Artificial drains would be blocked using machine excavated peat dams.
- Larger drains would be blocked with peat, where possible, or with plastic piling.
- Encroaching scrub and trees would be removed.

Recovery of Dwarf Shrub-Heath

6.8.119 Within the Site much of the dwarf-shrub component of the vegetation has been lost (or is supressed) due to the long-terms effects of sheep grazing and potentially historical burning. This reduces the value of this habitat for species such as black grouse, which feed on the shoots, seeds and berries of plants like blaeberry. In large parts of the Site Molinia (purple moor-grass), which is less palatable for sheep than heather, has become dominant in the vegetation. Some cattle breeds are more capable of digesting Molina than sheep and can be effective in helping to encourage the recovery of dwarf shrubs where Molina is too dominant.

6.8.120 Dwarf-shrub restoration plans would be developed for three main areas to the northwest and northeast of the Proposed Development (see Figure 6.9) comprising:

- Area (A) Dunool (c. 87 ha)
- Area (B) Riders Knowe (c. 35 ha)
- Area (D) Knockgray (c. 22 ha)

The main objectives for these areas will be to:

- Reduce the over-dominance of *Molinia* (purple moor-grass)
- Encourage heather and blaeberry recovery.
- Retain acid / marshy grassland communities (i.e. encourage a habitat 'mosaic').
- Improve habitat condition for the benefit for a wide range of moorland plant and invertebrate species.
- Improve habitat quality for moorland bird species including black grouse.

6.8.121 The proposed actions are outlined as follows:

- Remove livestock over winter and reduce stocking rates (appropriate to the vegetation condition).

For Molinia dominated areas introduce cattle during the spring and summer.

Planting of Native Broadleaved Woodland

6.8.122 There is very limited native or semi-natural woodland present within the Site. The establishment of some native woodland and improving woodland connectivity would be beneficial for a wide range of flora and fauna including species potentially affected by the Proposed Development such as bats, black grouse and brown trout. This would also help to address the loss of young plantation woodland due to the construction of the Prosed Development. Planting on a large enough scale may also contribute significantly towards reducing flood risk within the wider catchment by delaying storm flow and reducing peak discharge.

6.8.123 Native woodland establishment would be undertaken in several areas, primarily focused on the banks of the main watercourses within the Site. It is estimated that c. 29 ha of planting could be achieved (see Figure 6.9). In these areas the following is proposed:

- Develop native tree planting plans.
- A mix of native tree species suited to the location, local soil type and hydrology.
- Using tree species of local genetic provenance, where possible.
- Standard measures as required to protect the whips/young trees from damage by stock, rabbits and deer (e.g. stock-proof fencing, with appropriate marking to reduce black grouse collision risk, tree guards).
- Beating-up in the second season to replace any failures.

Black Grouse Habitats

6.8.124 The measures outlined above should also improve habitat quality for black grouse. Additional measures to address potential impacts on black grouse from the Proposed Development are also proposed (this is disused further within Chapter 7 of the EIAR).

Alternative Regional Habitat Management Proposal

6.8.125 The Applicant has outlined a proposed Habitat Management Plan within the Proposed Development Area which aims to compensate for the anticipated adverse environmental effects of the Proposed Development on local species and habitats and, in the long term, lead to net biodiversity gain.

6.8.126 However, in the Applicant's view, onsite HMPs for wind farm development are often limited in their efficacy by the size of areas available for management, its isolation from other habitats, existing land use constraints, and the available opportunities for ecological enhancement within the development areas in question. Higher value biodiversity gains may be achieved, with the same investment, by focussing efforts on alternative offsite locations. For example, areas already recognised for their high value to nature (e.g. designations such as National Nature Reserves, Natura 2000 sites and UNESCO Biosphere Reserves), or strategic initiatives that support habitat connectivity by linking key sites over a wider geographic area. This landscape scale approach is widely recognised as creating more resilient habitats that can bring about significant biodiversity net gain.

6.8.127 Furthermore, a centralised co-ordinating function may be better placed to deploy resources for habitat management measures than individual applicants for proposed wind farm developments as they can act across a wider area according to a broader strategic vision for an area or region.

6.8.128 This regional approach is already accepted in the planning system in a number of different contexts.[32] A pertinent example includes the Scottish Borders Council 'biodiversity offset projects',[33] where a number of onshore wind farm developments have, through their planning conditions, made capital contributions to the Scottish Borders Council towards broader natural environment efforts to support habitat for black grouse, in particular, in lieu of onsite HMP. Scottish Borders Council estimate that 14 wind farm schemes, such as Langhope Rig, have made contributions of £1.7 million to regional biodiversity projects since 2009.

6.8.129 The concept of broader regional biodiversity offsetting outwith a Proposed Development Area is supported in a number of pieces of planning guidance at both national and local level.[34] [35] However, so far, a prescribed approach for regional habitat management, similar to the Scottish Borders, does not exist within Dumfries and Galloway.

6.8.130 For these reasons, as an alternative to the Proposed Development's HMP, the Applicant would be prepared to offer a payment in lieu of the proposed onsite HMP to the Local Authority. It is envisioned that this funding would go directly towards habitat management elsewhere within the broader region according to an overarching strategic plan external to the Proposed Development. The sum offered is envisioned to be equivalent to the capital works required to enable the Proposed Development's onsite HMP (e.g. the costs of ditch blocking, fencing, and broadleaf tree planting).

[32] See for examples: RSPB, *Planning naturally – spatial planning with nature in mind: in the UK and beyond* (July 2013)

[33] https://www.scotborders.gov.uk/info/20013/environment/723/biodiversity/2 (accessed 2 November 2021)

[34] At a national level the Scottish Government's, *Scotland's Third Land Use Strategy 2021-2026* (March 2021) anticipates that National Planning Framework 4 will 'guide spatial development' and also introduces Regional Land Use Partnerships and Regional Land Use Frameworks which 'will take a natural capital/ecosystem approach to identify at a landscape level potential land use changes with positive climate and environmental impacts'.

[35] At a local level, the Local Development Plans of Dumfries and Galloway, South Ayrshire, and East Ayrshire all recognise the regional importance of biodiversity.

6.8.131 It is envisioned that initiatives could come forward from conservation organisations, landowners, and community groups, amongst others, in order to secure funding from the Applicant's contribution in order to deliver habitat management according to set criteria, including location and eligibility. Funding awarded to initiatives could be evaluated according to natural capital criteria, allowing meritocratic selection of projects which deliver the highest potential value for nature.

6.8.132 Other than focusing funding according to greatest biodiversity impact, one of the advantages of this approach is that it lays the foundation for applicants of other proposed developments to contribute to such a fund, enabling greater scale than could be achieved through individual onsite HMPs. Such a fund could also look beyond the wind industry to other sectors where development has an environmental impact, for example forestry and house building, and potentially leverage in other sources of funding outside development. The Scottish Borders biodiversity offset scheme, for example, is estimated to have leveraged in an additional £3 million, in addition to £1.7 million of wind farm developer contributions, from sources such as Scottish Rural Development Programme and Forestry Grant Scheme.

6.8.133 The Applicant has consulted with organisations such as the Galloway and Southern Ayrshire Biosphere, NatureScot, RSPB, and Scottish Wildlife Trust with regards to the proposed regional approach described above and understands these organisations to be supportive of the principle. Furthermore, we note the Biosphere may be well placed to oversee the distribution of any funding provided on behalf of the Local Authority given that it has defined boundaries covering the region which may form a proxy for project location eligibility, it already has a Natural Heritage Management Plan which could form the focus for habitat management funding,[36] and it has staff and a governance structure to oversee allocation of funding and subsequent monitoring and reporting, with oversight provided by the Partnership Board and Trustees which includes representation from relevant Local Authorities. Further, as an independently constituted body the Biosphere would be eligible to apply for other match funding opportunities not open to the public or private sector which could increase the scope of initiatives and associated biodiversity benefits.

6.8.134 The Applicant would be pleased to consider the acceptability of this proposed alternative with DGC, which could be fulfilled through a Section 69 agreement of the Local Government (Scotland) Act 1973. For the avoidance of doubt, the Applicant considers an onsite HMP and an alternative financial contribution towards a regional habitat management fund to be mutually exclusive and notes that it would be economically unviable for the project to support both.

Bat Mortality Risk

6.8.135 As potentially significant impacts on bat populations are predicted, and given the sensitivity of the populations affected, an operational Bat Protection Plan is proposed following current best practice guidance (NatureScot *et al*. 2019[21]). This is comprised of the following elements, which would be developed into a detailed plan in consultation with NatureScot prior to the commencement of the operational phase:

- For all of the wind turbines located within the young plantation areas, once the trees are felled during the construction phase, a buffer zone would remain unplanted for the duration of the operational phase, to ensure that the minimum recommended distance (i.e. 50 m) between the wind turbine blade tips and forest edge habitats within the Site would be maintained in the long-term (see Figure 12.3);
- Bat activity monitoring (including monitoring at wind turbine hub height) would be completed for at least three years after the Proposed Development becomes operational, in order to inform the need for a wind turbine bat management protocol (see below);
- The "feathering" of turbine blades to reduce rotation speeds while idling will be implemented; and
- A bat carcass search programme for at least three years after the Proposed Development becomes operational, would be implemented. It would include trials to determine values for Site-specific biases that affect estimates of bat mortality from carcase searches, such as scavenger removal rates and search accuracy.

6.8.136 If the monitoring identifies a level of bat mortality occurring above an 'incidental' level (subject to agreement with NatureScot as to what rate of mortality is considered 'incidental') a wind turbine bat mitigation protocol would be developed and implemented. The aim of the protocol would be to minimise the risk of fatalities occurring during periods of elevated risk to bats. This would most likely be achieved curtailment (opening the blade pitch into the fully feathered position, which reduces blade rotation speed to <2 rpm) but other options, such as acoustic deterrent devices, would also be considered.

6.8.137 Similar approaches, to what is outlined here, have been adopted for wind farms in North America and continental Europe and have been shown through monitoring to significantly reduce the number of bat fatalities at operational wind farms (e.g. between 50 to 93%) with only a marginal power loss (Arnett *et al*. 2016[26]).

6.8.138 The details of any turbine bat mitigation protocol that is required (i.e. the trigger points for blade feathering and unfeathering, which would be software controlled) would be determined based on the results of weather (e.g. rain, wind speed and temperature) and bat activity monitoring. This is so that the conditions that correspond to nights with comparatively high bat activity at turbine height can be determined. From this, a protocol would be developed which is effective at minimising the risk to bats whilst also ensuring that curtailment is as efficient as possible. That is, avoiding curtailment occurring unnecessarily when the risk to bats is low temporally (e.g. daytime, nights outside of active period) or spatially (e.g. some wind turbine locations may have consistently low levels of activity).

6.8.139 The effectiveness of the turbine bat management protocol would also be monitored for three years through a robust bat carcass search programme. A method using specially trained dogs, developed by Exeter University, has been proven to be far more effective than human searches particularly on difficult terrain such as clear-fell areas (see Appendix 4 of the NatureScot *et al*. 2019 guidance document for further details).

Residual Effect Assessment

6.8.140 The residual effects of the operational phase are summarised in Table 6.16. All effects are negative unless otherwise stated. The summary of the residual effect assessment provided below for blanket bog habitats assumes that the proposed onsite HMP would be implemented in full. However, if the alternative off-site proposal is taken forward (i.e. funding of regional projects) the residual effect of the Proposed Development would be Minor, but not Significant.

Table 6.16: Summary of Residual Effects for the Relevant Habitats and Faunal IEFs during the Operational Phase (significant effects highlighted in bold)

Feature	Effect without mitigation	Summary of mitigation measures	Residual effect / confidence / duration
Blanket bog (including modified areas)	Minor – Habitat loss / degradation	• Bog restoration plan implemented under the proposed HMP.	Negligible Near-certain Long-term (NB potential for a net gain in the long-term)

[36] Available at https://www.gsabiosphere.org.uk/wp-content/uploads/2018/11/Galloway-and-Southern-Ayrshire-UNESCO-Biosphere-Natural-Heritage-Management-Plan-Sept-2018.pdf (accessed 2 November 2011).

Feature	Effect without mitigation	Summary of mitigation measures	Residual effect / confidence / duration
Aquatic Habitats and Salmonid Fish	Moderate – Pollution (acidification, hydrocarbons)	• Effective operational drainage design and management. • Pollution prevention measures, including effective spillage procedures, as detailed in the operational Method Statements. • Pollution spill kits available at appropriate locations across the Site and all Site workers briefed on their location and use. • Implementation of the Fisheries Management and Monitoring Plan.	Minor-negligible Near-certain Long-term
Badger	Minor – disturbance from construction activities and lighting	• Follow SPP protocol for the protection of badgers and their setts during maintenance works. • Vehicle speed restrictions of <15 mph on Site would be strictly imposed.	Negligible Near-certain Long-term
Bats	**Moderate-Major** – wind turbine mortality (collision / barotrauma) affecting Leisler's, noctule, common and soprano pipistrelle bats.	• Maintenance of a minimum 50 m wide buffer from the wind turbine blade tips to nearest planted forest edge within the Site. • Should monitoring indicate that bat mortality is occurring above incidental levels, then a turbine management protocol (curtailment), which may be turbine-specific, would be developed and implemented to further reduce the risk of bat mortality during the operational period. • Bat activity monitoring (pre- and post-construction) and bat carcass searches (post-construction) for up to 3 years.	Minor (all species) Near-certain Long-term
Otter	Minor – killing / injury	• Follow SPP protocol for the protection of otter during maintenance works. • Vehicle speed restrictions of <15 mph on Site would be strictly imposed.	Negligible Near-certain Long-term
	Minor – disturbance from maintenance activities		Negligible Near-certain Long-term
Reptiles	Minor – killing / injury	• Follow SPP protocol for the protection of reptiles during maintenance works. • Vehicle speed restrictions of <15 mph on Site would be strictly imposed.	Negligible Near-certain Long-term
	Minor – disturbance from maintenance activities		Negligible Near-certain Long-term

Decommissioning Phase Effects

6.8.141 Decommissioning would involve secondary earthworks associated with the removal of above-ground structures and the opportunity for habitat reinstatement and recovery, to varying degrees depending on the habitat type (e.g. restoration of marshy grassland and wet heath is more achievable than natural bog flora in areas of former blanket bog). However, in the short-term, decommissioning works would have the potential for adverse effects on sensitive habitats and habitats supporting faunal IEFs as well as the potential for disturbance to sensitive species and their resting sites (e.g. otter). Further, there would be potential for pollution, arising from siltation and hydrocarbon spillages from vehicles and machinery, which could adversely affect sensitive terrestrial and aquatic habitats and fish down-stream of the works.

6.8.142 The scale and nature of effects would be similar to those of the construction phase, with the type of access and working methods (such as for wind turbine and foundation removal) being critical to determining the level of effects.

6.8.143 It is therefore assumed that the general effects from decommissioning would be no greater than those during the construction phase.

General Best Practice Measures during the Decommissioning Phase

6.8.144 The potential effects on habitats and protected fauna from decommissioning of the Proposed Development are difficult to assess with certainty due to the potential for ecological baseline conditions to have changed over the proposed 35-year operational life of the Proposed Development. However, it would be expected that the ecological constraints would be broadly similar to the current baseline in 35 years. As such, it is likely that the decommissioning mitigation would be similar to the construction mitigation.

6.8.145 Pre-works surveys and the relevant SPP measures proposed for the construction phase would apply to the decommissioning works. However, these measures would be reviewed, in advance of the decommissioning, in order to take into account the results of monitoring during the operational phase, and current best practice to mitigate impacts on the species that may have emerged since the Proposed Development was constructed.

6.9 POTENTIAL CUMULATIVE EFFECTS

6.9.1 Cumulative effects have been considered only for those features that are of moderate or greater sensitivity within the context of the Site.

Aquatic Habitats & Fish

6.9.2 There is the potential for cumulative effects on salmonid fish populations and supporting habitats related to the construction works and the potential for other similar activities to occur in the same general period in the same sub-catchments of the Water of Deugh. The Proposed Development projects that have been considered in this assessment are Shepherds Rigg wind farm and Lorg wind farm grid connection.

6.9.3 Based on a review of the information within the available EIA Reports, there does not appear to be any appreciable felling proposed within the same sub-catchment that the Proposed Development is located within. It is assumed that all felling would be carried out under current best practice in relation to the protection of surface waters (i.e. Forests & Water Guidelines) and that this would help to ensure that significant cumulative effects are avoided.

6.9.4 The potential timing of the construction of the Lorg Wind Farm grid connection is unknown at present. It is assumed that appropriate measures will be proposed and followed in design, construction and management of pollution risk for surface waters so that significant impacts would be avoided.

6.9.5 On that basis it is considered reasonable to assume that significant adverse impacts arising from cumulative impacts and pressures on the watercourses within the same sub-catchment would also be avoided.

Bat Populations – Operational Mortality

6.9.6 The potential for significant cumulative mortality on bat populations, from the Proposed Development in combination with other wind farm developments proposed in the wider area, has also been considered. This assessment, following current guidance (NatureScot *et al*. 2019[21]) has focused on the potential increased pressure, at a local-scale, on bat populations from mortality associated with wind farm development, i.e. within c. 10 km. With the exception of Windy Rig wind farm, which became operational in 2022, existing, operational wind

farms (e.g. Wether Hill, Windy Standard, Afton and associated extensions) are not considered in detail as they are mostly located on the fringes of the 10 km study area and are considered to be in comparatively low-risk locations, being mostly sited on exposed, high elevation ridges (generally above 500 m). For Torrs Hill, a two-turbine proposed wind farm consented in 2004 c. 7 km to the southwest of the Proposed Development, there appeared to be no publicly available assessment information regarding the potential operational impact on bats. Other proposed wind farms currently at Scoping stage, with no published impact assessment information available, have also not been considered in any detail here (e.g. Manquhill, Divot Hill).

6.9.7 As discussed earlier within this Chapter, there are considerable uncertainties about inferring mortality risk from pre-construction bat activity surveys and attempting to quantify the potential effect on bat species and their populations. Determining the potential importance of such effects for local or regional bat populations is further complicated by the absence of reliable estimates of the key population metrics. This places a considerable constraint on assessment at the individual project-level and these uncertainties are multiplied when considering potential cumulative effects with several other proposals. Additionally, differences in survey methods and the detection equipment used between study sites (e.g. bat call detection range can vary considerably between different detector models and types of ultrasonic microphone) greatly complicates direct comparisons in recorded activity levels. Attempts to address these limitations and provide a more useful and standardised method of interpreting and comparing data from bat activity surveys have been made (e.g. Ecobat) but this has only been adopted in recent years and was not available for impact assessments completed prior to 2018.

6.9.8 The following proposals within 10 km from the Proposed Development have been taken into consideration, where EIA information is available, their locations are shown on Figure 5.10:

- Benbrack (Dumfries & Galloway), Consented, 18 turbines;
- Cornharrow (Dumfries & Galloway), Consented, 7 turbines;
- Euchanhead (Dumfries & Galloway), Application, 21 turbines (7 within the study area);
- Glenshimmeroch (Dumfries & Galloway), Consented, 10 turbines;
- Lorg (Dumfries & Galloway), Consented, 9 turbines;
- Margree (Dumfries & Galloway), Consented, 9 turbines (5 located within the study area);
- Shepherds Rig (Dumfries & Galloway), Application, 17 turbines;
- South Kyle (East Ayrshire / Dumfries & Galloway), Under construction, 50 turbines (28 located within the study area);
- Troston Loch (Dumfries & Galloway), Consented, 14 turbines;
- Windy Rig (Dumfries & Galloway), Operational, 12 turbines;
- Windy Standard I Repower, Application, 8 turbines (to replace 36 operational turbines at Windy Standard I); and
- Windy Standard III (Dumfries & Galloway), Consented, 20 turbines.

6.9.9 Table 6.17 provides a summary of the relevant findings of the various published assessments for these proposals.

Table 6.17: Summary of Assessment Information Available for Projects Considered in the Cumulative Assessment of Potential Operational Effects on Bats

Site	High Risk Species Present	Summary of Operational Assessment	Summary of Operational Mitigation
Benbrack	Common and soprano pipistrelle, Leisler's, Noctule.	Low levels of bat activity were reported. Negligible effects on Pipistrelle, Myotis and Nyctalus species.	Minimum of 50 m separation from the blade tip to the maximum tree height.
Cornharrow	Common and soprano pipistrelles	Very low level of bat activity was recorded where the turbines are proposed to be located. Operational phase was considered to have no significant impacts.	Minimum of 50 m separation from the blade tip to the maximum tree height.
Euchanhead	Common and soprano pipistrelle, Leisler's, Noctule.	High risk reported for Pipistrelles and Nyctalus species.	Minimum of 50 m separation from the blade tip to the maximum tree height. Monitoring and curtailment plan
Glenshimmeroch	Soprano pipistrelle, common pipistrelle, Nathusius' pipistrelle, Nyctalus species	Operational effects reported as Minor adverse (not significant) for common and soprano pipistrelle and Nyctalus bats. Negligible adverse (not significant) for Nathusius' pipistrelle.	Minimum of 50 m separation from the blade tip to the maximum tree height.
Lorg	Soprano pipistrelle, common pipistrelle, Nathusius' pipistrelle, Nyctalus species	Low levels of bat activity, dominated by common and soprano pipistrelle, non-significant adverse effects on bat species and populations.	
Margree	Common and soprano pipistrelle, Daubenton's, Natterer's, Leisler's, noctule, brown long-eared.	Moderate levels of bat activity, dominated by common and soprano pipistrelles with a low - to moderate noctule and *Myotis* activity across the site. Medium risk reported for all bat species.	Minimum of 50 m separation from the blade tip to the maximum tree tip height.
Shepherds Rig	Common and soprano pipistrelle, Leisler's, Noctule.	Low risk reported for all bats species due to low levels of activity recorded.	Minimum of 50 m separation from the blade tip to the maximum tree height. Monitoring plan
South Kyle	Common and soprano pipistrelle, Leisler's and Noctule.	The impacts on bats during the operational phase are considered to be Minor and not significant.	Monitoring is proposed to determine if curtailment is necessary to ensure that bat mortality is maintained below significant levels.
Troston Loch	Leisler's bat, noctule, common pipistrelle, soprano pipistrelle, Myotis species.	Effect on conservation status (all bats) adverse, long-term, of low magnitude and not significant in terms of the EIA Regulations.	Minimum of 50 m separation from the blade tip to the maximum tree height.
Windy Rig	Common and soprano pipistrelle, *Nyctalus* species (Leisler's and Noctule).	Overall bat activity was assessed as low and no significant effects reported for any species.	Minimum of 50 m separation from the blade tip to the maximum tree height.
Windy Standard I Repower	Soprano pipistrelle, common pipistrelle, Nathusius' pipistrelle, *Nyctalus* species (Leisler's and Noctule), Myotis species and brown long-eared bat.	Assessment of relative activity determined low to moderate bat activity. A low negative impact was predicted for common, soprano and Nathusius' pipistrelles, Myotis sp. and brown long-eared and a moderate negative impact for noctule and Leisler's bat. No significant effects predicted.	Minimum of 50 m separation from the blade tip to the maximum tree height. Proposed turbines capable of full blade feathering which will be implemented to reduce rotation speed when idling.

Site	High Risk Species Present	Summary of Operational Assessment	Summary of Operational Mitigation
Windy Standard III	Common and soprano pipistrelle Daubenton's bat, and brown long-eared bat.	Very low levels of bat activity across the proposed Development Area. Residual impacts were predicted to be of low adverse magnitude and not significant.	Areas around turbines will be managed to ensure that they remain free of tree and tall shrub growth to maintain an appropriate buffer between blade tips and tree/scrub vegetation. Should any bat mortality impacts be identified during operation, an appropriate mitigation strategy will be put in place.

6.9.10 Within 10 km of the Proposed Development there are c. 140 large wind turbines (i.e. non-domestic turbines feeding directly into the National Grid) operating or currently under construction. There are eight wind farm proposals that have been consented but not yet built located within (or partly within) the cumulative assessment study area (comprising 85 turbines in total) and three proposed wind farms at application stage, including the Proposed development, comprising a further 38 turbines in total. Finally, there are currently two proposed developments at scoping stage (Manquhill and Divot Hill) which would result in an additional 10 turbines within the study area. Should all these proposals be consented and built, and not accounting for re-powering proposals that would replace older and smaller turbines with fewer and larger turbines, this would increase the number of turbines operating in the study area from c. 140 to c. 270, of which the Proposed Development would contribute c. 5% of the total. This would be an almost doubling of the number of turbines in operation or under construction and clearly an appreciable increase in the potential exposure of bats to wind turbine mortality from current levels. Most of the schemes considered in this cumulative assessment would affect the same species as the Proposed Development and may also potentially put at risk the same individual bats, particularly for the more wide-ranging species such as Leisler's and noctule. However, the Proposed Development and the majority of the proposed wind farms within the cumulative assessment study area are not located in high-risk areas for the key species under consideration (i.e. Leisler's, Noctule), as identified from the analysis of an extensive survey of high-risk species across Southern Scotland (Newson *et al*. 2017[29]). No bat roosts were found within the turbine development areas of the schemes considered within the cumulative assessment, and the sites were generally considered unsuitable to provide roosting habitats for bats.

6.9.11 No significant residual operational effects have been reported for any bat species at any proposed wind farm in the cumulative assessment study area. This is due to a combination of proposed mitigation measures of a similar nature to what has been proposed for the Proposed Development. This includes the maintenance of minimum buffer zones (e.g. 50 m) between wind turbines and features that could attract high levels of bat activity. Also, there are commitments to either implement turbine curtailment, to minimise the risk to bats, or to monitor bat activity for a period in order to determine if curtailment is required.

6.9.12 In conclusion, there is clearly the potential for current wind turbine mortality rates, affecting the same bat populations that could be affected by the Proposed Development, to increase in combination with the other proposed wind farms. Due to the limitations outlined above (see para. 6.9.7) it is not possible to accurately quantify this increased risk in terms of the potential implications for the survival rates and productivity of the local bat populations that might be affected. However, most of the existing and proposed developments are located in sub-optimal habitats that tend not to attract high levels of bat activity and the vast majority of that activity is by species that are relatively common and widespread and whose populations are assumed to be at favourable conservation status in the study area. The potential for significant cumulative effects on these populations should be avoidable providing that the proposed mitigation measures are implemented as stated in the various assessments and that they are as effective as they have been shown to be at operational wind farm sites. Effective monitoring of bat mortality rates, optimising of operational mitigation strategies, along with better data on the affected bat populations, are also important to ensure that the conservation status of the populations affected is not compromised.

6.10 CONCLUSIONS

6.10.1 This assessment has systematically considered the potentially significant effects of the Proposed Development on important ecological features (i.e. sensitive habitats and protected species) and any potential cumulative effects that could occur in combination with other relevant projects.

6.10.2 Ecological constraints (i.e. sensitive habitats and important locations for protected / notable species) have been carefully considered during the design process. The potential effects from the construction and operation of the Proposed Development on several ecological features have therefore been avoided, or reduced, through siting infrastructure away from the more sensitive locations. However, it is not possible to avoid all potentially significant effects through the layout design alone.

6.10.3 The assessment has identified potentially significant effects on watercourses and salmonid fish (associated with the Water of Deugh catchment) due to the possibility of pollution to surface waters from construction works. Potentially significant effects on bat populations have also been identified for the operational phase of the Proposed Development due to mortality from collision with the turbine blades.

6.10.4 Various mitigation measures have been proposed to address these effects. The residual assessment has concluded, assuming that the proposed mitigation measures are implemented effectively, that all potentially significant adverse effects from the Proposed Development (including cumulative) are avoidable for each ecological feature.

6.10.5 Outline SPPs have been prepared for the relevant protected species. Detailed plans will be developed prior to works commencing on the Site and following pre-construction surveys to update the findings of the EIA surveys. The outline SPPs set out the approach that would be followed to ensure that significant effects are avoided during tree felling and construction and that the works proceed lawfully with respect to the legislation protecting the relevant species.

6.10.6 A Bat Protection Plan for the operational phase of the Proposed Development is also proposed. This Plan includes various elements, based on current best practice guidance:

- The design of forest re-planting to avoid locating edge habitats for bats near to the proposed wind turbines;
- Feathering of turbine blades when idling (i.e. when not generating);
- Post-construction monitoring of bat activity; and
- Monitoring of bat mortality through a scientifically robust bat carcass search programme.

6.10.7 The proposed monitoring would continue for 3 years after the site becomes operational. The need for a wind turbine curtailment protocol (which may be turbine-specific), to reduce further the risk of bat mortality, would be determined during this monitoring period (i.e. should monitoring indicated bat mortality rates occurring above what would be considered 'incidental' levels). The details of the curtailment protocol would be approved with DGC in consultation with NatureScot.

6.10.8 A Fish Monitoring Plan is to be developed, in advance of works commencing on the Site, which would set out in detail the approach to the protection and monitoring of fish populations (with a focus on salmonid species) prior to, during and following the construction of the Proposed Development. This Plan will also include water quality monitoring at various locations on watercourses draining the Site and at suitable control sites.

6.10.9 Although no significant effects on habitats of nature conservation importance are predicted, extensive habitat creation and enhancement measures are proposed to be developed and implemented, under a proposed HMP, to address the potential effects of the Proposed Development on habitats such as blanket bog and wet heath. Native woodland establishment is also proposed along several riparian corridors within the site. The proposed

HMP has the potential to result in a net-positive contribution regional objectives for blanket bog restoration and native woodland creation in the long-term and would also help to offset potential adverse effects on black grouse.

6.10.10 As an alternative to on-site habitat creation and enhancement measures, to be discussed and agreed with DGC and the relevant consultees, the Applicant is proposing contributing funds, equivalent to the costs of the onsite measures, to regional nature conservation and biodiversity projects.

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Chapter 7

Ornithology

Contents

Glossary

Term	Definition
Appropriate Assessment	An assessment required by the Habitats Regulations where a project (or plan) is likely to have a significant effect on a European site, either alone or in combination with other plans or projects (part of the Habitats Regulations Assessment process).
Assemblage	A group of species found in the same location.
Avoidance	Prevention of impacts occurring, having regard to predictions about potentially negative environmental effects (e.g. project decisions about site location or design). Also used to refer to bird behaviour, for example, avoidance of a windfarm or individual wind turbines.
Baseline conditions	The conditions that would pertain in the absence of the proposed project at the time that the project would be constructed / operated / decommissioned. The definition of these baseline conditions should be informed by changes arising from other causes (e.g. other consented developments).
Biodiversity	The variability among living organisms from all sources, including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part: this includes diversity within species, between species and of ecosystems.
Biodiversity offsets	Measurable conservation outcomes resulting from actions designed to compensate for unavoidable significant negative effects on biodiversity. The goal of biodiversity offsets is to achieve no net loss, or preferably a net gain, of biodiversity.
Collision Risk Area	The area occupied by the proposed wind turbines (including a buffer zone around the outermost turbines).
Collision Risk Assessment	The assessment of the effects of wind turbine strike on conservation status for the bird population under consideration. This assessment is typically informed by the results of collision risk modelling, available demographic information about the population and information from monitoring studies and the scientific literature about the species flight behaviour in relation to operating wind farms.
Collision Risk Model	A mathematical process that attempts to predict and quantify the annual rate of bird turbine strike. In the case of EIA, the model inputs typically include data derived from bird flight activity surveys of the location of the proposed wind farm along with a range of other assumed parameters (e.g. bird biometrics, flight speed, active periods, wind direction, wind turbine blade swept volume, wind farm area, wind turbine avoidance behaviour).
Compensation	Measures taken to offset the loss of, or permanent damage to, ecological features despite mitigation. Any replacement area should be similar in terms of biological features and ecological functions that have been lost or damaged, or with appropriate management can reproduce the ecological functions and conditions of those biological features. Compensation addresses negative effects which are residual, after avoidance and mitigation have been considered. It is this objective of compensation, and not its location, that distinguishes compensation from 'mitigation'. Depending on circumstances, compensation measures may be located within or outside the project site.
Competent authority	An organisation or individual who is responsible for determining an application for consent for a project. In the context of the UK Habitats Regulations, 'competent authority' has a wider meaning, which includes any Minister, government department, public or statutory undertaker, public body of any description or person holding a public office.
Connectivity	A measure of the functional availability of the habitats needed for a particular species to move through a given area. For example, stop-over sites for migratory birds to rest and feed during migration. Connectivity may also refer to the regular use of areas outside of a designated site by the same population of birds for which the site is designated (e.g. pink-footed geese may use a designated site as a night roost and commute daily to arable farmland outside of the designation area to feed.
Conservation objective	Objective for the conservation of biodiversity (e.g. specific objective within a management plan or broad objectives of policy). Also the conservation objectives for the qualifying species of a designated site, defined in order to maintain or improve the conservation status of the population.
Conservation status	The state of a species / population including, for example, abundance, distribution and population trends.
Cumulative impact / effect	Additional changes caused by a proposed development in conjunction with other developments or the combined effect of a set of developments taken together acting on the same feature.
Distribution	The geographical presence of a feature. This can depend on factors such as climate and altitude.
Displacement	The potential for wind turbines, or a windfarm, to prevent or reduce access to habitats or other features (e.g. preferred flight corridors) supporting the bird population. Related to avoidance behaviour (see above).
Ornithological feature	A population of birds and its supporting habitats.
Ecosystem	A dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit.
Ecosystem services	Ecosystem services are the benefits that people derive from the natural environment. The natural environment can be considered as a stock of 'natural capital' from which many benefits flow – social, health-related, cultural or economic.
Effect	Outcome to an ornithological feature from an impact. For example, the effect on the status of a bird population resulting from the impact of wind turbine mortality. See also 'Impact'.
Enhancement	Improved management of habitats or provision of new habitats supporting the species, resulting in a net benefit to biodiversity, which is unrelated to a negative impact or is 'over and above' that required to mitigate/compensate for an impact.
Environmental Impact Assessment (EIA)	Assessment of projects carried out under the EIA Regulations.
Environmental Impact Assessment Report (EIAR)	A document describing the effects of a project on the environment prepared during EIA.
Favourable condition / status	Satisfactory condition of a population / ornithological feature. In some cases, favourable condition is specifically defined (e.g. for some designated sites). In relation to populations, that the population is self-sustaining in the long-term.
Flight Risk Volume	The volume of airspace where birds are at risk of being struck by the wind turbine blades, defined as the area of the wind farm multiplied by the height of the wind turbines.
Fragility	The degree of sensitivity of habitats, communities and species to environmental change.
Fragmentation	The breaking up of a habitat, ecosystem or land-use type into smaller parcels with a consequent impairment of ecological function.

Term	Definition
Geographic scale	The geographic context for evaluation.
Habitat	The place or type of site where an organism or population naturally occurs. Often used in the wider sense referring to major assemblages of plants typically found together.
Habitats Regulations Appraisal	An assessment of projects (or plans) potentially affecting European sites in the UK, required under the Habitats Regulations.
Impact	Actions resulting in changes to an ecological feature. For example, the construction activities of a development removing an area of bird breeding habitat. See also 'Effect'.
Important ornithological features	Ornithological features (i.e. species, populations, supporting habitats) requiring specific assessment within EcIA because there is the potential for significant effects to occur.
Important Bird Area	An area identified using internationally agreed criteria (developed by BirdLife International) as being globally important for the conservation of bird populations. In the UK the IBA network is administered by the RSPB. IBAs may form part of a country's existing protected area network, and so are protected under national legislation, but this is not always the case.
Local sites	'Non-statutory' sites of nature conservation value that have been identified 'locally' (i.e. excluding SSSIs, SPAs, SACs, and Ramsar sites). Local Nature Reserves are included as they are a designation made by the Local Authority rather than statutory country conservation bodies. Local Sites are often called Wildlife Sites, Local Nature Conservation Sites, Sites of Importance for Nature Conservation or other, similar names.
Mitigation	Measures taken to avoid or reduce negative impacts and effects. Measures may include locating the development and its working areas and access routes away from areas of high ornithological interest, or timing works to avoid sensitive periods. Depending on circumstances, mitigation measures may be located within or outside the project site.
Net ecological gain	The point at which the quality and quantity of habitats or species improves compared to their original condition (i.e. improvements over and above those required for mitigation/compensation).
No net loss	The outcome resulting from losses being offset by gains.
Operational phase	The period when the Proposed Development is operating, assumed to be 35 years.
Population	A collection of individuals, all of the same species and in a defined geographical area.
Precautionary Principle	The principle that the absence of complete information should not preclude precautionary action to mitigate the risk of significant harm to the environment.
Proposed Development	The project that is the focus of the impact assessment
Rarity	A measure of relative abundance of a species that can apply at a range of geographical scales.
Replacement	The creation of a habitat that is an acceptable substitute for the habitat which has been lost.
Restoration	The re-establishment of a damaged or degraded system or habitat to a close approximation of its pre-degraded condition.
Sensitivity	Sensitivity is the conservation status and relative rarity of a population at different geographical scales (e.g. local, regional, national, international) also taking into account importance of the area of interest in providing critical supporting habitat to that populations.
Scoping	The determination of the extent of an assessment (for an EIA).
Screening	Determination of whether or not an EIA is necessary.
Significant effect	An effect that either supports or undermines conservation objectives for 'important ornithological features'
Synergistic effect	Occurs when the sum of two effects together is greater than the sum of the effects separately.
Zone(s) of Influence	The area(s) over which ornithological features may be affected by the biophysical changes caused by the proposed project and associated activities.

List of Abbreviations

Abbreviation	Description
BAP	Biodiversity Action Plan
CRM	Collision Risk Model
CRA	Collision Risk Area
CRH	Collision Risk Height
ECoW	Environmental / Ecological Clerk of Works
CEMP	Construction Environmental Management Plan
DGC	Dumfries and Galloway Council
DGRSG	Dumfries and Galloway Raptor Study Group
EcIA	Ecological Impact Assessment
FRV	Flight Risk Volume
HMP	Habitat Management Plan
IBA	Important Bird Area
IOF	Important Ornithological Feature
LNCS	Local Nature Conservation Site
LNR	Local Nature Reserve
NHZ	Natural Heritage Zone
NNR	National Nature Reserve
PVA	Population Viability Analysis
RSPB	Royal Society for the Protection of Birds
SBL	Scottish Biodiversity List
SBS	Scottish Biodiversity Strategy
SOC	Scottish Ornithologists' Club
SSSI	Site of Special Scientific Interest
SPA	Special Protection Area
SPP	Species Protection Plan
WWT	Wildfowl & Wetlands Trust

7.1 STATEMENT OF COMPETENCE

7.1.1. The ornithological baseline studies, evaluations and assessments presented in this Chapter were undertaken by MBEC ecological consultants during 2018-2020, on behalf of the Applicant. All surveys and assessments were completed by suitably experienced ornithologists and EIA practitioners. MBEC is a Chartered Institute of Ecology and Environmental Management (CIEEM) Registered Practice and has extensive experience with onshore wind farm development planning in Scotland including baseline ornithological surveys, wind farm design advice, impact assessment and mitigation.

7.2 INTRODUCTION

7.2.1. This Chapter provides the assessment of the potential effects of Quantans Hill Wind Farm (the 'Proposed Development') on bird populations and their supporting habitats. The assessment focuses on bird species considered to be potentially vulnerable to the effects of onshore wind farm development and whose populations are also of conservation concern internationally, nationally or in a regional context. The potential effects on other fauna, habitats and flora are considered in Chapter 6: Ecology & Biodiversity.

7.2.2. The specific objectives of the assessment, as detailed in this Chapter, are to:

- Set out the methodology used in completing the assessment;
- Summarise the key findings from consultation, desk study and fieldwork;
- Identify the potential species of concern and evaluate the importance of the Proposed Development Area (and the applicable zones of effect) for the species that become the focus of the assessment (also referred to as 'Important Ornithological Features' IOFs);
- Identify the potential effects, including direct, indirect and cumulative;
- Assess the potentially significant effects associated with the construction, operation / maintenance and decommissioning of the Proposed Development;
- Define mitigation measures, where appropriate, to avoid, reduce and offset adverse effects; and
- Determine the level of residual effect, taking into consideration the proposed mitigation measures.

7.2.3. This Chapter also provides a description and evaluation of the avifauna of the Proposed Development Area (and applicable buffer zones surrounding the Proposed Development where effects might occur), based upon data derived from desk study sources and fieldwork with further detail provided in various technical appendices.

7.2.4. This assessment is informed by data derived from desk study and a set of baseline surveys. The methodologies and results of the desk study and baseline surveys are summarised and reported in this Chapter. Further detail and background information is provided in a set of technical appendices, listed as follows:

- Technical Appendix 7.1: Ornithological Desk Study & Survey Results;
- Technical Appendix 7.2: Collision Risk Model Report; and
- Technical Appendix 7.3: Outline Bird Protection Plan.

7.2.5. A separate Confidential Annex to this Chapter (issued to the Scottish Ministers and NatureScot) includes details of breeding locations of species at risk from human persecution and / or disturbance (i.e. raptor species listed on Schedule 1 to the Wildlife & Countryside Act 1981, as amended, (WCA)[1]) in accordance with the guidance on the publication of environmentally sensitive information (NatureScot 2016[2]).

7.2.6. The assessment has concluded that the Proposed Development could result in an appreciable adverse impact on the Dumfries and Galloway red kite (*Milvus milvus*) population (from cumulative operational collision mortality). Various mitigation measures are proposed to address this, with the aim of reducing the risk of collision mortality, so that a significant effect is avoided in the long-term. There is uncertainty about the potential effectiveness of some of the measures proposed and therefore a precautionary approach has been adopted in the assessment to avoid underestimating the level of impact on this species.

7.2.7. The Proposed Development also has the potential to result in adverse impacts on black grouse (*Lyrurus tetrix*) and curlew (*Numenius arquata*), which are considered unlikely to be significant at the regional scale. The proposed habitat enhancement measures, described in an outline Habitat Management Plan (HMP), are intended to offset some the direct and indirect effects on these species.

7.3 LEGISLATION, POLICY AND GUIDANCE

7.3.1. This impact assessment has been carried out in accordance with current best practice and in compliance with the provisions of the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017. Consideration has been given to all relevant legislation, and relevant national and local planning policy guidance, including the following:

- The Conservation (Natural Habitats etc.) Regulations 1994 (as amended) ("The Habitats Regulations") transposed from the EC Council Directive 92/43/EEC on the Conservation of Natural Habitats and Wild Fauna and Flora[3];
- Wildlife and Countryside Act 1981 (as amended);
- Nature Conservation (Scotland) Act 2004 (as amended);
- Wildlife and Natural Environment (Scotland) Act 2011;
- The Conservation of Habitats and Species Regulations 2017;
- The UK Biodiversity Action Plan (UK BAP) / UK Post-2010 Biodiversity Framework;
- The Dumfries and Galloway Biodiversity Action Plan (LBAP);
- The Scottish Biodiversity List;
- Scottish Planning Policy (June 2014); and
- Scottish Government Planning Advice Note 1/2013: Environmental Impact Assessment.

Summary of Relevant Planning Policy and Guidance

7.3.2. Scottish planning policy and guidelines of relevance include National Planning Framework 3 and the Planning Advice Note 60 entitled 'Planning for Natural Heritage'.

7.3.3. Scotland's National Planning Framework (NPF) 3 (Scottish Government 2014) provides a strategic level framework for the spatial development of Scotland as a whole (Note: NPF4 has now been approved and will be adopted in February 2023) whereas the Planning for Natural Heritage: Planning Advice Note 60 (Scottish Government 2000) outlines development control processes and provides case studies for good management of the natural heritage, including vegetation restoration following development. The relevant national biodiversity frameworks, action plans, other connected policies and associated supporting documents are described below.

UK Biodiversity Action Plan

7.3.4. Relevant biodiversity policies were originally based on the UK Biodiversity Action Plan (UK BAP) which listed 65 Priority Habitats and 1150 Priority Species and created action plans for the recovery of these priority habitats and species. The UK BAP formally ended in 2010 and was replaced by the UK Post-2010 Biodiversity Framework published by JNCC and Defra in 2012[4]. The UK Post-2010 Biodiversity Framework sets out the priorities for UK-level work to support the Convention on Biological Diversity's (CBD's) Strategic Plan for Biodiversity 2011-2020 as well as its five strategic goals and 20 'Aichi Targets' agreed at the CBD meeting in Nagoya, Japan, in October

[1] Available from: http://www.legislation.gov.uk/ukpga/1981/69

[2] Scottish Natural Heritage (2016). Environmental Statements and Annexes of Environmentally Sensitive bird Information. Guidance for Developers, Consultants and Consultees. Available from: https://www.nature.scot/environmental-statements-and-annexes-environmentally-sensitive-bird-information

[3] Despite the UK's exit from the European Union, domestic legislation that has been derived from, or modified by, the provisions of the Birds Directive remain in effect.

[4] JNCC and Defra (2012). UK Post-2010 Biodiversity Framework. Available at: http://data.jncc.gov.uk/data/587024ff-864f-4d1d-a669-f38cb448abdc/UK-Post2010-Biodiversity-Framework-2012.pdf

2010. In addition, it also considers the EU Biodiversity Strategy (EUBS) launched in May 2011 (JNCC and Defra 2012).

The Scottish Biodiversity Strategy

7.3.5. In 2004 the document 'Scotland's Biodiversity – It's in Your Hands' was published. This outlined a 25-year strategy for conserving and enhancing biodiversity in Scotland and halting the decline in species of conservation concern. This was supplemented in 2013 by the '2020 Challenge for Scotland's Biodiversity: A Strategy for the Conservation and Enhancement of Biodiversity in Scotland'. These two documents provide the overview of Scottish biodiversity policies set within the UK framework (Scottish Government 2012) and are supplements to the Scottish Biodiversity Strategy (SBS) published in 2004. Together, these form the complete SBS (Scottish Government 2013[5]).

7.3.6. The SBS outlines desirable outcomes for 2020 and lists the principles and approaches that should be undertaken to achieve these outcomes. The 2020 Challenge places an emphasis on tackling the key pressures placed on Scotland's biodiversity from the effects of climate change, non-native species and habitat fragmentation.

7.3.7. The SBS emphasises the need to take account of how ecosystems work, particularly across landscapes. It states that both the broad and local scales need to be considered, that the capacity of ecosystems to respond to impacts is not infinite and that resilience is to be built into ecosystems using an adaptive, integrated approach at the scale of river catchments. An update to the SBS is currently at draft stage and seeks to build on the previous version of the national strategy with the ambition for Scotland to be 'Nature Positive' by 2030 and to have restored and regenerated biodiversity across the country by 2045[6].

7.3.8. The UK BAP list of priority habitats and species (as defined in UK Post-2010 Biodiversity Framework) remain an important reference point for the SBS and the Scottish Biodiversity List (SBL).

The Scottish Biodiversity List

7.3.9. Since the original publication of the SBL in 2005, there are now four categories of habitats and species[7]:

- Conservation action needed - this includes habitats and species that have undergone a significant decline in Scotland and / or are rare or have a restricted distribution and are under threat (e.g. species protected Under the Wildlife and Countryside Act 1981, as amended);
- Avoid negative impacts - this includes habitats and species that are protected through international obligations (e.g. European protected species or habitats), those that are rare or have a restricted distribution and / or have undergone a significant decline in Scotland (e.g. species protected Under the Wildlife and Countryside Act);
- Watching brief only - this includes species on the UK BAP list but not considered to be at particular risk in Scotland as well as species with international obligations not identified in the other two categories for action (e.g. 'near threatened' category of the Red-List criteria drawn up by the International Union for Conservation of Nature (IUCN), a list that provides information on the status of flora and fauna that is of conservation concern); and
- Communicating with the public - these are non-domestic species and habitats voted as being of importance to the Scottish public in 2005 and are designed to be used to inspire and engage the public on biodiversity conservation.

7.3.10. As a result, the habitats and species are listed on eight SBL schedules:

- Schedule 1 - on the UK BAP list;
- Schedule 2 - are protected under an international obligation;
- Schedule 3 - rare in the UK (less than sixteen 10 km squares);
- Schedule 4 - less than six Scottish 10 km squares;
- Schedule 5 - greater than 25% Scottish decline (over 25 years or other appropriate time period);
- Schedule 6a - endemic to Scotland;
- Schedule 6b - endemic subspecies/race (and must meet at least one other criterion); and
- The Social Criteria List.

7.3.11. The conservation designations that apply to the species that are the focus of this assessment, including the SBL, are provided in Table 7.1.

Local Biodiversity Action Plan

7.3.12. Originally under the UK BAP, and now under the SBS, local authorities have a responsibility to produce their own list of priority habitats and species and associated actions for conservation. These are called Local Biodiversity Action Plans (LBAP). The most recent version available for Dumfries and Galloway was published by the Dumfries and Galloway Biodiversity Partnership in April 2009. The LBAP outlines a vision for different habitats / landscape settings, incorporating a list of key species for each. Additionally, the Scottish Biodiversity List and the Dumfries and Galloway LBAP identify other locally important species that are rare or under threat at a local level. These species have also been taken into consideration, where relevant, in this assessment.

Scottish Planning Policy

7.3.13. The Scottish Planning Policy (SPP, 2014[8]), alongside the National Planning Framework (see below), sets out national policies for operation of the planning system and for the development and use of land. The SPP applies to the preparation of development plans, the design of development and the determination of planning applications and appeals. The SPP presumes in favour of development that contributes to sustainable development.

7.3.14. In relation to ecology and EIA, the SPP sets out broad polices that are relevant to the focus of this Chapter, which have been taken into consideration in the design and assessment of the Proposed Development. The SPP states that policies and decisions should be guided by a set of 'Principal Policies', including: "protecting, enhancing and promoting access to natural heritage, including green infrastructure, landscape and the wider environment".

7.3.15. Under the 'Subject Policies' of the SPP, the policy principals set out for the planning system which are of relevance to this assessment include the following, under the heading Valuing the Natural Environment:

- 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;
- promote protection and improvement of the water environment, including rivers, lochs, estuaries, wetlands, coastal waters and groundwater, in a sustainable and co-ordinated way;
- protect and enhance ancient semi-natural woodland as an important and irreplaceable resource, together with other native or long-established woods, hedgerows and individual trees with high nature conservation or landscape value; and
- seek benefits for biodiversity from new development where possible, including the restoration of degraded habitats and the avoidance of further fragmentation or isolation of habitats.

7.3.16. The SPP also states (in para. 202) that "*developers should seek to minimise adverse impacts through careful planning and design, considering the services that the natural environment is providing and maximising the potential for enhancement*".

7.3.17. In relation to development and protected species, the SPP states (in para. 214) that "*The presence (or potential presence) of a legally protected species is an important consideration in decisions on planning applications. If there is evidence to suggest that a protected species is present on site or may be affected by a proposed development, steps must be taken to establish their presence. The level of protection afforded by legislation must*

[5] Scottish Government (2013). 2020 Challenge for Scotland's Biodiversity [online]. Available at: https://www.gov.scot/publications/2020-challenge-scotlands-biodiversity-strategy-conservation-enhancement-biodiversity-scotland/

[6] Biodiversity strategy to 2045: tackling the nature emergency, Scottish Government (2022). Available at: https://www.gov.scot/publications/scottish-biodiversity-strategy-2045-tackling-nature-emergency-scotland/

[7] Scottish Natural Heritage: Scottish Biodiversity List [online]. Available at: https://www.nature.scot/scotlands-biodiversity/scottish-biodiversity-strategy/scottish-biodiversity-list

[8] Available at: https://www.gov.scot/publications/scottish-planning-policy/

be factored into the planning and design of the development and any impacts must be fully considered prior to the determination of the application".

National Planning Framework 3

7.3.18. The current National Planning Framework (NPF3, 2014[9]) sets out the spatial aspects of the Scottish Government's Economic Strategy over a 20-30 year period. In relation to the delivery of the NPF it includes reference to national and regional strategies and objectives of relevance to this assessment. For example, NPF3 refers to the 2020 Challenge for Scotland's Biodiversity and the objective of promoting and enhancing ecosystems. NPF3 also emphasises the importance of a landscape-scale approach to environmental planning and management in addressing declines in ecosystem services. The Scottish Biodiversity Strategy and the objective of completing a suite of protected places and improving their connectivity through a national ecological network centred on these sites is also referred to in NPF3. This includes the objective to "*increase new woodland creation to an average of 10,000 hectares per year from 2015, and ...increase the rate of peatland restoration to 22,000 hectares per year*".

Draft National Planning Framework 4

7.3.19. Consideration has also been given in this assessment to the relevant policies set out in the draft National Planning Framework 4 (NPF4)[10].

7.3.20. National Planning Policy 4 was not approved at the time this document was drafted. NPF4 was initially laid before the Scottish Parliament in November 2021 and has subsequently been the subject of consultation and Parliamentary Committee scrutiny. A revised version of NPF4 2022, which reflects the Scottish Government's consideration of the responses received as part of the consultation, was laid before the Scottish Parliament on 8 November 2022 for approval.

7.3.21. NPF4 2022, received final approval from the Scottish Parliament on 11 January 2023 and awaits adoption by the Scottish Ministers. Regulations have now been laid before the Parliament enabling the Scottish Ministers to adopt the plan, and this is now scheduled to happen in February 2023.

7.3.22. Under 'Policy 3: Nature crisis', NPF4 seeks to ensure that "*development proposals contribute to the enhancement of biodiversity, including restoring degraded habitats and building and strengthening nature networks and the connections between them*". Also, that any potential adverse impacts of development proposals on biodiversity, nature networks and the natural environment should be minimised through careful planning and design. Design should consider the need to reverse biodiversity loss, safeguard the services that the natural environment provides and build the resilience of nature by enhancing nature networks and maximising the potential for restoration.

Dumfries and Galloway Local Development Plan

7.3.23. The Dumfries and Galloway Local Development Plan (LDP), adopted in October 2019, provides guidelines for development proposals in the region. The policies and Supplementary Guidance relating to the protection of the natural heritage and biodiversity, which are potentially relevant to this assessment are listed as follows:

- Policy OP1: Development Considerations.
- Policy NE4: Sites of International Importance for Biodiversity;
- Policy NE5: Species of International Importance;
- Policy NE6: Sites of National Importance for Biodiversity and Geodiversity
- Policy NE7: Forestry and Woodland;
- Policy NE11: Supporting the Water Environment;
- Policy NE15: Protection and Restoration of Peat Deposits as Carbon Sinks; and

7.3.24. The purpose and objectives of these policies have been taken into consideration, where applicable, in the design and assessment of the Proposed Development.

Impact Assessment Guidance

7.3.25. The approach taken to this assessment draws on a range of guidance from several sources including guidance produced by statutory nature conservation organisations and available published scientific literature. Listed below are the key guidance documents and scientific literature that were considered, in tandem with professional judgement, in determining the detailed and site-specific approach to the baseline surveys and impact assessment.

7.3.26. The field survey, IOF evaluation and assessment methods follow current best practice guidance as detailed in the following documents:

- Recommended Bird Survey Methods to Inform Impact Assessment of Onshore Wind Farms (NatureScot 2017);
- Assessing the cumulative impacts of onshore wind farms on birds (NatureScot, August 2018);
- Assessing the Significance of Impacts from Onshore Wind Farms Outwith Designated Areas (NatureScot, February 2018);
- Significance of impacts on birds within or affecting designated areas (NatureScot 2013);
- A Review of Disturbance Distances in Selected Bird Species (NatureScot 2007);
- Environmental Statements and Annexes of Environmentally Sensitive Bird Information (NatureScot, September 2016);
- Guidance on Assessing Connectivity with Special Protection Areas (NatureScot, June 2016);
- Calculating a theoretical collision risk assuming no avoiding action (NatureScot 2000);
- Avoidance Rates for the onshore NatureScot Wind Farm Collision Risk Model (NatureScot 2018);
- Environmental Impact Assessment Handbook. Guidance for competent authorities, consulting bodies, and others involved in the Environmental Impact Assessment process in Scotland (NatureScot 2018);
- Chartered Institute of Ecology and Environmental Management Guidelines for Ecological Impact Assessment in the UK and Ireland (CIEEM 2018, revised September 2019);
- Natural Heritage Zones Bird Population Estimates. SWBSG Commissioned Report Number: 1504 (Wilson *et al*. 2015); and
- Dealing with construction and birds (NatureScot, March 2016).

7.3.27. Additional reference material which is relevant to the baseline surveys and assessment is referred to within the assessment and the Technical Appendices.

7.4 METHOD OF ASSESSMENT

Desk Study

7.4.1. An initial desk study was completed prior to the start of fieldwork in April 2018. The purpose of this initial study was to ensure that all relevant species that could potentially be present in the area, based on their known breeding or wintering ranges and the broad habitats present, were taken into consideration in survey planning. A precautionary approach was followed, informed by professional judgement and current relevant guidance, in determining the species that would need to be considered in terms of survey planning.

7.4.2. Information on designated sites (local, regional, national and international) that have ornithological interest was also collated during the initial desk study. In addition to this, following NatureScot guidance on SPA bird populations and potential connectivity to habitats affected by onshore wind farm development, any potentially relevant SPAs up to 20km from Proposed Development Area were also considered (NatureScot 2016[11]).

[9] Available at: https://www.gov.scot/publications/national-planning-framework-3/

[10] Available from: https://www.gov.scot/publications/scotland-2045-fourth-national-planning-framework-draft/

[11] Scottish Natural Heritage (2016). Assessing Connectivity with Special Protection Areas. Version 3, June 2016. Available at: https://www.nature.scot/sites/default/files/2018-08/Assessing%20connectivity%20with%20special%20protection%20areas.pdf

7.4.3. Details of international and national designated sites, such as Special Areas of Conservation (SACs) and SSSIs, were obtained through NatureScot's Natural Spaces website[12] and associated Geographic Information System (GIS) data made publicly available by NatureScot.

7.4.4. The results of bird surveys completed to inform the EIA of a previous wind farm at the same general location were reviewed. A summary of the key findings from the baseline surveys is provided in section 7.6 of this Chapter. Further detail provided in Appendix 7.1 and the Confidential Annex.

7.4.5. A further desk study was completed during the wind farm design phase in 2020-21. This involved contacting organisations that hold bird records and requesting any relevant data they may hold for the area. Requests for notable records of species of conservation concern for the area were placed with the following:

- Royal Society for the Protection of Birds (RSPB);
- Dumfries and Galloway Raptor Study Group (DGRSG);
- Southwest Scotland Environmental Information Centre (SWSEIC); and
- The Wildfowl & Wetlands Trust (WWT).

7.4.6. The information from these desk studies and the subsequent field surveys was also used in the wind farm design process as well as helping to inform the assessment of IOF sensitivity during the EIA phase for the Proposed Development.

7.4.7. Published assessments for other wind farm developments in the surrounding area that are operational or in the planning process were consulted in relation to collating relevant information for the assessment of potential cumulative effects.

7.4.8. Table 7.1 provides the list of species that were initially considered in determining the approach to the baseline surveys. These species were selected based on the conservation status / relative rarity of their populations, potential sensitivity to the impacts of onshore wind farm development, the suitability of habitats within the Proposed Development Area and their breeding / wintering ranges (i.e. the likelihood of the species being present in the area). Also included in this table is a summary of the current conservation status, nature conservation policy and legal designations for each species.

Table 7.1: Initial List of Focal Species and their Designations

Common Name	Scientific Name	Species Designations
Whooper swan	*Cygnus cygnus*	Ann. I[i], Sch. 1[ii], UK Amber List[iii], SBL[v]
Greylag goose	*Anser anser*	UK Amber List[iii]
Pink-footed goose	*Anser brachyrhynchus*	UK Amber List[iii]
Black grouse	*Lyrurus tetrix*	UK Red List[iii], UK BAP[iv], SBL[v]
Osprey	*Pandion haliaetus*	Ann. I[i], Sch. 1[ii], UK Amber List[iii], SBL[v]
Goshawk	*Accipiter gentilis*	Sch. 1[ii]
Hen harrier	*Circus cyaneus*	Ann. I[i], Sch. 1[ii], UK Red List[iii], SBL[v]
Red kite	*Milvus milvus*	Ann. I[i], Sch. 1[ii], SBL[v]
Lapwing	*Vanellus vanellus*	UK Red List[iii], UK BAP[iv], SBL[v]
Curlew	*Numenius arquata*	UK Red List[iii], UK BAP[iv], SBL[v]
Barn owl	*Tyto alba*	Sch. 1[ii], SBL[v]
Short-eared owl	*Asio flammeus*	Ann. I[i], UK Amber List[iii], SBL[v]
Merlin	*Falco columbarius*	Ann. I[i], Sch. 1[ii], UK Red List[iii], SBL[v]
Peregrine falcon	*Falco peregrinus*	Ann. I[i], Sch. 1[ii], SBL[v]

i. Species listed on Annex I of the EC Birds Directive (Directive 2009/147/EC on the conservation of wild birds - the codified version). These species are the subject of special conservation measures concerning their habitat, in order to ensure their survival and reproduction within their area of distribution.

ii. Species listed on Schedule 1 to the Wildlife and Countryside Act 1981 (as amended). All wild birds their nests eggs and dependant young are protected under the Wildlife and Countryside Act. Schedule 1 species receive additional legal protection under the Act.

iii. Birds of Conservation Concern (BoCC) in the UK (Stanbury et al. 2021[13]). The population status of birds regularly found in the UK is reviewed every five years to provide an up-to-date assessment of conservation priorities. Quantitative criteria are used to assess the population status of each species and to place it on the Red, Amber or Green list. These are global conservation status, recent decline, historical decline, European conservation status, rare breeders, localised species and international importance.

iv. Priority species in the 2007 UK Biodiversity Action Plan (UK). Local Biodiversity Action Plan species are given in the Dumfries and Galloway LBAP (April 2009). The UK BAP was superseded by the UK Post-2010 Biodiversity Framework (JNCC 2012).

v. Species included on the Scottish Biodiversity List (Scott Wilson 2005), which is part of the Scottish Biodiversity Strategy (published by the Scottish Government in May 2004).

Baseline Surveys

Overview of Baseline Surveys Completed

7.4.9. The baseline surveys were completed between April 2018 and March 2021. The surveys provided data to systematically assess the use of all habitats within Proposed Development Area by breeding and non-breeding birds, with a focus on the species relevant to this assessment. All surveys were completed by suitably experienced and, where appropriate, licensed surveyors following current best practice methods.

7.4.10. The survey areas are shown on Figure 7.1 and details of the survey methods and results are provided in Technical Appendix 7.1. References to the 'Site' within this Chapter denotes the red line boundary as shown on Figure 7.1.

7.4.11. The following surveys were completed between April 2018 and March 2021:

- Summer and winter flight activity surveys (April 2018 to August 2019 and September 2020 to March 2021);
- Breeding moorland wader surveys (April to July, 2018 and 2019);
- Breeding raptor surveys (April to August 2018 and March to August 2019, 2020);
- Black grouse lek survey (April and May 2018, 2019 and 2020); and
- Wintering goose and swan surveys (e.g. waterbody and grazing counts) (October 2018 to May 2019).

7.4.12. Flight activity surveys were carried out to systematically sample, record and quantify the use of the airspace over the survey area by certain key species. Surveyors, stationed at fixed vantage points (VPs), recorded the proportion of time that these key species spent flying at different elevations relative to the potential turbine blade swept height. The data has been used to identify constraints, such as regularly used flight corridors and areas of concentrated flight activity, which may be taken into consideration in the wind farm design process to reduce impacts. The flight activity data is also used to inform the EIA process and is used in the collision risk model to provide an estimate of annual collision mortality.

7.4.13. The VPs were selected to provide a combined visibility of the potential development area. For the 2018-19 survey, the VPs were established before the potential layout of the wind farm was known. The vantage point locations and their viewsheds (areas of theoretical visibility) are shown on Figure 7.3a. For the flight activity survey completed between October 2020 and March 2021 the number of VPs was reduced (from five to three) and some of the

[12] NatureScot. Natural Spaces. Available at: https://gateway.snh.gov.uk/natural-spaces/index.jsp

[13] Stanbury, A.J., Eaton, M.A., Aebischer, N.J., Balmer, D., Brown, A.F., Douse, A., Lindley, P., McCulloch, N., Noble, D.G. & 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 Volume: 114, pages: 25pp.

positions were changed. This was in response to the emerging wind farm layout, which was smaller than the original potential development area, and to provide better coverage with respect to the turbine 11 area. The VP locations and indicative viewsheds for this period of flight activity survey are shown on Figure 7.3b. A total of 78 hours of observation was completed from each VP during April to December 2018, 72 hours from January to August 2019 and 60 hours between September 2020 and March 2021. Full details of the flight activity survey effort, including timings and weather conditions, are provided in Appendix 7.1.

Survey Constraints / Data Limitations

7.4.14. The following summarises constraints specific to the baseline surveys and assessment of the Proposed Development. Limitations that apply more broadly to the assessment of potential impacts on bird populations are set out in the guidance documents referred to above or within the relevant Technical Appendices. It was not possible to agree permission to access all landholdings within the survey areas shown on Figure 7.1. However, all areas within the Site and within at least 500 m of the majority of the Proposed Development were accessible to the surveyors. Where access was restricted, surveyors monitored suitable habitats from the nearest accessible location within the Site or from public roads and footpaths (e.g. ad hoc vantage points to monitor for breeding raptor activity). In combination with the data collated during the desk study, there is considered to be sufficient information available to make an accurate assessment of the current ornithological sensitivity of the Proposed Development Area and its use by the key species relevant to this assessment.

7.4.15. One of the VPs (VP3) for the initial survey period (April 2018 to August 2019) was selected before the potential wind farm layout was known and is located very close to turbine 11. However, the VP location was on the corner of a small conifer plantation, which provided some screening to the west and meant that the surveyor was back-clothed by the trees and not silhouetted against the sky helping to reduce their visibility. This VP was not used for the September 2020 to March 2021 survey, following a review of the emerging wind turbine layout.

7.4.16. During part of the baseline survey period (2020-21) a section of the central part of Proposed Development Area (on the Marbrack landholding) was planted with trees (primarily Sitka spruce saplings). The location of the plantation area is shown on Figure 12.2. there is no evidence that the works associated with this (e.g. track construction, fencing, tree planting) appreciably affected the baseline data, with respect to the key bird species that are the focus of this assessment, as most of this work was completed outside of the period when the flight activity surveys were being undertaken. The potential influence that the establishment of this new plantation, and a similar planting scheme proposed for the landholding within the Proposed Development Area to the east of this plantation (Furmiston), may have in the long-term for the use of this area by species such as red kite, hen harrier and black grouse has been taken into consideration in the impact assessment.

7.4.17. The Scottish Government measures to control the Covid-19 pandemic constrained travel for fieldwork during 2020, particularly during the spring/summer. This resulted in some adjustments being made to the number and timing of survey visits, but it was possible to complete an adequate survey effort within the key survey periods.

7.4.18. In conclusion, whilst there were some unavoidable site-specific limitations to some aspects of the field surveys, the baseline data (including the additional survey effort undertaken in 2020-21), supplemented with the information derived from the desk study, are sufficiently extensive and detailed to identify and accurately characterise the use of Proposed Development Area by the key species and to inform a robust assessment of IOF sensitivity and the potential effects of the Proposed Development.

Assessment Methods

Introduction

7.4.19. The methods adopted for this assessment follow current best practice, informed by the best available scientific evidence and experienced professional judgement. Where there are uncertainties, reasonable worst-case assumptions are made to minimise the risk of effects being underestimated in their importance. The assessment method takes into account relevant guidance such as CIEEM's Guidelines for Ecological Impact Assessment in the UK (2018[14]) and NatureScot's Environmental Impact Assessment Handbook (2018[15]). NatureScot guidance related to the assessment of the effects of onshore wind farm development on birds is also of relevance and has also been considered where appropriate.

7.4.20. The EIA process involves the application of specific, standardised criteria to evaluate impacts and IOFs. However, due to the complexities of species interactions with their environment and the potential uncertainty of some effects and the efficacy of mitigation measures, experienced professional judgement plays a key role in the evaluation of IOFs and in the determination of the significance of residual effects.

7.4.21. The assessment process can be summarised as a series of stages, as follows:

- Identifying the ornithological IOFs that could be significantly affected by the Proposed Development (effectively part of Scoping);
- Evaluating the importance (i.e. importance at the relevant geographical scale, also referred to as IOF 'sensitivity') of the IOF informed by data from baseline surveys and other appropriate sources;
- Identifying and systematically characterising impacts and their effects (wherever possible based on best available scientific evidence), noting any uncertainties and taking a precautionary approach as appropriate;
- Incorporating measures to avoid and mitigate negative impacts and effects;
- Assessing the significance of any residual effects after the beneficial effects of any proposed mitigation has been taken into account;
- Identifying appropriate compensation measures to offset significant residual effects; and
- Identifying opportunities for ecological enhancement.

7.4.22. In this assessment, the terms 'impact' and 'effect' have the following meanings:

- Impacts - arise from the construction or operation / implementation of the proposals and result in a material change to an IOF; and
- Effects - are the consequences of the impact, which may be varied, for the IOF under consideration.

Ornithological Feature Sensitivity

7.4.23. Assigning a level of sensitivity to a feature requires consideration of a number of factors. Sensitivity is typically defined by consideration of international and / or national conservation status and relative rarity at different geographical scales (e.g. local, regional, national, international) and estimates of population size within the area of influence of the Proposed Development (or importance of the habitats within the Proposed Development Area in providing critical supporting habitat to populations present in the wider area). Where there is uncertainty about the accuracy of the available information used to inform judgements on IOF sensitivity a precautionary approach has been adopted to minimise the risk of under-valuing any feature.

7.4.24. Some explanatory definitions of ornithological feature sensitivity (populations and supporting habitats) are given in Table 7.2, below.

[14] Chartered Institute of Ecology and Environmental Management (2018). Guidelines for Ecological Impact Assessment in the UK and Ireland (September 2018). Available at https://cieem.net/wp-content/uploads/2019/02/Combined-EclA-guidelines-2018-compressed.pdf [Accessed 01/08/2019].

[15] Scottish Natural Heritage (2018). A handbook on environmental impact assessment Guidance for Competent Authorities, Consultees and others involved in the Environmental Impact Assessment Process in Scotland (version 5, April 2018). Available at: https://www.nature.scot/handbook-environmental-impact-assessment-guidance-competent-authorities-consultees-and-others [Accessed 01/08/2019].

Table 7.2: Defining ornithological feature sensitivity

IOF sensitivity	Example criteria / definitions
Very High (International)	Habitats or species that form part of the cited interest of an internationally protected site or candidate site (for example, SPA, Ramsar site). Bird species listed on Annex I of the EC Birds Directive if present in qualifying numbers / proportions of the national / international population.
High (National)	A nationally designated site (e.g. SSSI, National Nature Reserve (NNR)) and the habitats and species that form its cited interest. Regularly occurring, but rare bird species (for example, less than 300 breeding pairs in the UK). Birds present in nationally important numbers (for example, more than 1%[16] of the UK population). A site that provides critical habitat for any regularly occurring bird population of national importance, which is also considered a rare species in the UK.
Medium (Regional, e.g. NHZ)	A Local Nature Reserve, some local designated sites depending on specific site conditions. Any regularly occurring population of a nationally important bird species which is threatened or rare in the region (for example, more than 1% of the regional population or NHZ population where reliable estimates are available). Regularly occurring, regionally important population of bird species listed on the current UK Red list, presence of regionally important habitats critical to such species. Regionally important populations of National and Local Biodiversity Action Plan species.
Low	High Local: Sites with an identified ornithological interest meeting the criteria for Council area designation (such as Site of Importance for Nature Conservation), Local Wildlife Sites, which may include amenity and educational criteria in urban areas. Designated Local Nature Reserves. Any regularly occurring, locally significant population of bird species and their supporting habitats.
	Medium Local: A population of a species or assemblage of species which are not considered to qualify for non-statutory designation, but which are considered locally important (i.e. approx. 10 km radius from Proposed Development Area). Populations and supporting habitats of any bird species conservation importance in the context of the local area (i.e. approx. 10 km radius from the Proposed Development Area).
	Low Local: A population of a species or assemblage of species which are not considered to qualify for non-statutory designation, but which are considered locally important in the context of the immediate surrounding area. Populations and supporting habitats of any bird species of conservation importance in the context of the immediate surrounding area.
Negligible	A commonplace species / population of little or no conservation importance at a local scale. Habitats of negligible value to any bird population.

7.4.25. For the purposes of this assessment, importance in relation to population size is based on the estimated proportion in comparison to the wider geographical population. Where 1% of the bird population for a given geographical scale is regularly present within Proposed Development Area, then that site is considered to be important for that species and spatial scale. The 1% criterion for importance is well-established and can be applied at the regional, sub-regional or local scales, providing there is sufficiently accurate information available on population sizes within these geographical units. Where there is uncertainty about the accuracy of the available information, a precautionary approach has been adopted to minimise the risk of under-estimating the importance of the Proposed Development Area for any species.

7.4.26. Current and accurate information on population sizes below the national level is frequently unavailable for many species. The evaluation of regional, sub-regional, and local importance must therefore often be based on the available information and professional judgement. Breeding population estimates, based on NHZ boundaries which divide Scotland into a number of distinct biogeographical areas, have been published and updated for some key species (Wilson *et al.* 2015[17]). The Proposed Development is located within the 'Western Southern Uplands & Inner Solway' NHZ.

Effect Characterisation

7.4.27. The overall character of an effect is a function of a wide range of variables, determined through informed professional judgement, including the following considerations:

- Direction of effect: whether the effect benefits (positive) or detracts / harms (adverse) the value of the IOF;
- Extent of the effect: number or area affected or potentially affected (quantified where possible, as the percentage / proportion of the total IOF population lost or affected);
- Complexity of the effect: relating to whether an effect on a IOF is direct or indirect effect, near or far, immediate or delayed;
- Reversibility of the effect: reversible or irreversible (can the effect be reversed, within a reasonable timescale and with reasonable expectation of recovery, or is it permanent and irreversible);
- Frequency of the effect: is the effect acting constantly or intermittently (e.g. occasional noise disturbance in comparison to a longer-term change to the existing baseline levels of disturbance);
- Duration of the effect: is the effect occurring during a more or less sensitive period of the IOF (e.g. relative to the bird breeding season); and
- Confidence: certain, near-certain, probable, unlikely or extremely unlikely.

7.4.28. The overall effect, considering all of the above factors, for each IOF is categorised for each phase of the Proposed Development (i.e. the construction phase, the operational phase and the decommissioning phase). To help illustrate this, summary descriptions of the various effect levels (primarily considering effect magnitude) are provided in Table 7.3 below. The anticipated duration of the effect may also be summarised as the following categories within the assessment: permanent (>30 years); long-term (15-30 years); medium-term (5-15 years); and short-term (less than 5 years).

Table 7.3: Categorisation of the level of an effect on IOFs

Level	Description
Total / Near Total	Loss of the integrity of the population under consideration, threatening its survival, from a large increase in direct or indirect additive mortality, reduction in productivity immediately affecting its viability / conservation status.
High	Major increase in direct or indirect additive mortality, reduction in productivity, which would affect the populations' long-term viability / conservation status.

[16] The >1% population threshold for determining the importance of a site is not based on any underlying ecological principle it has become accepted as an appropriate indicator of importance, particularly in acting as a trigger for sites to be considered for potential formal designation and protection.

[17] Wilson, M. W., Austin, G. E., Gillings S. and Wernham, C. V. (2015). Natural Heritage Zone Bird Population Estimates. SWBSG Commissioned report number SWBSG_1504. pp72.

Level	Description
Medium	Moderate increase in direct or indirect additive mortality, reduction in productivity, which has the potential to affect the populations' long-term viability / conservation status.
Low	Minor increase in direct or indirect mortality, reduction in productivity, either of sufficiently small-scale or short duration that long-term harm to the status of the population is unlikely.
Negligible	Negligible, but measurable, increase in direct or indirect mortality, reduction in productivity, of sufficiently small-scale or short duration to avoid any long-term harm to the population.

7.4.29. Certain species are considered to display greater relative vulnerability to the impacts of wind farm developments than others. Relative vulnerability can be summarised by broad criteria which are assigned to each species based on certain aspects of their ecology, sensitivity to disturbance, biometrics and flight behaviour. Species-specific vulnerability to wind farm development is considered within the impact assessment process (i.e. one of the factors considered in determining the level of effect magnitude) and does not form part of the determination of feature sensitivity, which is undertaken without reference to the development type and impact parameters.

7.4.30. For individual species, their relative vulnerability to wind farm development is outlined and discussed within the assessment. This is determined from the available published research, monitoring studies and literature reviews that have considered species-specific effects of wind farm development (i.e. displacement, barrier effects, and collision risk). It is important to note that such assessments of vulnerability broadly illustrate differences in potential species-specific responses to wind farm development and are an aid to impact assessment. They do not necessarily reflect variation in vulnerability between individuals, sexes and age groups in the same population, and in the same individual over time (e.g. seasonal changes) or other influencing factors such as habitat type and condition, wind farm size and layout, and topography.

Effect Significance

7.4.31. Significance (in the specific meaning applicable to EIA) is a measure of the importance that should be given to an assessed effect in relation to the consideration of further mitigation and the overall impact of the Proposed Development. Effects can be significant at a wide range of geographical scales (i.e. from the local level to effects that are of international importance for the feature under consideration), but which result in important consequences for the functioning and / or conservation status of the population under consideration. In general terms, significance is determined through the interaction between IOF sensitivity and the categorised effect level (i.e. taking into account effect extent, duration, reversibility etc.).

7.4.32. For consistency across the EIAR, effect significance is reported in categories, from No effect to Major, through Negligible, Minor and Moderate. For illustrative purposes only, a matrix is provided as Table 7.4 to indicate how effect level and ornithological feature sensitivity relate to judgements of effect significance. In practice, the determination of significance involves the careful application of informed professional judgement and consideration of a wide range of factors, as outlined above. For the purposes of this assessment, effects are considered Significant (i.e. 'significant' in terms of the EIA Regulations) if they are reported as greater than Moderate and detectable / applicable at above the local level geographical scale.

Table 7.4: Matrix illustrating the relationship between the effect level and feature sensitivity

IOF sensitivity		Effect level			
		High	Medium	Low	Negligible
Very High		Major	Major	Major-Moderate	Negligible
High		Major	Major-Moderate	Moderate	
Medium		Major-Moderate	Moderate	Moderate-Minor	
Low	*High*	Moderate	Moderate-Minor	Minor	
	Medium	Moderate-Minor	Minor	Minor	
	Low	Minor	Minor	Minor	
Negligible		Negligible			

Approach to Mitigation

7.4.33. Potentially significant adverse effects on IOFs have been addressed by following the mitigation hierarchy principles:

- Avoidance: Seek options / alternative location(s) or layouts that avoid / reduce risk of harm (e.g. locating wind turbines away from regularly used nest sites, roost sites and areas of high flight activity);
- Mitigation: Potentially significant adverse effects avoided or minimised through mitigation measures (e.g. timing of works to avoid / reduce disturbance to breeding birds);
- Compensation: Where there are significant residual negative effects despite the mitigation proposed, these should be offset by appropriate compensatory measures (e.g. habitat improvement or creation outside the zone of effect of the wind farm); and
- Enhancement: Seek to provide net benefits for biodiversity over and above requirements for avoidance, mitigation or compensation. Identify opportunities for ecological enhancement and net-gain.

7.4.34. In relation to the Proposed Development, appreciable reduction or avoidance in potential adverse effects has been achieved through the wind farm design process. Locally important areas for sensitive species (such as moorland wader breeding areas, nest sites and core foraging areas for Schedule 1 raptors species) have been identified as constraints during the design process and have been avoided where possible. How the development design considered ornithological constraints in this process is outlined in Chapter 2: Site Selection and Design Evolution.

7.4.35. Where potentially significant effects are predicted, further mitigation measures have been recommended to reduce their severity. These measures are taken into account in the assessment of residual effects. This requires consideration of the effectiveness of the proposed mitigation and the likelihood of them being achieved. For example, timing of construction works to avoid disturbing sensitive breeding habitats or nest sites can be highly effective at avoiding disturbance and the associated adverse effects. Whereas habitat creation to compensate for displacement losses can require long timescales to be achieved and cannot always be guaranteed in its effectiveness. Therefore, it is important to take a realistic and conservative approach to assumptions about the efficacy of any mitigation, particularly measures proposed to reduce impacts below a significant level. Such assessments, of the efficacy of proposed mitigation, are based on a combination of informed professional judgement and experience of similar mitigation measures from other projects.

Collision Risk Modelling

7.4.36. Annual collision rates for key species have been estimated following a method developed by Band *et al.* (2007[18]). The results of this process provide an estimate of annual mortality from turbine blade strike with a varying degree of potential error margin and reliability depending on a wide range of factors. The model output, following careful consideration due to these factors and the recognised limitations of such models, is used to inform the assessment of potential effects of wind turbine bird strike on the populations that are the focus of the EIA. The calculations and parameters involved are detailed in Technical Appendix 7.2: Details of the Collision Risk Modelling. In summary, the process involves three stages:

- Stage one is the estimation of the number of transits through the proposed rotor swept volume per year, based on observed flight activity data and parameters of the wind farm and wind turbine design;
- Stage two involves the estimation of the predicted proportion of transits through the rotor swept volume that would result in a collision between the bird and a wind turbine blade. All predicted collisions are assumed to be fatal. This provides an estimate of the number of fatalities per year for the wind farm but assumes that no bird takes avoiding action to prevent a collision; and
- Finally, an assumed rate for collision avoidance is applied to the estimate.

7.4.37. This method is more suitable for some species than others. For example, small, cryptic and fast-flying birds, such as merlin, are difficult to detect beyond a distance of a few hundred metres and this results in under-estimates of flight activity based on observational data alone. For these species collision risk is best assessed through other means, for example territory modelling and assumptions about flight activity, rather than collision risk modelling alone.

7.4.38. To provide a biologically realistic estimate of collision risk it is necessary to assume that birds take action to avoid collision (Band *et al.* 2007[18]). Birds may display avoidance at several spatial scales: e.g. avoiding a wind farm as a whole; altering flight direction to avoid turbines within the wind farm (e.g. flying between turbine rows); or taking action very close to an individual turbine to avoid a collision.

7.4.39. Reliable observational data on which to base accurate estimates for different types of avoidance are lacking for many species. Additionally, there are many other factors associated with wind farm location, habitat types and landform, which may also influence collision risk on a site-specific basis. Therefore, estimates of collision rates derived from assumed avoidance values, in the absence of suitable empirical data, should be treated with caution. NatureScot initially recommend a default avoidance rate of 95% but have in recent years, following various literature reviews of bird collision monitoring studies, increased these rates for some species. For example, current guidance is to assume a 99% avoidance rate for red kite and 99.5% for whooper swan (NatureScot 2018[19]).

7.4.40. In this assessment, estimates of collision risk / mortality have been calculated for the feature species where there was sufficient data to carry out the analyses. Further details and discussion of various generic and assessment-specific assumptions, limitations, and biases applicable to collision risk modelling are provided in Technical Appendix 7.2.

Cumulative Impact Assessment

7.4.41. The potential for cumulative impacts with other proposals has been assessed following current CIEEM and NatureScot guidance (NatureScot 2018[20], CIEEM 2018[21]). This part of the assessment focuses on those features where there is a realistic potential for cumulative adverse effects to occur. The assessment includes consideration of operational projects; projects under construction; consented projects which are not yet under construction; and projects for which planning applications have been submitted and for which sufficient information is publicly available (as of September 2021).

7.4.42. Cumulative effects, from two or more development proposals, can be additive (i.e. the effect of each of the proposals can be summed), antagonistic (i.e. the combined effects are less than if they were summed) or synergistic (i.e. the combined effects are greater than if they were summed). In relation to combined collision mortality estimates the approach has been to assume, on a precautionary basis, that the effect on key feature populations would be additive. However, combining collision mortality estimates from several different projects is likely to lead to over-estimates, as individual birds taken from a population, as a result of collision mortality, can be removed only once and this then reduces the number of birds subject to collision risk from other sources. Also, birds that are lost to the population as a result of wind turbine collision may have died anyway from other causes (i.e. compensatory mortality).

7.4.43. Broadly, there are three main sources for cumulative effects:

- Type 1 – those arising from the Proposed Development being assessed;
- Type 2 – those arising from the Proposed Development in combination with those that are predicted to arise from completed development projects; and
- Type 3 – those arising from the Proposed Development being assessed in combination with those arising from other proposed projects.

7.4.44. Type 1 cumulative effects are associated with the Proposed Development (e.g. the cumulative result of wind farm operational displacement and collision risk needs to be considered as they are antagonistic effects) and are considered within Section 7.7 of this Chapter.

7.4.45. Type 2 and 3 effects are potential 'in combination' effects associated with other existing and proposed developments and are considered in Section 7.10 of this Chapter. The cumulative assessment focuses on wind farm development and the potential for significant cumulative effects on red kite from wind farm collision mortality within the context of NHZ 19.

7.4.46. In relation to Type 3 effects, this assessment focuses on proposals which have consent, or for which an application for consent has been submitted. There is clearly greater uncertainty about projects which are at the EIA Scoping stage. Additionally, projects at this stage rarely have any detailed baseline survey information or assessments available for review. Therefore, the assessment of potential cumulative effects is inevitably more speculative for such proposals.

7.4.47. The relevant spatial scale is also an important consideration in determining the scope of the cumulative assessment. The assessment of potential cumulative effects has been restricted to those projects that have the potential to interact with the same key feature populations at a similar scale or influence as the Proposed Development, at the regional or NHZ scale.

Assessment Limitations

7.4.48. The methods adopted for this assessment follow current best practice and have been agreed in consultation with NatureScot. There are no methodological limitations, specific to this assessment, which appreciably affect the reliability or robustness of its conclusions.

7.4.49. Generally, all impact assessments are subject to some degree of uncertainty as to the potential scope, scale, duration and magnitude of effects and the range and sensitivity of features affected. This can result in EIAs both underestimating and overestimating potential effects. Often of greatest potential importance with respect to

[18] Band, W., Madders, M. and Whitfield, D.P. (2007). Developing field and analytical methods to assess avian collision risk at Wind Farms. In de Lucas, M., Janss, G. and Ferrer, M. (eds.) Birds and Wind Power. Quercus.

[19] Scottish Natural Heritage (2018). Avoidance Rates for the onshore NatureScot Wind Farm Collision Risk Model, September 2018.

[20] Scottish Natural Heritage (2012). Assessing the Cumulative Impact of Onshore Wind Energy Developments [online]. Available at: https://www.nature.scot/guidance-assessing-cumulative-impact-onshore-wind-energy-developments [Accessed 01/08/2019].

[21] Chartered Institute of Ecology and Environmental Management (2018). Guidelines for Ecological Impact Assessment in the UK and Ireland (September 2018). Available at https://cieem.net/wp-content/uploads/2019/02/Combined-EclA-guidelines-2018-compressed.pdf [Accessed 01/08/2019].

ornithological impact assessment is the extent that natural variability in bird activity may influence the reliability of assessment conclusions. The presence and intensity of use of a site by key species can vary widely over the period that wind farms are typically operational for (e.g. 25-30 years). Baseline data is typically collected over 2-3 years and this may not be reflective of the use and importance of Proposed Development Area for any given species of concern over these longer timescales. For longer-lived species, such as many raptors, individual breeding success can vary markedly from year to year, and this can have a strong influence on ranging behaviour, flight activity and potential exposure to wind turbine collision risk or the effects of wind farm displacement.

7.4.50. There are various approaches that can be taken to address such limitations. It is important that assessments include consideration of how population trends, in the key species of potential concern for the assessment, and relevant longer-term information available from national and local monitoring studies (e.g. Scottish Raptor Monitoring Scheme). Also, to take into consideration the potential, given the extent, type and quality of habitats within the Proposed Development Area, for it to support species that are currently not present but that realistically could re-colonise the area within the development operational lifetime or could increase in number if the population is currently below its potential carrying capacity.

7.4.51. Limitations with respect of bird collision risk modelling are well known (Band *et al.* 2007[18]). Such models are often limited by the current understanding of how bird flight activity and behaviour is affected by wind farms in the long-term and in proximity to individual wind turbines. However, this model includes input parameters that can be adjusted to some extent to account for species-specific differences in morphology and flight behaviour and incorporates variables for individual turbine design, wind farm layout and operational regime. A further advantage of the Band Model, which has become widely adopted in wind farm EIA, is that it enables comparisons of collision risk between proposals, which also helps to inform cumulative assessment.

7.4.52. General and project-specific uncertainties have been accounted for in this impact assessment, where appropriate, by assuming reasonable 'worst cases' where relevant in the evaluation of feature sensitivity and the assessment of the potential effects of the Proposed Development. These are highlighted and discussed, where relevant, within the assessment section of this Chapter.

7.5 CONSULTATION

EIA Scoping

7.5.1. During the EIA scoping process, the opinions of various statutory and non-statutory consultees were requested in relation to the main potential effects that might arise from the Proposed Development, the species that should be considered in the assessment, what other information they would expect to be provided in the EIAR and whether the proposed desk study, survey and assessment methodologies were appropriate.

7.5.2. Responses to the scoping report were collated and provided by the Energy Consents Unit (ECU) in October 2020. A summary of the key points relevant to this assessment arising from the EIA scoping process is provided in Table 7.5.

Table 7.5 Summary of the key points raised by consultees with respect to the Ornithological Impact Assessment

Subject	Summary of Points Raised	How they have been Addressed
Designated Sites	NatureScot confirmed that the potential effects of the proposed development on the Loch Ken and River Dee Marshes SPA qualifying interests should be fully considered.	This issue is considered in the assessment, see section 7.6.
Cumulative Impacts	NatureScot advised that the focus of the cumulative assessment, in the context of the NHZ, might be particularly concerned with wider countryside impacts on curlew, hen harrier and golden plover.	Cumulative impacts on curlew are considered in the assessment. No potentially significant cumulative effects on hen harrier or golden plover were identified during the assessment.
Flight Activity Survey Effort	RSPB noted that they welcomed the fact that two years' worth of ornithological data had been gathered and broadly agreed that it is enough to inform a reliable assessment of the potential effects of the proposed development. However, RSPB commented that targeted flight activity surveys, with an emphasis on dawn and dusk for migrating swans and geese during spring and autumn passage, should be undertaken.	Additional flight activity surveys were completed during autumn/winter 2020-21.
Black grouse & red kite	RSPB highlighted the presence of a black grouse lek and the high flight activity recorded for red kite. They commented that they would expect to see detail of assessment of impact to these species and the appropriate level of mitigation measures outlined in the environmental impact assessment. Also, that this should include assessment of cumulative impact from other developments in combination with this project.	This assessment includes full consideration of all the direct, indirect and cumulative effects that have the potential to be significant for both species.

Important Ornithological Features

7.5.3. This assessment focuses on populations of bird species that are known to be sensitive to effects from the construction and / or operation of onshore wind farms, based on current established scientific understanding (i.e. from relevant guidance and available research and site monitoring studies). Consideration has been given in this assessment to those species whose populations are also of conservation concern in the UK and / or Europe. These include:

- Species listed on Annex I of the European Council Directive 2009/147/EC on the Conservation of Wild Birds (i.e. 'Annex I' species);
- Species listed on Schedule 1 to the Wildlife and Countryside Act 1981, as amended (i.e. 'Schedule 1' species), which includes most 'Rare' native breeding species (i.e. <300 breeding pairs per annum);
- Species that form the qualifying interest of a statutory designated site (e.g. SPA, SSSI); and
- Species of national or regional conservation concern (e.g. Scottish Biodiversity List or Local Biodiversity Action Plan), not included within the above categories, but that are present within the area of interest in nationally or regionally important numbers.

7.5.4. Consideration is given to the range of species that may use, or pass through/near to, a proposed wind farm site at different times of year. Taking into account the type and extent of habitats present and their suitability to support important breeding, moulting, staging or wintering populations of species that are considered to be vulnerable to wind farm development. Also, the potential for the Proposed Development Area to be overflown by birds on migration due to its proximity to important flight corridors.

7.5.5. Table 7.1 provides a list of potential focal species for this assessment, based on the above criteria, which were identified through the initial desk study process. Following completion of the Scoping process and baseline surveys, the list of IOFs for the assessment has been determined as follows (key seasons in relation to use of Proposed Development Area):

- Whooper swan (spring / autumn migration)

- Greylag goose (spring / autumn migration)
- Pink-footed goose (spring / autumn migration)
- Black grouse (breeding / non-breeding)
- Hen harrier (non-breeding)
- Red kite (breeding / non-breeding)
- Curlew (breeding)
- Merlin (non-breeding)
- Peregrine falcon (breeding / non-breeding)

7.5.6. Apart from consideration of the potential for effects on bird populations that form the qualifying features of the Loch Ken and River Dee Marshes SPA and Ramsar Site, all designated sites with cited ornithological interest have been scoped out of this assessment due to the Proposed Development being located outside of the potential connectivity range for all relevant species, as defined in NatureScot guidance (2016)[11].

7.5.7. Certain, relatively common species, which are present within the survey area and potentially vulnerable to wind farm development (e.g. may be at risk from collision mortality such as common buzzard, raven, mallard, grey heron), have been excluded from detailed consideration in this assessment as their populations (other than at a local level) are not considered to be at any risk of significant effects from the Proposed Development.

7.5.8. Common moorland songbirds have also been scoped out of further consideration in this assessment, except for the proposed Bird Protection Plan (BPP) and ensuring that all nesting birds are protected, in compliance with the Wildlife & Countryside Act 1981 (as amended), during construction works.

7.5.9. The potential effects on birds arising from the connection of the Proposed Development to the National Grid are not considered within this EIA and will be subject to a separate application by the relevant network operator. The potential effects on all relevant IOFs from the construction and operation of the Grid connection will be fully assessed as part of a separate consenting process.

7.5.10. The potential for the necessary public road accommodation works to result in any appreciable impacts on bird species of conservation concern and their supporting habitats has been considered based on a desk-based review of the potential works locations in relation to statutory and non-statutory designated sites.

7.6 BASELINE

Introduction

7.6.1. This section provides a summary of the results of the desk study and baseline ornithological surveys. Further details are provided in Technical Appendix 7.1.

Designated Sites

7.6.2. The locations of natural heritage designated sites within 10 km of Proposed Development Area are shown on Figure 6.2. There are no statutory designated sites (e.g. Special Protection Areas, Special Areas of Conservation, Sites of Special Scientific Interest) within the Site or adjacent to it. The nearest such designation is Cleugh SSSI, which is within 5 km of the Site and a further two SSSI's within 7 km of the Site boundary (Loch Doon and Merrick Kells, which is also a SAC). The citations for these designations do not mention any specific ornithological interest

7.6.3. Table 7.6 provides a summary of the Special Protection Areas (SPAs) within 20 km of the Proposed Development. The potential for adverse effects to occur beyond this distance from the Proposed Development, alone or in combination with any other plan or project, is considered negligible in this case, with respect to bird populations that are the qualifying features of SPAs that may also occur within or near to the Proposed Development Area. This takes into consideration NatureScot guidance on species-specific SPA population connectivity. Therefore, the need to undertake an assessment under the provisions of the Habitats Regulations 1994 (as amended) protecting these sites is not considered to be required in the case of this Application.

Table 7.6: Special Protection Areas within c. 20 km of the Proposed Development and a summary of their qualifying features.

Name	Designation	Distance from Site	Qualifying Species (Latest Assessed Condition)
Loch Ken and River Dee Marshes	SPA / Ramsar Site (including Kenmure Holms and River Dee (Parton to Crossmichael) SSSI)	15 km South	This SPA is an internationally important site for: Greenland white-fronted goose, wintering (Favourable Maintained, 14 Nov 2010) Greylag goose, wintering (Favourable Maintained', 30 Apr 2007). The SPA also supports important breeding populations of common tern, kingfisher, wigeon, teal, mallard, shoveler, tufted duck, goosander, water rail, coot, oystercatcher, lapwing, redshank, curlew, and black-headed gull. The following species of wintering wildfowl are notable: whooper swan; bean goose; wigeon; teal; pintail; goldeneye; smew; and goosander.
Muirkirk and North Lowther Uplands	SPA (various SSSIs)	c. 18 km north	This SPA supports populations of European importance of: Golden plover (*Pluvialis apricaria*), breeding (Unfavourable Declining, 30 Jun 2015). Hen harrier, breeding (Unfavourable Declining, 20 Jul 2008). Hen harrier, non-breeding (Unfavourable Declining, 2 Dec 2004). Merlin, breeding (Unfavourable No Change, 25 Jul 2009).

7.6.4. The NatureScot document "Assessing Connectivity with Special Protection Areas (SPAs)" (2016) provides guidance on determining if there are likely to be adverse effects on bird populations ranging outside of the SPAs as a result of a proposed development. Included in the document are details of the typical foraging ranges for breeding and wintering populations of species that form the qualifying interests of SPAs.

7.6.5. The distance from the Proposed Development to Loch Ken and River Dee Marshes SPA is within the reported ranging distance for wintering greylag goose (estimated to be up to 15-20 km from their roosts) but not for Greenland white-fronted goose (core range of 5-8 km).

7.6.6. During surveys completed in the winters of 2018-19 and 2020-21 there was no evidence of appreciable numbers of roosting or feeding migratory Icelandic greylag geese, which may be part of the Loch Ken and River Dee Marshes SPA population, occurring within the survey area. This is consistent with a study of the feeding distribution of the SPA population (Mitchel 2012[22]).

7.6.7. The available data indicates that the Proposed Development area, and associated buffer zones, do not support roosting or feeding migratory Icelandic greylag geese that are part of the Ken and River Dee Marshes SPA population. Therefore, there is no potential for any direct or indirect (e.g. displacement, barrier effects) on use of

[22] Mitchell, C. (2012). Mapping the distribution of feeding Pink-footed and Iceland Greylag Geese in Scotland. Wildfowl & Wetlands Trust / Scottish Natural Heritage Report, Slimbridge. 108pp.

habitats outside of the SPA that support the SPA population. The only potential effect is the risk of collision mortality during principle migratory, or within Scotland, movements of Icelandic greylag geese that form part of the SPA population. The results of the flight activity survey, and collision modelling, have confirmed that that the Proposed Development presents a negligible risk for this population (estimated at <1 collision during the lifetime of the Proposed Development, see Table 7.15). No material effects are predicted from the Proposed Development, alone or in combination with any other known plan or project, for Icelandic greylag goose as a qualifying feature of the Ken and River Dee Marshes SPA population.

7.6.8. The reported core ranging distances for all of the qualifying species for Muirkirk and North Lowther Uplands SPA are much shorter than the distance from the SPA to the Proposed Development. There is considered to be no connectivity to the SPA qualifying interests and the Proposed Development would not undermine the conservation objectives of the SPA. There is no Likely Significant Effect from the Proposed Development, alone or in combination with other plans or projects. Therefore, further consideration of any potential effects on the Muirkirk and North Lowther SPA has been scoped out of this assessment.

7.6.9. Loch Doon SSSI is located c. 8 km west of the Proposed Development Area. The SSSI citation does not include the ornithological interest of the loch but it is an important site for breeding osprey and is also used by whooper swans during the winter. Bogton Loch SSSI, further to the north (c. 15 km northwest of the Proposed Development Area) is also a regionally important site for wintering whooper swans.

7.6.10. Loch Ken and River Dee Marshes SPA, c. 15 km south of the Proposed Development Area is also used by whooper swans. The Proposed Development is, however, well outside of the foraging range for birds wintering within the SPA. Whooper swans do pass through the general area on migration, as recorded during the baseline surveys (see below), and small groups occasionally use the carse land near Carsphairn (c. 2 km west of the Proposed Development, see Table 7.7).

7.6.11. There are no non-statutory sites designated for their natural heritage within or adjacent to the Proposed Development Area (e.g. Local Nature Reserves, Local Nature Conservation Sites, Wildlife Sites, Provisional Wildlife Sites).

7.6.12. Galloway Forest Park Important Bird Area (IBA[23]) is a large non-statutory designated area (58,295 ha in total) located to the south and west of the Proposed Development Area. The IBA designation process was originally triggered due to the importance of the area for black grouse, peregrine and short-eared owl. The IBA comprises lochs, forest, moorland and mountain habitats that mostly corresponds to the boundary of the Galloway Forest Park. A section of the IBA extends into Proposed Development Area boundary near to Furmiston but is located just outside of the Proposed Development area.

7.6.13. The Proposed Development Area is located within the Galloway and Southern Ayrshire Biosphere Reserve. This is a non-statutory designation conferred by the United Nations Educational, Scientific and Cultural Organization (UNESCO) in recognition of the special natural qualities of the area. Galloway and Southern Ayrshire Biosphere Reserve was designated in 2012, it includes areas within Dumfries and Galloway, East Ayrshire and South Ayrshire and is comprised of three zones: Core; Buffer and Transition. The Proposed Development Area is located within the Transition zone, which is the largest zone of the Biosphere Reserve. The Core zone is formed by sites with statutory nature conservation designations and includes the Merrick Kells SSSI and SAC and the Cairnsmore of Fleet SSSI and NNR. The Buffer Zone corresponds approximately with the boundary of Galloway Forest Park.

Desk Study Records

7.6.14. Figure 7.2 shows the locations of non-confidential ornithological records collated from various sources. This includes non-confidential records provided by RSPB and SWSEIC and records of key species from surveys of the area in relation to a previous wind farm development proposal. Records considered to be sensitive (e.g. relating to a breeding site at risk from human disturbance, persecution or exploitation) are fully considered within this assessment but due to their confidential nature are provided in a separate Confidential Annex to this Chapter.

7.6.15. The findings from baseline ornithological surveys conducted for the previous Quantans Hill wind farm proposal (during the period autumn 2009 and spring 2011) were also reviewed as part of the desk study. The survey areas differed slightly to those completed for the Proposed Development, however a large proportion of the area was included in the 2009-2011 surveys. The key findings are summarised below:

- A black grouse lek of two males plus another two non-lekking males;
- Two barn owl nest sites, out with the Proposed Development Area boundary but within 500 m of it;
- Infrequent flights of greylag and pink-footed geese during winter and early spring
- Infrequent activity of hen harrier, however no evidence of nesting or roosting within the wider survey area;
- Records of other protected raptors including golden eagle (one flight), osprey (one flight), red kite (recorded during walkover survey), goshawk (one flight, one incidental), merlin (two flights) and peregrine (one);
- Three territories of curlew within the Proposed Development Area boundary (plus two in wider survey area) and two territories of snipe (plus one in wider survey area); and
- No regular wildfowl or wader flights or significant use of nearby waterbodies (Kendoon Loch and Water of Deugh) in winter.

7.6.16. The RSPB provided records of black grouse and red kite for the period 2010 to 2020. As these records are sensitive the full details have been included in the Confidential Annex. A summary of the information is provided below:

- Black grouse – records of small numbers of lekking males (1-2 individuals, 5 records over the 10-year period), all of which were located outside of the Proposed Development Area, c. 2 km from the Site boundary. There were no records more recent than 2014. There was a Forestry Commission record of a single non-displaying male from 2013, provided at the 10x10 km OS Grid square scale, and the Proposed Development Area is located party within this square.
- Red kite – Five records of confirmed breeding (recently fledged young or nests with eggs), and two observations of non-breeding birds, during the period 2015 to 2018. One of the breeding records (from 2015) is within 1 km of the Proposed Development. However, this site has not been re-used by a breeding pair since 2015 (i.e. up to and including 2021). It is understood that this pair favour another breeding location, which is >2 km from the Proposed Development.

7.6.17. Dumfries and Galloway Raptor Study Group also provided records for the period 2010-20 in relation to breeding red kite as well as breeding peregrine falcon. Two peregrine breeding locations were reported, both of which are more than 2 km from the Proposed Development. The red kite breeding records mirror those provided by the RSPB but with the addition of some other breeding records (three locations in total) that are more than 2 km from the Proposed Development. However, one of the breeding sites is within 1.5 km of the Proposed Development. Further detail is provided in the Confidential Annex.

7.6.18. SWSEIC also provided some notable bird records for the area, the records relating to species of conservation concern and potential relevance to this assessment are shown in Table 7.7 below, further detail is provided in Appendix 7.1.

Table 7.7: Summary of key bird records provided by SWSEIC

Common Name	Scientific Name	Year	Month	No. Records	Location
Whooper swan	*Cygnus cygnus*	2015	Feb.	2 (2 birds)	Carsphairn, carse land to northwest
		2015	Mar.	2 (14 birds)	
		2015	Apr.	1 (2 birds)	

[23] IBAs are a global designation selected by Birdlife International, in partnership with the RSPB in the UK, which identify sites as a priority for conservation. Designation as an IBA does not confer any statutory protection.

Common Name	Scientific Name	Year	Month	No. Records	Location
		2016	Mar.	1 (23 birds)	Dundeugh fish farm
Black grouse	*Lyrurus tetrix*	2008	Nov.	1 (2, pair)	Moorbrock
		2017	May	1 (1 adult female)	Cairnsmore of Carsphairn
Red kite	*Milvus milvus*	2014	April	1	Loch Sherrow
		2015	Jan.	1	Carsphairn
		2015	Feb.	2	Carsphairn
		2015	Mar.	1	Carsphairn
		2015	Apr.	1	Carsphairn
		2015	Apr.	1	Kendoon
		2015	Apr.	1	Knockgray Farm
		2015	May	1	Carsphairn
White-tailed Eagle	*Haliaeetus albicilla*	2015	Mar.	1	Kendoon fish farm
Hen Harrier	*Circus cyaneus*	2013	Nov.	1 male(s)	Marbrack Farm, Carsphairn
Osprey	*Pandion haliaetus*	2011	Sep.	1	Kendoon Loch.
		2015	May	1 (2 birds)	Carsphairn
		2016	May	1 (3, together)	Kendoon Fish Farm
Dotterel	*Charadrius morinellus*	2009	May	1 (5 birds)	Cairnsmore of Carsphairn
		2010	May	3 (flock of 22)	Cairnsmore of Carsphairn
		2011	April	2 (8 and 5 birds)	Cairnsmore of Carsphairn
		2012	May	3 (flock of 10)	Cairnsmore of Carsphairn
		2014	Apr	1 (3 birds)	Cairnsmore of Carsphairn

7.6.19. With the exception of the winter hen harrier record at Marbrack, the majority of these records are in locations well outside of the Proposed Development Area. The dotterel records relate to a well-used stopover site for this species on migration on, or near, the summit of Cairnsmore of Carsphairn, which, although within the Site (i.e. the redline boundary), is more than 2 km from the Proposed Development.

7.6.20. Data in relation to satellite tracking studies of goose and whooper swan migration was requested from WWT in September 2021. Unfortunately, no data was provided in time for the completion of the assessment and submission of the EIAR.

Flight Activity Surveys

7.6.21. The following is a summary of the results of the two flight activity survey periods. Further discussion of the flight activity survey findings is provided in the species accounts section that follows this initial overview. The species accounts are listed in taxonomic order. Further information about these surveys in also provided in Appendix 7.1.

7.6.22. The location of the VPs selected for the flight activity surveys are shown on Figure 7.3a and b. The mapped flight lines, for 'target species' (i.e. focal species for the surveys and this assessment), relative to the location of the proposed wind turbines, are shown on Figures 7.5 and 7.6 with the data sub-divided into seasons. The mapped flight lines of other species (referred to as 'secondary') are provided on figures accompanying Appendix 7.1.

7.6.23. During the initial April 2018 to August 2019 survey period a total of 150 hours of observation were completed from each of the VPs, 78 hours per VP in 2018 and 72 hours per VP in 2019 (see Table 7.8). Additional survey effort was undertaken during the autumn and spring migration periods.

Table 7.8: Hours of Observation Completed at each Vantage Point (April 2018 to August 2019)

Year	Month	VP1	VP2	VP3	VP4	VP5	Total
2018	April	6	6	6	3	3	24
	May	12	9	9	12	12	54
	June	6	9	9	9	9	42
	July	6	6	6	6	6	30
	August	6	6	6	6	6	30
	September	9	9	6	9	9	42
	October	12	15	15	9	9	61
	November	15	12	12	12	12	64
	December	6	6	9	12	12	45
Total		78	78	78	78	78	392
2019	January	6	6	6	6	6	30
	February	6	6	6	6	6	30
	March	9	9	9	9	9	45
	April	12	12	18	12	12	66
	May	15	9	9	9	9	51
	June	9	15	9	15	15	63
	July	6	9	9	9	9	42
	August	9	6	6	6	6	33
Total		72	72	72	72	72	360

7.6.24. A summary of the number of observations of target and secondary species with flights wholly or partially at 'collision risk height' (CRH) is provided in in Table 7.9. Also shown are the number of flights that were within or partly within the wind turbine envelope (i.e. the 'collision risk area' or CRA, defined by a 500 m wide buffer of the outermost proposed wind turbines).

Table 7.9: Flight Lines of Target and Secondary Species at Collison Risk Height (figures in parentheses give the number of birds for flight lines representing more than one individual)

Year	Month	Flight Lines Recorded within the CRA (no. birds)
2018	April	1 red kite;
	May	5 red kite; 9 kestrel
	Jun.	4 (5) red kite; 5 (6) kestrel; 2 (13) common gull
	Jul.	3 (5) red kite; 7 kestrel
	Aug.	3 red kite; 6 kestrel
	Sep.	3 (4) red kite; 2 (4) common snipe
	Oct.	2 red kite; 1 peregrine; 1 (6) golden plover; 2 kestrel
	Nov.	6 (7) red kite; 1 golden eagle; 6 kestrel

Year	Month	Flight Lines Recorded within the CRA (no. birds)
	Dec.	1 kestrel
2019	Jan.	1 red kite; 1 hen harrier; 1 (4) greylag goose
	Feb.	5 red kite
	Mar.	4 (5) red kite; 1 (28) whooper swan; 1 (15) pink-footed goose; 1 curlew; 4 kestrel
	Apr.	12 (13) red kite; 1 peregrine; 1 merlin; 1 goshawk; 1 (3) greylag goose; 2 kestrel
	May	8 red kite; 1 peregrine; 2 (3) curlew
	Jun.	9 (11) red kite; 1 kestrel
	Jul.	3 (5) red kite; 1 (1) herring gull; 2 common snipe
	Aug.	1 red kite

7.6.25. Red kite was the most frequently observed target species throughout much of the April 2018 to August 2019 survey period with a high proportion of flight activity within the collision risk area (CRA). Activity by other target raptor species was relatively sporadic and indicative of non-breeding birds passing through the area or hunting for short periods before moving on.

7.6.26. There were a small number of pink-footed goose, greylag goose and whooper swan flights that passed through the CRA during the spring migration period in 2019.

7.6.27. Breeding waders such as curlew and snipe were infrequently recorded, although it is important to note that snipe is often under-recorded in standard flight activity survey due the species relatively small size and tendency to be more active in the air during dusk and at night. Curlew were confirmed as breeding in several locations during the 2019 survey but were only recorded in flight within the CRA once in March 2019 and on two occasions in May 2019.

7.6.28. During the September 2020 to March 2021 survey period a further 60 hours of observation were completed from each of the three VPs (see Table 7.10). This survey ended in March 2021 in time for the data to be available to inform the wind farm design process. Additional survey effort was targeted to the autumn migration period.

Table 7.10: Hours of Observation Completed at each Vantage Point (September 2020 to March 2021)

Year	Month	VP6	VP7	VP8	Total
2020	September	9	9	9	27
	October	12	15	15	42
	November	15	12	12	39
	December	6	6	6	18
2021	January	6	6	6	18
	February	6	6	6	18
	March	6	6	6	18
Totals		60	60	60	180

7.6.29. A summary of the number of observations of target and secondary species with flights wholly or partially at CRH within the CRA during this period is provided in Table 7.11.

Table 7.11: Flight Lines of Target and Secondary Species at Risk Height (figures in parentheses give the number of birds for flight lines representing more than one individual)

Year	Month	Flight Lines Recorded within the CRA (no. birds)
2020	Sep.	4 red kite; 5 kestrel
	Oct.	7 red kite; 1 hen harrier; 1 goshawk; 5 (6) kestrel
	Nov.	4 red kite; 1 hen harrier; 1 (15) whooper swan; 1 (119) pink-footed goose; 6 kestrel
	Dec.	1 kite; 1 merlin; 3 kestrel
2021	Jan.	9 red kite; 2 kestrel
	Feb.	5 (6) red kite; 2 (27) pink-footed goose; 2 kestrel
	Mar.	5 (4) red kite; 1 kestrel

7.6.30. During the September 2020 to March 2021 flight activity survey, red kite remained the most frequently recorded target species within the CRA. Hen harrier activity had apparently increased from the previous survey period being recorded through the autumn months and on into December. Merlin was recorded on two occasions.

7.6.31. There were a small number of pink-footed goose and whooper swan flights that passed through the CRA during autumn migration in 2020, part of a pattern of movement that occurs over a broader front (e.g. along the Glenkens valley).

Breeding Bird Surveys

7.6.32. The following is a summary of the key findings from the baseline breeding bird surveys completed in 2018, 2019 and 2020 in relation to IOFs recorded as breeding or potentially breeding within or close to the Proposed Development Area. Further detail is provided in Technical Appendix 7.1. and in the following section of this chapter, which discusses IOF sensitivity. The non-confidential mapped results from the various surveys are provided as:

- Figure 7.4a Non-Confidential Breeding Bird Survey Results - Waders 2018-19
- Figure 7.4b Non-Confidential Breeding Bird Survey Results - Others 2018
- Figure 7.4c Non-Confidential Breeding Bird Survey Results - Others 2019

7.6.33. Sensitive breeding records related to Schedule 1 species (e.g. red kite and peregrine) are provided in the separate Confidential Annex.

Black Grouse

7.6.34. During spring 2018 there were two male black grouse recorded lekking in the survey area, towards the southern end of Proposed Development Area, to the south of Quantans Hill (this is close to the proposed location for turbine 10). A female was also recorded in May 2018, flushed from the ground near Quantans Hill. There were two other sightings of black grouse during the flight activity surveys in 2018, one of which was of a male in the same location as the lek site. This is c. 1.5 km southeast of another lek site, attended by 2 males, recorded during the surveys for the previous Quantans Hill wind farm proposal (during baseline surveys in 2002-11). There was no evidence of lekking activity in that area in 2018, 2019 or 2020.

7.6.35. Surveys in spring 2019 found no evidence of black grouse lekking anywhere within the survey area. An adult female was seen during a flight activity survey in April 2019 from VP 4, it circled over Rider's Knowe, c. 1.5 km north of the Proposed Development, and then headed southwest towards Knockwhirn.

7.6.36. Surveys in spring 2020 also found no evidence of black grouse lekking anywhere within the survey area. There were no observations of black grouse during other surveys completed during 2020 (e.g. including Phase I habitat and protected species walkover surveys).

Red kite

7.6.37. Surveys for breeding red kite were completed in 2018, 2019 and 2020. The Site and surrounding area provide suitable breeding habitat for red kite with numerous mature woodlands with potentially suitable trees for nesting adjacent to extensive farmland and open moorland that provides a wide range of food sources (e.g. sheep carrion, rabbits, voles, field mice, birds, worms, and invertebrate prey).

7.6.38. There was no evidence to indicate red kite were nesting within the Site in 2018, 2019 or 2020. However, during 2020 a breeding attempt was discovered in a location that is near to the edge of the Site, and c. 800 m from the Proposed Development. This site is referred to as KT1. A marked increase in red kite flight activity within the Site, in comparison to the 2018-19 survey period, was noted during later summer 2020. This may have been partly related to the activity associated with this breeding attempt.

7.6.39. The baseline surveys have coincided with an apparent expansion of red kite breeding activity in this general area in the past five years. The available evidence suggests there are up to three pairs of red kite nesting within 2 km of the Site and are likely to be using habitats within the Proposed Development area for hunting to varying extents. This is a fluid situation which may change again in the near future as red kites move between their favoured nest sites or new pairs settle in the area. Red kites are not particularly territorial, other than in defending their nest sites, and there are several alternative nesting sites that have not been occupied for several years.

Curlew

7.6.40. Surveys for breeding curlew were completed in 2018 and 2019. During the 2018 survey two breeding curlew territories were recorded just outside of Proposed Development Area in fields near to the Water of Deugh. During 2019, curlew breeding activity occurred in two areas within the Site (see Figure 7.4a). To the northeast of Furmiston Craig and to the east of Craig of Knockgray. A total of three curlew breeding territories were recorded in 2019.

Barn owl

7.6.41. There are several known, and potentially suitable, sites for nesting barn owl within the survey area and there is also abundant rough grassland habitat for hunting in the general area. One of these sites was confirmed to be occupied by a breeding pair in 2019. This site is >500 m from the Proposed Development. Further information is provided in the Confidential Annex.

Peregrine

7.6.42. There was no evidence of any known or potential peregrine breeding sites within the survey area being occupied by breeding pairs in 2018 or 2019. Based on information provided by DGRSG, there are breeding sites in the wider area (i.e. more than 2 km from the Proposed Development) that were confirmed to be occupied by pairs in 2018 and 2019, although breeding was thought to have been unsuccessful in both years. There is a historical breeding site which was abandoned due to afforestation which may be used again in the future once the trees are cleared. This site is closer to the Proposed Development although >1.5 km from the nearest proposed wind turbine. Further information is provided in the Confidential Annex.

Wintering/Passage Birds

Geese and Swans

7.6.43. During surveys completed in the winters of 2018-19 and 2020-21 there was no evidence of appreciable numbers of roosting or feeding geese or swans occurring within the survey area. The carse fields to the west and north of Carsphairn (c. 2km west of the Proposed Development) are occasionally used by whopper swans but there were no swans recorded using that area during the survey period.

[24] Holling, M. & the Rare Breeding Birds Panel (2018). Rare breeding birds in the UK in 2016. British Birds 111: 644 – 694.

Raptors

7.6.44. During winter 2018-19 and winter 2020-21 there was no evidence of the presence of any regularly used communal winter roost sites for short-eared owl, hen harrier or red kite within the Proposed Development Area or surrounding survey area.

Waders

7.6.45. There was a single small flock of golden plover recorded during the flight activity surveys in October 2018. There was no evidence during winter 2018-19 or winter 2020-21 of any use of the Proposed Development Area by flocks of wintering golden plover or other wader species.

7.6.46. Dotterel (*Charadrius morinellus*) were recorded on the summit of Cairnsmore of Carsphairn, towards the north-eastern edge of the Site, in spring of both 2018 and 2019, comprising a single bird in May 2018 and a group of five in May 2019. These sightings were birds on passage, most likely on migration to breeding grounds in the Grampians and Scandinavia. There was no evidence of any breeding occurring in either year, despite the presence of potentially suitable habitat. Dotterel is a scarce breeding and migrant wader in Scotland, with breeding confined to montane alpine habitats above approximately 700 m AOD. Dotterel is listed on Schedule 1 to the WCA, Annex I of the EC Birds Directive and is on the UK Red list of Birds of Conservation Concern due to recent breeding population and range declines (Stanbury *et al.* 2021[13]).

7.6.47. The Proposed Development area does not provide suitable habitat for dotterel. The area within the Site that is regularly used by dotterel during the spring migration period is well to the north of the Proposed Development (c. 1.5 – 2 km) and at a greater altitude than the maximum tip height of any turbine. No significant adverse effects from the construction works or any displacement effects from the operation of the wind farm are anticipated. There is the theoretical potential for birds to collide with turbines when approaching or leaving the upper slopes of Cairnsmore of Carsphairn but this is considered to be a low risk based on the evidence currently available. This species is not considered further in this assessment.

Ornithological Feature Sensitivity

Introduction

7.6.48. The following section provides an evaluation of the importance of the Proposed Development Area (and relevant buffer zones) for each of the key species that are the focus of this assessment (i.e. important ornithological features) based on the results of the 2018-2020 surveys and available data from other sources (e.g. RSPB and DGRSG).

7.6.49. A table summarising the results of the evaluations of feature sensitivity, considering the construction, operational and decommissioning phases, is given at the end of this section (see Table 7.12). This evaluation includes consideration of the relative importance of the Proposed Development Area based on population estimates at the national and regional (i.e. NHZ) scale, drawn from a range of sources.

Whooper Swan

Background

7.6.50. Whooper swan is a very rare breeding species in the UK (26 pairs, Holling & RBBP 2018[24]) but a relatively common winter migrant. It is listed on Schedule 1 to the WCA and Annex I of the EC Birds Directive and is currently on the UK Amber list of Birds of Conservation Concern (BoCC) due to its rarity as a breeding species and the wintering population being restricted to a small number of sites (Stanbury *et al*. 2021[13]).

7.6.51. The UK peak abundance was estimated at 11,000 wintering birds between winter 2004-2005 and winter 2009-2010 (Musgrove *et al*. 2013[25]) of which there were estimated to be a peak of 9,283 present in Scotland. The most

[25] Musgrove, A., Aebischer, N., Eaton, M., Hearn, R., Newson, S., Noble, D., Parsons, M., Risely, K., & Stroud, D. (2013). Population estimates of birds in Great Britain and the United Kingdom. British Birds 106, 64 –100.

recent national census, in 2015, resulted in estimates of 16,100 for the Great Britain (GB) wintering population (Hall *et al*. 2016[26]). The population estimate for the Western Southern Uplands and Inner Solway NHZ is 1,188 (Wilson *et al.* 2015[27]). However, this is likely to be an underestimate of the actual population that pass through the region during spring and autumn passage.

7.6.52. Whooper swans were occasionally recorded flying over the Site during the autumn and spring migration seasons. There was no evidence of regular movements across the Proposed Development Area during the winter months in any year or of birds roosting or feeing within at least 1 km of the Proposed Development.

Sensitivity Evaluation

7.6.53. The sensitivity of the Proposed Development Area for wintering / passage whooper swan is evaluated as Low (Local Medium). The Proposed Development Area is located within a region that is overflown by whooper swans on annual spring and autumn migration. The potential mortality risk to this species from collision with the turbines is considered within the assessment.

Greylag goose

Background

7.6.54. Greylag geese occur in two main populations in Scotland. A sedentary breeding population, referred to as the British greylag goose, which occurs as a resident breeding species across most of the west and north mainland of Scotland as well as the Western Isles and Orkney. The second population only occurs during the winter, and on passage during the autumn and spring and is known as the Icelandic greylag population. It is the Icelandic wintering population that is the one of the qualifying features of the SPA network in the UK, including the River Ken and Dee Marshes SPA/Ramsar Site. Birds from both populations occur in the region and have been recorded passing over the Proposed Development Area. It is the Icelandic greylag goose that is considered in this assessment.

7.6.55. The Icelandic greylag goose is listed on Annex II of the EC Birds Directive and the Amber list of UK BoCC (Stanbury *et al*. 2021[13]). It is legally hunted in Scotland due to its listing on Schedule 2 of the Wildlife & Countryside Act (1981, as amended). The most recent wintering population estimate for GB is 91,000 individuals, with a 25-year trend of a 6% decrease (Frost *et al*. 2019[28]). There is no regional population estimate available and no published estimate for the NHZ population.

Sensitivity Evaluation

7.6.56. The Proposed Development Area is not used by roosting or foraging greylag goose but occasionally birds fly over the Site, which is located within a wider region that Icelandic greylag geese pass through on annual migration. The potential risk to this species from collision with the turbines is considered within the assessment. The sensitivity of the Proposed Development Area for wintering / passage Icelandic greylag is evaluated as Low (Local Medium).

Pink-footed goose

Background

7.6.57. Pink-footed geese that winter in the UK breed primarily in central Iceland but also, in smaller numbers, on the east coast of Greenland (Mitchell & Hearn 2004[29]). Almost all the Iceland/Greenland population winter in Britain and as a consequence, many important staging and wintering sites have been protected as part of the SPA network.

7.6.58. The pink-footed goose is listed on Annex II of the EC Birds Directive and the Amber list of UK BoCC. It is legally hunted in Scotland due to its listing on Schedule 2 of the Wildlife & Countryside Act (1981, as amended). The most recent wintering population estimate for GB is 510,000 individuals, with a 25-year trend of a 111% increase (Frost *et al*. 2019[28]). The population estimate for the Western Southern Uplands and Inner Solway NHZ is 34,621 (Wilson *et al.* 2015[27]). However, this is likely to be an underestimate of the actual population that pass through the region during spring and autumn passage.

Sensitivity Evaluation

The Proposed Development Area is not used by pink-footed goose for roosting or feeding but occasionally birds fly over the Site, which is located within a wider region that pink-footed geese pass through on annual migration. The potential risk to this species from collision with the turbines is considered within the assessment. The sensitivity of the Proposed Development Area for wintering / passage pink-footed goose is evaluated as Low (Local Medium).

Black Grouse

Background Information

7.6.59. Black grouse is a native, resident breeding species, associated with areas of upland moorland, often close to native woodland or suitable plantation, at an altitude between 200 to 500 m AOD. Black grouse is a species of high conservation concern in the UK due to significant historical and ongoing population declines resulting from a combination of factors including habitat degradation and climate change. It is on the UK Red List of Birds of Conservation Concern (Stanbury *et al*. 2021[13]) and the Scottish Biodiversity List (as a former UK BAP Priority Species). The species remains a key focus for conservation management in Dumfries and Galloway.

7.6.60. The UK population was estimated at 5,100 displaying males in 2005 with the Scottish population estimated at 3,344 males (Sim *et al*. 2008[30]). A more recent UK estimate of 4,850, for 2016, was given in Woodward *et al*. (2020[31]). The only published population estimate for the NHZ is 121 displaying males (Wilson *et al*. 2015[27]), however this is likely to be an over-estimate of the current population due to apparent subsequent declines in Dumfries and Galloway (Warren *et al*. 2020[32]).

Sensitivity Evaluation

7.6.61. There is suitable breeding habitat for black grouse present across most of the Site, including several areas suitable for lekking and large areas suitable for nesting and brood-rearing. However, much of the vegetation has been heavily impacted by livestock grazing over the long-term and this has resulted in a very low abundance of dwarf shrubs such as heather (*Calluna vulgaris*) and blaeberry (*Vaccinium myrtillus*), which are an important food source for black grouse. Additionally, there is very limited cover of suitable woodland within the Proposed Development Area. The small plantations that dot the hillside offer poor feeding opportunities for black grouse (e.g. lacking species such as birch, rowan and larch) and are also heavily disturbed by livestock, particularly during bad weather. There was evidence of fox (*Vulpes vulpes*) presence across most of the survey area (including several animals that were seen hunting for ground-nesting birds during other surveys) and it is possible that nest failure due to predation is also significant factor in the low numbers of black grouse that the Site currently supports. It is also important to recognise that the regional population has been in severe decline. Data provided by RSPB indicate that the Site has not supported significant numbers of black grouse in the recent past, however, it may have been more attractive to black grouse in the past.

[26] Hall, C., Crowe, O., McElwaine, G., Einarsson, Ó., Calbrade, N., & Rees, E. C. (2016). Population size and breeding success of Icelandic Whooper Swans Cygnus cygnus: results of the 2015 international census. Wildfowl 66: 75–97.

[27] Wilson, M. W., Austin, G. E., Gillings S. and Wernham, C. V. (2015). Natural Heritage Zone Bird Population Estimates. SWBSG Commissioned report number SWBSG_1504. pp72.

[28] Frost, T., Austin, G., Hearn, R., McAvoy, S., Robinson, A., Stroud, D., Woodward, I., & Wotton, S. (2019) Population estimates of wintering waterbirds in Great Britain. British Birds, 112, pp 130-145.

[29] Mitchell, C. & Hearn, R.D. (2004). Pink-footed Goose Anser brachyrhynchus (Greenland/Iceland population) in Britain and Ireland 1960/61 – 1999/2000. Waterbird Review Series, The Wildfowl & Wetlands Trust/Joint Nature Conservation Committee, Slimbridge.

[30] Sim, I.M.W., Eaton, M.A., Setchfield, R.P., Warren, P.K., & Lindley, P. (2008). Abundance of male Black Grouse Tetrao tetrix in Britain in 2005, and change since 1995-96. Bird Study, 55, pp 304-313.

[31] Woodward, I., Aebischer, N., Burnell, D., Eaton, M., Frost, T., Hall, C., Stroud, D.A. & Noble, D. (2020). Population estimates of birds of Great Britain and the United Kingdom. British Birds, 113: 6914.

[32] P. Warren, P., Land, C., Hesford, N. & Baines, D. (2020). Conserving Black Grouse Lyrurus tetrix in southern Scotland: evidence for the need to retain large contiguous moorland habitat within a forest-moorland landscape, Bird Study, DOI: 10.1080/00063657.2020.1726875

7.6.62. Two males were recorded lekking at one location in 2018 with no further lekking behaviour recorded within the survey area in 2019 or 2020. Previous surveys for the original Quantans Hill wind farm proposal in 2011 also found a similarly low number of lekking males in the area. There were no desk study records of black grouse between 2015 and 2020. Although there may continue to be sporadic use of the area by low numbers of black grouse, currently the Site and immediate surrounding area does not appear to support a regular breeding population. It is possible that the recent tree planting on Marbrack (c. 58 ha) and Furmiston (c. 306 ha) may increase habitat quality for black grouse within those areas of the Site. However, as the conifer plantation component (c. 60-70% by area) reaches the thicket stage habitat quality will decline. Based on the available data, taking into account the conservation status of the species, and the potential for habitat quality to increase in the short to medium-term, the Proposed Development Area is considered to be of local importance for black grouse and has been given Low (Local High) sensitivity rating.

Osprey

National & Regional Status

7.6.63. Osprey is a rare migratory breeding raptor in the UK, listed on Schedule 1 to the WCA and Annex I of the EC Birds Directive. It is on the Amber list of Birds of Conservation Concern due to historical declines and low population size (Stanbury *et al*. 2021[13]). Following near extinction towards the beginning of the 20th century, the Scottish population has made a dramatic re-colonisation and recovery. Osprey breeding resumed in England in 2001 following a re-introduction programme.

7.6.64. The UK population is currently estimated at between 218 and 250 pairs. Approximately 200 pairs breed in Scotland (Holling & RBBP 2018). Based on 2013 breeding records, the population within the NHZ was estimated at six pairs (Wilson *et al*. 2015[27]). This is likely to be an underestimate of the current population size. Scottish Raptor Monitoring Scheme data reports 12 sites occupied by breeding pairs in Dumfries and Galloway in 2019 (Challis *et al*. 2020[33]).

Sensitivity Evaluation

7.6.65. Osprey do not breed within or near to the Site and there are no suitable waterbodies for hunting osprey within the Proposed Development Area. Osprey do occasionally hunt over Kendoon Loch, c. 2 km to the south of the Proposed Development. There was no evidence of regular flights by osprey across the Proposed Development Area during the baseline surveys. The Proposed Development Area is considered to be of Low (Local High) sensitivity for osprey.

Hen Harrier

National & Regional Status

7.6.66. Hen harrier is a widespread but scarce breeding species in the Scottish uplands, a partial migrant and winter visitor. It is listed on Schedule 1 to the WCA, and on Annex I of the EC Birds Directive. It is also on the Red List of UK Birds of Conservation Concern (Stanbury *et al*. 2021[13]), due to historical and ongoing population declines resulting primarily from the effects of human persecution.

7.6.67. The most recent national survey, in 2016, recorded 575 territorial pairs for the UK and Isle of Man (Wotton *et al.* 2016[34]). The latest breeding population estimate for the NHZ, based on the 2010 national survey, is 18 pairs (15-20, 95% confidence limits), and the total Scottish population (total of NHZ) is 501 pairs (Wilson *et al.* 2015[27]). The most recent estimate of wintering hen harriers in Scotland is approximately 1,534-1,832 (Dobson *et al*. 2012[35]).

Sensitivity Evaluation

7.6.68. There is no evidence to indicate that the Proposed Development Area provides important supporting habitat for hen harrier during the breeding season. The Proposed Development Area is used occasionally by hunting hen harriers during the winter months. The Proposed Development Area is considered to be of local importance only for wintering hen harrier and has been evaluated at Low (Local High) sensitivity for this species.

Red Kite

National & Regional Status

7.6.69. The red kite is a resident breeding species in Scotland, following a successful re-introduction programme (it was made extinct as a Scottish breeding bird in the late nineteenth century) carried out between 1989 and 2009 at four release sites in Scotland. One of these sites was near Laurieston, in Dumfries and Galloway, which is c. 30 km south of the Proposed Development.

7.6.70. The red kite is listed on Schedule 1 to the WCA and Annex I of the EC Birds Directive. It is now on the UK Green list (Stanbury *et al*. 2021[13]) due to the recovery of the national population, although there remain concerns about high mortality rates, primarily caused by human persecution / poisoning, slowing the speed of expansion from some of the re-introduced areas, particularly the Black Isle (Smart *et al*. 2010[36]), despite a relatively high nesting success rate (Sansom *et al*. 2016[37]).

7.6.71. The UK population was estimated at 4,350 in 2016 (Woodward *et al*. 2020[31]). Sansom *et al.* (2016)[37] reported a population estimate of 266 pairs for Scotland in 2014. During January 2019, a Europe-wide red kite winter roost count was completed. Scottish Raptor Study Group volunteers counted all known winter roost sites, with a total of 940 red kites recorded across 29 roost sites (Scottish Raptor, May 2019). The population for the NHZ was estimated at 83 by Wilson *et al.* (2015[27]), which is likely an under-estimate of the current population size due to subsequent and ongoing expansion in Dumfries and Galloway. The Scottish Raptor Monitoring Scheme (SRMS), which is responsible for coordination of the monitoring of red kites in Scotland, reported 119 sites occupied by breeding pairs in Dumfries and Galloway in 2019 (Challis *et al*. 2020[33]). Of these sites, 78 pairs were monitored and of these 59 were known to successfully fledge young, with an average of 1.3 young per successful pair. If all pairs that were identified as potentially breeding in 2019 were similarly successful as the monitored pairs, and ignoring immature and non-breeding birds, that equates to a minimum of c. 350 individuals.

Sensitivity Evaluation

7.6.72. Based on the findings from the desk study and the 2019-20 surveys, although no red kites nested within Site, and no nests were closer than c. 800m to the Proposed Development, the Proposed Development Area is clearly of importance as a hunting ground supporting breeding pairs nesting in the surrounding area. As red kites tend not to be territorial in relation to their foraging ranges, the Proposed Development Area is likely to be used by several different individuals that are nesting in the wider area and used by young non-breeding birds for hunting as well. As a minimum, it is assumed that the Proposed Development Area supports (most likely to varying degrees) three to four breeding pairs that are known to nest within c. 2 km of Proposed Development Area boundary. This equates to c. 3% of the Dumfries and Galloway breeding population (which is equivalent to the NHZ population) and, in all likelihood, <1% of the Scottish population. The Proposed Development Area is therefore considered to be of Medium sensitivity for red kite, i.e. it is of regional importance.

[33] Chalis, A., Wilson, M.W., Schönberg, N., Eaton, M.A., Stevenson, A. & Stirling-Aird, P. (2020). Scottish Raptor Monitoring Scheme Report. BTO Scotland, Stirling.

[34] Wotton, S.R., Bladwell, S., Mattingley, W., Morris, N.G., Raw, D., Ruddock, M., Stevenson, A. & Eaton, M.A. (2018). Status of the Hen Harrier Circus cyaneus in the UK and Isle of Man in 2016, Bird Study, 65:2, 145-160.

[35] Dobson A, Clarke M, Kjellen N & Clarke R (2012). The size and migratory origins of the population of Hen Harriers Circus cyaneus wintering in England. Bird Study, 59 (2), pp. 218-227.

[36] Smart, J., Amar, A., Sim, I. M. W., Etheridge, B., Cameron, D., Christie, G. & Wilson, J. D. (2010). Illegal killing slows population recovery of a re-introduced raptor of high conservation concern - The red kite Milvus milvus. Biological Conservation, 143, 1278-1286.

[37] Sansom, A., Etheridge, B., Smart, J. & Roos, S. (2016). Population modelling of North Scotland red kites in relation to the cumulative impacts of wildlife crime and wind farm mortality. Scottish Natural Heritage Commissioned Report No. 904.

Curlew

National & regional population status

7.6.73. Curlew is on the UK Red List of BoCC due to significant and ongoing declines over recent decades in the UK and Scotland (Stanbury *et al*. 2021[13]). This decline has been recorded across their global range, consequently, curlew has an IUCN status of Near Threatened. Curlew is a UK BAP priority species and is on the Scottish Biodiversity List.

7.6.74. The most recent Scottish breeding population size was estimated at 30,194 pairs (Wilson *et al.* 2015[27]), with an estimated 58,000 pairs for Great Britain (Woodward *et al.* 2020[31]). The population estimate for breeding curlew within the NHZ is 4,282 pairs (in 2005), although this is likely to be an over-estimate given subsequent and ongoing population declines. Scottish coasts and estuaries support around 85,700 curlew in winter (*Humphreys et al.*, 2015[38]), with an estimate for Great Britain of 140,000 individuals in 2004/05-2008/09 (Musgrove *et al.* 2013[25]).

Sensitivity evaluation

7.6.75. A peak of three breeding territories within the Site was recorded in 2019, of which, one was within 500 m of the nearest proposed wind turbines. The population of breeding curlew that the Site supports (peak of three territories) is important in the context of the local area, a Low (Local High) sensitivity rating for the Proposed Development Area is considered appropriate.

Common gull

National & regional population status

7.6.76. The common gull is currently on the UK Amber list of Birds of Conservation Concern (Stanbury *et al*. 2021[13]). This is due to recent breeding and winter population declines as well as reductions in the breeding and wintering range in the UK. The size of the UK population is uncertain, due to a lack of comprehensive single-year censuses but has been estimated at 48,500 pairs (Mitchell *et al.* 2004[39]). A much larger number of common gulls winter in the UK, estimated at over 700,000 individuals (Banks *et al.* 2007). In the UK, most common gulls breed in Scotland but they are more widely distributed during winter. There is no available population estimate for breeding common gull at the regional / NHZ level.

Sensitivity evaluation

7.6.77. The areas of the Site and the surrounding survey area that common gull were recorded using, and which provide attractive foraging habitat for this species, are all outside of the Proposed Development area. They are associated with the enclosed fields to the south and west and along the course of the Water of Deugh. Common gulls do also breed and hunt over moorland areas, however, there was no evidence of breeding occurring within the Site and only very occasional activity within the Proposed Development Area. The Proposed Development Area is considered to be important in the context of the local area only for this species, a Low (Local Medium) sensitivity rating is considered appropriate.

Herring gull

National & regional population status

7.6.78. Herring gull is on the UK Red List of BoCC due to apparent declines over recent decades in the UK and Scotland (Stanbury *et al*. 2021[13]). The UK breeding population was estimated at 130,000 pairs (based on data from 1998 to 2002) and the winter population at 730,000 individuals (Woodward *et al*. 2020[31]). The Scottish breeding population was estimated at 52,089 pairs by Wilson *et al.* (2015), with 1,130 pairs estimated for the NHZ (based on colony counts from 2000). This is likely to be an over-estimate given subsequent and ongoing population declines.

Sensitivity evaluation

The areas of the Site and surrounding survey area that herring gull were recorded using were mostly outside of the Proposed Development Area. Proposed Development Area is considered to be important in the context of the local area only for this species, a Low (Local Medium) sensitivity rating is considered appropriate.

Barn Owl

National & regional population status

7.6.79. Barn owl is on Schedule 1 of the WCA and also on the Scottish Biodiversity List. The national (UK) breeding population was estimated in 2001 at between 3,000-5,000 pairs (Musgrove *et al*. 2013[2525]) and also 4,000 to 14,000 in 2016 (Woodward *et al.* 2020[31]). There are no estimates for the NHZ population available for this species. SRMS monitoring for the Dumfries and Galloway area in 2019 recorded 83 known sites occupied, out of a total of 245 sites checked (Challis *et al*. 2020[33]).

Sensitivity evaluation

7.6.80. Barn owl do not breed within the Site but there are at least two locations that have been used by breeding pairs in recent years near to Site boundary. Taking into consideration the suitability and quality of the foraging habitat within large parts of the Proposed Development Area, which will be within the hunting range of both of these breeding sites, a precautionary sensitivity level of Medium (i.e. regional scale importance) is considered appropriate for barn owl.

Merlin

National & Regional Status

7.6.81. Merlin is a small falcon that breeds across the Scottish uplands, particularly associated with heather moorland habitats and moving to suitable lower lying-areas during the winter. It is listed on Schedule 1 to the WCA and Annex I of the EC Birds Directive. The merlin is currently on the UK Red list of Birds of Conservation Concern due in part to historical and recent breeding population declines (Stanbury *et al*. 2021[13]).

7.6.82. The 2008 national survey resulted in an estimated breeding population for GB of approximately 1,159 pairs with the Scottish population estimated at 733 pairs (Ewing *et al*. 2011[40]). However, there was some doubt cast over the accuracy of these figures. Wilson *et al.* (2015)[27] did not use the national survey results in their estimates of the NHZ populations. They used merlin counts from NHZs where this species was intensively studied and a high proportion of merlin pairs were likely to have been found, arriving at an estimate of 434 pairs for Scotland. The Western Southern Uplands and Inner Solway NHZ was estimated to hold 12 pairs (ranging from 7-18).

Sensitivity Evaluation

7.6.83. No evidence of breeding was found within the Site during 2018 or 2019. There is no evidence to indicate that the Proposed Development Area provides important supporting habitat for any pairs of breeding merlin present in the wider area. There were occasional hunting flights by birds outside of the breeding season. The Proposed Development Area is considered to be of Low (Local High) sensitivity for merlin.

Peregrine

National & Regional Status

7.6.84. Peregrine is listed on Schedule 1 to the WCA, and it is currently on the UK Green List, having been moved from the Amber List following recent status reviews (Stanbury *et al*. 2021[13]).

[38] Humphreys, E.M., Marchant, J.H., Wilson, M.W. & Wernham, C. V. (2015). Curlew (*Numenius arquata*): SWBSG Species Dossier 16. Report by BTO Scotland to SWBSG as part of Project 1403. Updated by SWBSG March 2017.

[39] Mitchell, I.P., Newton, S.F., Ratcliffe, N. & Dunn, T.E. (Eds.). (2004). Seabird Populations of Britain and Ireland: results of the Seabird 2000 census (1998-2002). Published by T and A.D. Poyser, London.

[40] Ewing, S. R., Rebecca, G. W., Heavisides, A., Court, I. R., Lindley, P., Ruddock, M., Cohen, S., & Eaton, M. A. (2011). Breeding status of the Merlin Falco columbarius in the UK in 2008. Bird Study 58: 379–389.

7.6.85. The UK peregrine population was the subject of national surveys in 2002 and 2014. The population in the UK, Isle of Man and Channel Islands was estimated at 1,769 pairs in 2014, a 22% increase on the 2002 estimate (Wilson *et al*. 2018[41]). However, most of this increase was associated with populations in lowland England, with some upland populations declining during that period. The Scottish breeding population was estimated at 523 occupied territories which was a decrease on the 2002 estimate. The decrease in the population estimates for Scotland between 2002 and 2014 appears to be largely due to losses from upland and inland sites. Based on the 2014 national survey data the NHZs population was estimated to be 34 pairs (Wilson *et al*. 2015[17]). The current SRMS report for Dumfries and Galloway gives a total of 54 peregrine home ranges occupied by breeding pairs in 2019 (Chalis *et al*. 2020[33]). This is figure cannot be directly compared to the NHZ estimate as it includes coastal breeding sites that are not part of the NHZ.

Sensitivity Evaluation

7.6.86. There are no current or recently occupied breeding sites for peregrine within 2 km of the Proposed Development. However, the Site, and the Proposed Development Area, is occasionally overflown by this species. It does not appear, on the basis of the evidence collected from the flight activity surveys in 2018-19 and 202-21, to be an important hunting area for this species, i.e. supporting breeding birds in the wider area. However, although levels of peregrine activity within or near the Proposed Development during the survey period were low this also coincided with years when the nearest breeding pair were unsuccessful and failed to raise any young. In years when they are successful, activity patterns relative to the Proposed Development Area may change. The Proposed Development Area is considered to be of Low (Local High) sensitivity for breeding peregrine.

Summary of Feature Sensitivity

7.6.87. The ornithological features evaluated as international, national, regional or local sensitivity (i.e. Local medium and above) are listed in Table 7.12 along with a summary of the rationale for their sensitivity evaluation. These features are considered in the impact assessment following the method described in Section 7.4, in the same order as they are presented in this Table.

Table 7.12: Summary evaluation of the sensitivity of important ornithological features

Ornithological Feature	Summary of evaluation	Feature Sensitivity
Whooper Swan	Proposed Development Area is not used by whooper swans but this species does occasionally fly over the Site and the wider surrounding area during the autumn and spring migration seasons.	Low (Local Medium)
Greylag goose	Proposed Development Area is not used by greylag but is located within a wider region that is overflown by Icelandic greylag geese on annual migration.	Low (Local Medium)
Pink-footed goose	Proposed Development Area is not used by pink-footed geese but is located within a wider region that is overflown by pink-footed geese on annual migration.	Low (Local Medium)
Black grouse	The available data indicates that the Site does not currently support a breeding population and does not appear to have supported significant numbers of black grouse in the recent past (i.e. past 10 years). Currently the Proposed Development Area is considered to be of local importance to black grouse. There is potential for habitat quality to increase as a result of extensive tree planting in the central and eastern parts of the site. However, habitat quality would be expected to decline across much of those areas within c. 10-15 years.	Low (Local High)
Osprey	There was no evidence of regular flights by osprey across Proposed Development Area during the baseline survey and this species does not currently breed within the Site or in the wider survey area. The Proposed Development Area is of low sensitivity for osprey.	Low (Local High)
Hen harrier	There is no evidence to indicate that Site provides important supporting habitat for hen harrier during the breeding season. The Proposed Development Area is used occasionally by hunting birds during the winter months. The Proposed Development Area is of local importance only for wintering harrier.	Low (Local High)
Red kite	As a minimum, it is assumed that Proposed Development Area supports (most likely to varying degrees) three-four breeding pairs that are known to nest within c. 2 km of Proposed Development Area boundary. This equates to c. 3% of the Dumfries and Galloway population and <1% of the Scottish population. Proposed Development Area is therefore considered to be of regional importance for red kite.	Medium
Curlew	A peak of three breeding territories within the Site was recorded in 2019, one of which was within 500 m of the proposed wind turbines. The population of breeding curlew that Proposed Development Area supports is important in the context of the local area only.	Low (Local High)
Common gull	There was no evidence of breeding occurring within the Site and only very occasional activity within the Proposed Development area. The Proposed Development Area is considered to be important in the context of the local area only for this species.	Low (Local Medium)
Herring gull	There was no evidence of breeding occurring within the Site and only very occasional activity within the Proposed Development area. The Proposed Development Area is considered to be important in the context of the local area only for this species.	Low (Local Medium)
Barn owl	Barn owl do not breed within the Site but there are at least two locations where breeding has occurred in recent years near to Site boundary. There is suitable foraging habitat within large parts of Proposed Development Area that will be within the hunting range of both of these breeding sites.	Medium

[41] Wilson, M. W., Balmer, D. E. Jones, K., King, V. A., Raw, D., Rollie, C. J., Rooney, E., Ruddock, M., Smith, G. D., Stevenson, A., Stirling-Aird, P. K., Wernham, C. V. Weston, J. M. & Noble, D. G. (2018). The breeding population of Peregrine Falcon Falco peregrinus in the United Kingdom, Isle of Man and Channel Islands in 2014. Bird Study 65: 1–19.

Ornithological Feature	Summary of evaluation	Feature Sensitivity
Merlin	There is no evidence to indicate that Site provides important supporting habitat for any pairs of breeding merlin present in the wider area. There were occasional hunting flights by birds outside of the breeding season. The Proposed Development Area is considered to be of local importance for this species.	Low (Local High)
Peregrine	The Proposed Development Area does not appear to be an important hunting area for this species, i.e., supporting breeding birds in the wider area. Proposed Development Area is considered to be of local importance for breeding peregrine.	Low (Local High)

Changes likely to occur over time in the absence of developing the project

7.6.88. Below is a discussion of the factors that may influence the baseline condition of the Proposed Development Area under a 'do nothing' scenario (i.e., the Proposed Development is not consented and constructed).

7.6.89. On the assumption that livestock grazing levels and management practice do not change, outside of the proposed woodland planting areas (see below), there should remain broadly similar distributions of the existing habitat types within Proposed Development Area. Ongoing degradation of the heath and mire habitats (including suppression of dwarf shrub growth) due to the long-term effects of grazing and trampling by livestock and from artificial drainage, will be expected to continue.

7.6.90. Within the two areas where new woodland is being established (Marbrack) and consented and expected to be planted in 2022 (Furmiston), there will be a gradual change and loss of marshy grassland, wet heath and acid grassland habitats as the trees grow and eventually reach canopy closure. The duration of this change / loss will vary in relation to the ground conditions, tree species and management practice. Most of the new woodland is comprised of young Sitka spruce trees (c. 60-70%) planted at typical commercial densities. In those areas there may be little remaining of the original ground flora after about 10-15 years due to the effects of shading and changes to soil water levels.

7.6.91. Consideration has been given in this assessment to the potential for the recently established plantation areas to influence the future use of these areas by the key species of concern for this assessment. It is likely that small mammal densities may increase as a result of the exclusion of grazing animals from the planting areas and this may increase the attractiveness and importance of these areas for red kite in the near future. This may also temporarily increase the attractiveness for species like hen harrier and short-eared owl. However, following canopy closure of the conifers there will be a shading out of the ground flora that is supporting small mammals. Prey availability will likely eventually decline and fall below current levels. This may take 10-15 years, although there may be a point during the pre-thicket stage, before canopy closure, where the trees are too large and too close together for red kite to hunt effectively. In conclusion, a significant part of Proposed Development Area (c. 245 ha) will become largely unsuitable habitat for red kite within c. 10-15 years and this is likely to result in an appreciable decrease in the use of that part of Proposed Development Area by this species.

7.6.92. Consideration also has given to the potential effect on black grouse habitat quality from the extensive tree planting plans for some of the landholdings within the Proposed Development Area and on neighbouring land. It is possible that in the medium-term (c. 10-15 years) the establishment of these new plantations will be of benefit to black grouse and the associated native broadleaved edge planting will be of longer-term benefit. However, this will eventually result in the net loss of suitable moorland foraging, nesting, and brood-rearing habitat within the Proposed Development Area and surrounding area, habitat that is already of relatively poor quality in some respects due to the suppression of key dwarf shrub species due to livestock grazing pressure. It is anticipated, without intervention to specifically improve habitat quality for black grouse, the Proposed Development Area will continue to support only very low numbers.

7.6.93. National population trends form the UK Breeding Bird Survey (covering most widespread breeding species in Scotland) were published in 2018[42]. In relation to the upland bird species relevant to this assessment, curlew have shown the largest declines, and this is predicted to continue. Curlew declines are thought to be related to land use and predation pressure (Douglas *et al.* 2014[43]) as well reductions of the quality of foraging habitat in grasslands and trampling by cattle (Brown *et al.* 2015[44]).

~~7.6.94.~~ As a result of the effects of climate change, average temperatures and seasonal rainfall are predicted to change, which are likely to affect the breeding bird assemblage in the medium to long-term. Across the UK during the period 2008-2017, temperature was on average 0.3°C warmer than the 1981-2010 average and 0.8°C warmer than 1961-1990 (UKCP18[45]). In the past few decades, there has been an increase in annual average rainfall, particularly over Scotland, for which the period 2008-2017 saw an average 11% increase on the 1961-1990 period. Over land the projected general trends of climate changes are towards warmer, wetter winters and hotter, drier summers.

7.6.95. A continuing trend, predicted for Scotland, is for increasing precipitation in the west in the spring and decreases in the east during summer. Increasing variability in seasonal rainfall can affect breeding success in many moorland wader species, for example, drier conditions during the summer can result in a significant reduction in insect prey availability during the chick-rearing period.

7.7 ASSESSMENT OF POTENTIAL EFFECTS

Introduction

7.7.1. The following section considers the potentially significant effects of the construction, operation and decommissioning of the Proposed Development on the IOFs for this assessment, as listed in Table 7.12. Chapter 3: Project Description provides the details of the various elements of the Proposed Development, including an outline construction process and programme.

7.7.2. The mitigation measures proposed, and the likely residual effects are discussed in Sections 7.8 and 7.9.

7.7.3. The potentially significant effects associated with construction, operation and decommissioning of the Proposed Development that are the focus of this assessment are outlined below.

7.7.4. Potential effects that may occur during the construction phase for the Proposed Development include:

- disturbance to breeding, passage and wintering birds from supporting habitats, during construction works (for example, through human presence, vehicle movements, noise, dust, vibration, light);
- short to medium-term loss and change to habitats through construction-related habitat damage (for example, from plant trafficking); and

[42] See: https://www.bto.org/our-science/projects/bbs/latest-results/population-trends

[43] Douglas, D.J.T., Bellamy, P.E., Stephen, L.S. et al. 2014. Upland land use predicts population decline in a globally near-threatened wader. Journal of Applied Ecology, 51, 194-203.

[44] Brown, D., Wilson, J., Douglas, D. (2015). The Eurasian Curlew – the most pressing bird conservation priority in the UK? British Birds, 108, 660-668.

[45] UKCP18 Science Overview Report November 2018 (Updated March 2019), available from: https://www.metoffice.gov.uk/pub/data/weather/uk/ukcp18/science-reports/UKCP18-Overview-report.pdf

- cumulative effects arising from additive, synergistic and/or antagonistic effects with other existing and proposed developments in the area.

7.7.5. Potential effects that may occur during the operation of the Proposed Development include:

- long-term loss of and change to habitats associated with built structures and new permanent access tracks;
- risk of mortality from collision with wind turbines and other structures;
- behavioural displacement from important supporting habitats due to the presence of the wind turbines;
- potential effects on free movement (i.e. potential barrier effects) to and from roosting, feeding and nesting habitats;
- disturbance during maintenance and emergency works;
- effects of habitat management within the Site; and
- cumulative effects arising from additive, synergistic and/or antagonistic effects with other existing and proposed developments.

7.7.6. Potential effects that may occur during the decommissioning phase include:

- works associated with the dismantling of the Proposed Development resulting in physical damage to habitats supporting bird species of conservation concern;
- disturbance to breeding birds arising from dismantling works; and
- cumulative effects arising from additive, synergistic and/or antagonistic effects with other existing and proposed developments.

Construction Disturbance and Displacement

7.7.7. The following section considers potential effects on the relevant IOFs from construction disturbance. For any IOFs not specifically mentioned below the effects are considered to be nil-negligible. Construction effects include the potential disturbance to breeding / foraging birds (including dependent young) or sensitive sites, such as nests or roost sites, and the direct / indirect and temporary / permanent loss of habitat as a result of construction activities.

7.7.8. The anticipated duration for the construction of the Proposed Development is 18 months (see Chapter 3).

7.7.9. Assuming the least favourable timing of works in relation to the bird breeding season, disturbance to breeding birds arising from ground clearance, general construction noise, vehicles, vibration, lighting, presence of construction workers, etc., would influence breeding success and potentially cause displacement of birds from the affected areas. It is assumed that birds could be subject to disturbance from construction works during all / part of the breeding season for up to two breeding seasons in total, assuming the least favourable commencement date (e.g., mid-summer).

7.7.10. It is assumed in this assessment that no nesting Schedule 1 species or their dependent young would be disturbed by the works in compliance with the WCA. In addition, the active nest sites of all wild birds are protected so it is also assumed that the construction works would be carried out in a manner that avoids damaging nest sites of all wild birds. Measures to help achieve this are outlined in Section 7.8 with further detail provided in Technical Appendix 7.3: Outline Bird Protection Plan.

7.7.11. Noise from construction works may affect birds in several ways including the ability of a bird to select, establish and defend a territory, its foraging and breeding success and song learning. The degree of disturbance impact would be dependent on a range of variables, including the time of year, as the potential scale of effect may vary depending on the stage of the breeding season, the species affected, the duration and magnitude of the source of the disturbance, the nature of the surrounding habitats and topography and the availability of suitable alternative habitats for birds to move into.

7.7.12. Breeding raptors are particularly vulnerable to disturbance at the nest site where repeated disturbance can cause adults to cease egg incubation; even temporary cooling or overheating of eggs can result in failure to hatch. In extreme cases, for cliff nesting species (e.g., peregrine), adults may knock chicks out of the nest if the disturbance is sudden and intense. Flushing of the adult birds from the nest site is also likely to increase the risk of predation of chicks or eggs abandoned at the nest.

7.7.13. It is also important to consider that construction works would likely move progressively across the Proposed Development Area, and would not occur simultaneously across the entire area, therefore not affecting all habitats continuously throughout the construction period.

Whooper swan

7.7.14. Wintering foraging whooper swans show varying responses to different sources of human disturbance and some level of habituation. One study has reported a c. 250 m distance for active disturbance by people approaching on foot (Rees *et al*. 2005[46]). Evidence from surveys undertaken for the Proposed Development and desk study information indicates that there are a few areas in the vicinity of Proposed Development Area that are likely to attract small numbers of grazing and loafing whooper swan but there are far enough from construction works not to be at any appreciable risk of disturbance.

7.7.15. Passage and wintering whooper swans were only recorded using the Proposed Development Area for occasional overflights. The known potential roosts in the area are not considered to be close enough to the Proposed Development Area (i.e., > 1 km) to be at any risk of direct disturbance during construction. The construction of the Proposed Development would not have any appreciable direct effect on wintering/passage whooper swan or their supporting habitats.

7.7.16. The potential effect of pre-mitigation construction disturbance to wintering and passage whooper swan is Negligible and **not significant**.

Greylag goose

7.7.17. Construction-related effects are likely to be only potentially significant during the winter and passage periods. Evidence from surveys undertaken for the Proposed Development and desk study information indicates that there are few areas in the vicinity of Proposed Development Area that are likely to attract appreciable numbers of greylag geese for grazing and roosting.

7.7.18. The construction of the Proposed Development would not have any significant direct effect on wintering/passage greylag geese.

7.7.19. The potential effect of construction disturbance to wintering and passage greylag geese is Negligible and **not significant**.

Pink-footed goose

7.7.20. Construction-related effects are likely to be only potentially significant during the winter and passage periods. Evidence from surveys undertaken for the Proposed Development and desk study information indicates that there are few areas in the vicinity of Proposed Development Area that are likely to attract appreciable numbers of pink-footed geese for grazing and roosting.

7.7.21. The construction of the Proposed Development would not have any significant direct effect on wintering/passage pink-footed geese.

[46] Rees, E.C., Bruce, J.H., White, G.T. (2005). Factors affecting the behavioural responses of whooper swans (Cygnus c. cygnus) to various human activities. Biological Conservation 121: 369-382.

7.7.22. The potential effect of construction disturbance to wintering and passage greylag geese is Negligible and **not significant**.

Black grouse

7.7.23. There is the potential for black grouse to be disturbed by construction works near to lek sites, nesting, roosting, brood-rearing, and wintering areas. Black grouse are particularly sensitive to disturbance at their lek sites and at a relatively large distance. Whitfield *et al.* (2008[47]) reported that black grouse are likely to show a static response to disturbance, by a person on foot, between 500 to 750m from a lek site. However, based on records from the past 10-15 years, the Proposed Development Area is located outside of the main areas of recent black grouse activity in the wider area. Several historical lek sites were identified during surveys and from desk study sources, two of which are 1 to 2 km from Proposed Development Area.

7.7.24. Although there have been some black grouse observations in the period 2018-21, current evidence indicates that there are no active leks recorded within Proposed Development Area. For black grouse, the potential effect of construction disturbance is assessed to be no greater than Low, resulting in a significance level of Minor in the short-term (i.e., **not significant**).

Hen harrier

7.7.25. Breeding hen harriers are vulnerable to disturbance at or near their nest sites. Flushing of parent birds during incubation or early chick-rearing increases the risk of predation and exposes the eggs/chicks to the weather, which may also cause breeding failure depending on the conditions and how long the parent bird is kept away from the nest site. Ruddock & Whitfield (2007[48]) reported a median active disturbance response during the chick-rearing stage, from a person on foot, at 225m from the nest. The expert opinion survey suggested a protection buffer of 500-750m around the nest site. During wind farm construction, displacement of hen harriers has been suggested up to 500m around construction activity, and potentially up to 1km for some nesting and foraging behaviours, depending on the line-of-sight to the works (Bright *et al*. 2008[49]).

7.7.26. The potential effect on hen harrier from construction disturbance is anticipated to be low. There is no recent history of breeding attempts by this species within Proposed Development Area or within 2 km of Proposed Development Area. There is some potential for disturbance and displacement during the post-breeding and winter periods. There was no evidence form the surveys completed in 2018-21 of any hen harrier winter roost sites within the survey area.

7.7.27. Construction works could discourage hen harrier from hunting over these areas. However, taking into consideration the extent of unaffected similar habitats in the wider area, any short-term displacement due to construction operations should have a minimal effect on this species.

7.7.28. The assessment of the effect of construction-related disturbance to, and displacement of, hen harrier is considered to be no greater than Negligible-Low, resulting in an effect significance level of Minor in the short-term (i.e., **not significant**).

Red kite

7.7.29. As a species that often occupies agricultural landscapes, red kites can be tolerant of some human presence near to their nest sites, often using suitable trees near to farm buildings. However, nest failure due to human disturbance can occur and pairs not exposed to much human activity are likely to be less tolerant of such disturbance. A disturbance free zone around active nests of 400-600m was recommended by Petty (1998[50]). Ruddock & Whitfield (2007[43]) reported that that breeding red kites were unlikely to be disturbed from a human on foot >300m from a nest. From the expert opinion survey, median static response disturbance distances were 125m and between 30m (incubation) and 75m (chick-rearing) for active responses to disturbance.

7.7.30. There are no known nest locations which would be affected by construction disturbance from the Proposed Development. As Schedule 1 species with protection from disturbance while breeding, measures are proposed to ensure that works proceed lawfully with respect to these legal protections as well as following best practice to avoid disturbance during construction. Pre-construction surveys would be completed and the onsite ECoW (with specialist ornithologist advice as required) would have responsibility for ensuring that appropriate protection zones are established and adhered to.

7.7.31. At the distances over which disturbance is considered possible for this species, the construction of the Proposed Development should not have any effect on current red kite breeding sites. However, there is the potential for some temporary disturbance and displacement of hunting birds that are breeding in the surrounding area.

7.7.32. The potential effect of pre-mitigation construction disturbance to red kite is Low / short-term resulting in an effect significance of Minor which is **not significant**.

Curlew

7.7.33. There was one curlew breeding territory recorded within 500 m of the Proposed Development during the baseline survey period. There is the potential for disturbance to birds during the breeding season, however, breeding activity within the Proposed Development Area appears to be low. Vulnerability to the potential adverse effects of construction disturbance is not considered to be high in this context.

7.7.34. Assuming a realistic 'worst case' level of disruption for the duration of the construction period, the assessment of construction-related disturbance effects on breeding curlew is considered to be no greater than Low, resulting in an effect significance level of Minor in the short-term (i.e., **not significant**).

Barn owl

7.7.35. Known Barn owl nest / roost sites are in locations that should not be directly affected by the construction works. Construction activities may interfere with foraging behaviour, however as barn owls typically hunt outside of daylight working hours this would significantly reduce the potential for disturbance due to construction work. Therefore, it is likely that any effects on foraging during the construction period would be limited.

7.7.36. For barn owl construction disturbance effects are assessed to be Low, resulting in an effect significance level of Minor in the short-term (i.e., **not significant**).

Merlin

7.7.37. Breeding merlin are sensitive to disturbance from human activity, potentially over large distances. Flushing of birds from nest sites exposes the eggs / chicks to the risk of predation and also increases the potential for breeding failure due to the chilling of eggs and young if disturbance occurs during inclement weather. Behavioural responses to sources of disturbance are likely to vary according to stage in the breeding season and the prior exposure of individuals which may increase tolerance. Ruddock & Whitfield (2007[48]) reported an upper limit to static responses to disturbance (person on foot) at 300-500m.

7.7.38. At the distances over which disturbance is considered possible for this species, there is considered to be negligible risk of disturbance to breeding merlin during construction. There is the potential for some short-term displacement of birds passing through the area, potentially hunting, during and outside of the breeding season.

[47] 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.

[48] 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.

[49] Bright, J., Langston, R., Bullman, R. Evans, R., Gardner, S. & 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.

[50] Petty, S.J. (1998). Ecology and Conservation of Raptors in Forests. Forestry Commission Bulletin 118. The Stationery Office, London.

7.7.39. Merlin (pre-mitigation) construction disturbance is assessed to be Negligible-Low, resulting in an effect significance level of Minor in the short-term which is **not significant**.

Peregrine

7.7.40. Sudden loud noises or the approach of people close to a breeding site, particularly if this were to occur during sensitive periods, such as very cool or warm weather conditions during incubation and young chick brooding, could result in breeding failure. There is also the potential for sudden loud noise during works to flush the adult birds with the risk that chicks (or eggs) are injured or knocked off the nesting ledge. Additionally, during the later stages of the chick-rearing period, there is the risk that loud noise or approaching people to cause the chicks to fledge before they are fully capable of flight, resulting in injury or death from a fall or collision.

7.7.41. Ruddock & Whitfield (2007[48]), based on data from an expert questionnaire on the upper limit of static or passive disturbance, recommended a disturbance management zone of 500 - 750 m from the nest. However, they concluded that the peregrines can habituate to the effects of at least some human disturbance, and also highlighted the occupation of nest sites at working quarries to illustrate this. In addition, tolerance to sources of human disturbance is probably dependent on the nature of the 'background' disturbance regime. Pairs in remote locations appear to be more likely to react to human presence than urban peregrines, or peregrines at frequently visited sites.

7.7.42. There are no known, currently occupied, peregrine breeding sites within 2 km of the Proposed Development. Construction works may affect hunting flights by adults provisioning chicks, although levels of peregrine activity within or near the Proposed Development during the survey period were low this also coincided with years when the nearest breeding pair were unsuccessful.

7.7.43. However, assuming a 'worst case' level of disruption for the duration of the construction period, the pre-mitigation assessment of construction-related disturbance to, and displacement of, breeding peregrine, is considered to be no greater than Negligible-Low, resulting in an effect significance level of Minor in the short-term which is **not significant**.

Summary of pre-mitigation assessment

7.7.44. A summary of the assessment of potential construction phase disturbance and displacement effects for each IOF, prior to mitigation and management, is given in Table 7.13, below.

Table 7.13: Construction phase – pre-mitigation assessment of construction disturbance/displacement

IOF	Sensitivity	Effect	Significance level	Duration	Confidence
Whooper Swan	Low (Local Medium)	Negligible	Negligible	Short-term	Certain
Greylag goose	Low (Local Medium)	Negligible	Negligible	Short-term	Certain
Pink-footed goose	Low (Local Medium)	Negligible	Negligible	Short-term	Certain
Black grouse	Low (Local High)	Low	Minor	Short-term	Near certain
Osprey	Low (Local High)	Negligible	Negligible	Short-term	Certain
Hen harrier	Low (Local High)	Negligible-Low	Minor	Short-term	Near certain
Red kite	Medium	Low	Minor	Short-term	Near certain
Curlew	Low (Local High)	Low	Minor	Short-term	Near certain
Common gull	Low (Local Medium)	Negligible	Negligible	Short-term	Certain
Herring gull	Low (Local Medium)	Negligible	Negligible	Short-term	Certain
Barn owl	Medium	Low	Minor	Short-term	Near certain
Merlin	Low (Local High)	Negligible-Low	Minor	Short-term	Near certain
Peregrine	Low (Local High)	Negligible-Low	Minor	Short-term	Near certain

Direct Habitat Loss / Degradation

7.7.45. The following section considers potential effects on the relevant IOFs from loss and degradation of supporting habitats. For any IOFs not specifically mentioned below the effects are considered to be nil-negligible. Details and discussion of habitat losses resulting from the construction phase are provided in Chapter 6: Ecology & Biodiversity.

7.7.46. The total area of moorland habitats (i.e., primarily rush pasture, modified and unmodified blanket bog) directly affected by wind farm infrastructure has been estimated at 21.63 ha of marshy grassland, 10.18 ha of semi-improved acid grassland, 10.65 ha of blanket bog (mostly modified bog habitats as a result of artificial drainage and the long-term effects of stock grazing, see Chapter 6 for further details). These are relatively small areas of loss in comparison of the extent of these habitat types present within the survey area and wider surrounding area, which would be distributed across the Proposed Development Area.

7.7.47. Consideration has been given during the design of the Proposed Development to avoid or minimise effects where practicable, areas of particularly sensitive habitat such as watercourses, flushes, and areas of unmodified blanket bog on deeper peat. No significant loss (other than at a localised level) of any habitats is predicted from the construction and upgrade of the access tracks which would service the Proposed Development.

7.7.48. The scale of the direct moorland habitat loss would not give rise to a significant effect upon any IOF due to the relatively small total area, distributed over the Proposed Development Area, and the small extent of the habitat types affected in comparison to similar available habitat in the immediate surrounding area. This assessment takes into consideration the potential for wind turbine bases and access tracks to result in indirect effects over a wider area than the construction footprint because of changes to local hydrology.

Black grouse

7.7.49. The construction of turbine 7 would result in the loss of a lek site used by low numbers of displaying males (peak of two over the three-year survey period, only occurring in one year). This Proposed Development Area appears to be used only infrequently, a consequence of the low population remaining in the area. However, it is possible that the area was used by larger numbers of black grouse in the past, although there are no records to indicate this based on the information collated during the desk study. There is at least one other lek site in the surrounding area that has been used in the past 10-15 years.

7.7.50. The habitat loss effects on black grouse are considered to be Low in the long-term, which is an effect significance level of Minor and **not significant**.

Other Species

7.7.51. The potential pre-mitigation effect of direct habitat loss on red kite, other raptors, and owls (including barn owl), and curlew is not considered to be significant due to the comparatively small areas affected in comparison to the extent of similar, or better-quality habitats, in the surrounding area which would be unaffected by the Proposed Development.

Summary of pre-mitigation assessment

7.7.52. A summary of the assessment of potential pre-mitigation habitat loss effects for each relevant species is given in Table 7.14.

Table 7.14: Construction phase – pre-mitigation assessment of habitat loss / degradation

Species	Sensitivity	Effect	Significance level	Duration	Confidence
Whooper Swan	Low (Local Medium)	Negligible	Negligible	Long-term	Certain
Greylag goose	Low (Local Medium)	Negligible	Negligible	Long-term	Certain
Pink-footed goose	Low (Local Medium)	Negligible	Negligible	Long-term	Certain
Black grouse	Low (Local High)	Low	Minor	Long-term	Near certain
Osprey	Low (Local High)	Negligible	Negligible	Long-term	Certain
Hen harrier	Low (Local High)	Negligible-Low	Minor	Long-term	Near certain
Red kite	Medium	Low	Minor	Long-term	Near certain
Curlew	Low (Local High)	Low	Minor	Long-term	Near certain
Common gull	Low (Local Medium)	Negligible	Negligible	Long-term	Certain
Herring gull	Low (Local Medium)	Negligible	Negligible	Long-term	Certain
Barn owl	Medium	Low	Minor	Long-term	Near certain
Merlin	Low (Local High)	Negligible-Low	Minor	Long-term	Near certain
Peregrine	Low (Local High)	Negligible-Low	Minor	Long-term	Near certain

Potential Off-site Accommodation Works

7.7.53. Construction of the Proposed Development requires delivery to the Site of large components (such as turbine blades) transported on long trailers (i.e. abnormal loads). An Abnormal Load Access Assessment has been completed to assess the load delivery route from Glasgow to the Proposed Development site (see Appendix 11.1). This assessment has identified 60 points of interest requiring further consideration, including engineering works, to create areas of overrun to negotiate the pinch points. These locations do not form part of the Proposed Development as they lie outside of the Site. However, they have been reviewed, via desk study, in relation to their potential to result in significant adverse effects on important ecological features, including sites designed for nature conservation and protected species.

7.7.54. The results of this review are provided in Technical Appendix 11.3. In summary, it was concluded that the potential roadside works, providing that they are undertaken following standard practice with respect to environmental protection and management, should not result in any appreciable adverse effects on any statutory designated sites. Impacts on habitats outside of designated sites should be negligible as most of the work would affect small areas of the existing road-side verge, which is already subject to regular vegetation management. The risk to birds is considered to be low, but not negligible, and it is recommended that any necessary clearance of roadside trees and scrub is undertaken outside of the nesting period. Where this is not possible, it is proposed that nesting bird surveys are completed ahead of the works to ensure that any active nests are not affected, and the works proceed lawfully with respect to the legal protections afforded to birds under the Wildlife & Countryside Act 1981 (as amended).

Operational Collision Risk

Risk of collision with wind turbines

7.7.55. The following section considers potential effects on the relevant IOFs from operational collision mortality. For any IOFs not specifically mentioned below the effects are considered to be nil-negligible.

7.7.56. Bird fatalities due to collisions with wind turbines has been identified as one of the key adverse impacts on wildlife from wind farm development (e.g., Dewitt and Langston 2006[51], 2008[52], Marques *et al.* 2014[53]). However, most reviews of available data from studies of wind farms in the UK and the rest of Europe have found that collisions are generally rare in wind farms that have been well-sited, and do not reach a level that is likely to result in important demographic effects, other than at the scale of local populations (e.g., Crockford 1992[54], Benner *et al.* 1993[55], Winkelman 1995[56], Erickson *et al.* 2001[57], Hötker *et al.* 2006[58], Zwart *et al.* 2015[59], Hötker *et al.* 2017[60]).

7.7.57. The risk of collision is dependent on a wide range of factors including time of year, bird age, size and flight behaviour, degree of displacement (i.e., behavioural avoidance of the wind farm area or individual turbines), nature of the surrounding topography, habitat quality, weather, wind speed and direction, wind turbine design, layout and spacing. Some of these factors may act in combination to increase collision risk (e.g., soaring species may use topographic features to help generate lift, whilst turbines placed close to these features may increase collision risk for those species) others may interact to decrease risk (e.g., birds may avoid the wind farm as a whole resulting in a reduced potential for collisions to occur). Certain taxonomic groups are considered to be at greater risk of collision. In particular, larger, less manoeuvrable species and / or species (families, groups of species) which spend a considerable proportion of their life on the wing, for example divers, grebes, herons, wildfowl, waders, raptors, owls, and grouse.

7.7.58. Other groups of birds such as passerines are also at risk of collision with wind turbine blades, however they are often present in high enough densities and have relatively high reproductive rates such that the effect of the additional mortality from turbine collision is less likely to be significant to the local population.

7.7.59. Larger birds such as raptors tend to have a lower reproductive rate than smaller species, such as passerines and waders, a longer period before first breeding and a much lower population density. Consequently, although there may not be significant differences in the susceptibility to collision with wind turbines, differences in life history, reproductive strategy and population status can result in marked differences in the potential 'vulnerability' of different species to additional mortality from wind farms.

[51] Drewitt, A.L. & Langston, R.H.W. (2006). Assessing the Impacts of Wind Farms on Birds. Ibis. 148. 29-42.

[52] Drewitt, A. L. & Langston, R.H.W. (2008). Collision effects of wind-power generators and other obstacles on birds. Annals of the New York Academy of Sciences, 1134(1): 233-266.

[53] Marques, A.T., Batalha, H., Rodrigues, S., Costa, H., Ramos Pereira, M.J., Fonseca, C., Mascarenhas, M., Bernardino, J. (2014). Understanding bird collisions at wind farms: An updated review on the causes and possible mitigation strategies, Biological Conservation,

Volume 179, Pages 40-52.

[54] Crockford, N.J. (1992). A review of the possible impacts of windfarms on birds and other wildlife. JNCC Report No. 27. pp. 60, JNCC, Peterborough.

[55] Benner, J.H.B., Berkhuizen, J.C., de Graaf, R.J. and Postma, A.D. (1993). Impact of wind turbines on birdlife. Report no. 9247. Consultants on Energy and the Environment, Rotterdam, The Netherlands.

[56] Winkelman, J. E. (1995). Bird / wind turbine investigations in Europe. Pages 43-47 and 110-120 in LGL Ltd., environmental research associates, Ed. Proceedings of the National Avian-Wind Power Planning Meeting, Lakewood, Colorado. National Renewable Energy Laboratory, Golden, Colorado.

[57] Erickson, W. P., G. D. Johnson, M. D. Strickland, D. P. Young, Jr., K. J. Sernka, and R. E. Good. (2001). Avian collisions with wind turbines: A summary of existing studies and comparisons to other sources of avian collision mortality in the United States. National Wind Coordinating Committee, c/o RESOLVE, Inc., Washington, D.C.

[58] Hötker, H., Thomsen, K.-M. and Jeromin, H. (2006). Impacts on Biodiversity of Exploitation of Renewable Energy Sources: The Example of Birds and Bats – Facts, Gaps in Knowledge, Demands for Further Research, and Ornithological Guidelines for the Development of Renewable Energy Exploitation. Michael-Otto-Institut im NABU, Bergenhusen, Germany.

[59] Zwart, M.C., Robson, P., Rankin, S., Whittingham, M.J., & McGowan, P. J. K. (2015). Using environmental impact assessment and post-construction monitoring data to inform wind energy developments. Ecosphere 6(2):26.

[60] Hötker, H., Krone, O., & Nehls, G. (2017). Birds of Prey and Wind Farms: Analysis of Problems and Possible Solutions. Springer International Publishing.

7.7.60. The risk of collision is also influenced by wind farm site location. For example, wind farms sited near to migratory routes, particularly where there is a 'bottleneck' effect caused by the surrounding topography, migration staging areas, flyways between roosting and feeding areas or anywhere where high numbers of birds may congregate, for instance where there is a high concentration of food supply, are often the most hazardous to birds.

7.7.61. The size of the wind turbine also influences collision risk, with larger turbines being associated with higher collision rates, as the volume of air swept by the turbine blades generally increases with capacity of the turbine. However, the general pattern, in relation to bird mortality, is for wind farms comprising fewer and larger turbines to result in lower collision rates overall in comparison to wind farms, of a similar electricity generation capacity, with more numerous, smaller wind turbines (Thaxter *et al*. 2017[61]). The overall collision risk per megawatt generated at the wind farm scale generally decreases with increasing turbine size (Hötker *et al*. 2006[62]). The spatial arrangement of wind farms can also have an important influence on collision risk. There is evidence that some collision susceptible species show macro-avoidance of wind farms as a whole, rather than individual wind turbines, and that peripheral turbines are a greater hazard for some species (e.g., white-tailed eagle at Smøla wind farm). Therefore, siting new wind farms adjacent to existing ones is, in general terms, likely to result in a lower collision hazard to birds (i.e., help to reduce collisions rates per turbine) in comparison to more widely spaced smaller groupings or individual wind turbines (Rasan & Dürr 2017[63]).

Collision risk modelling

7.7.62. Table 7.15, below, gives the estimated number of collisions per year for each relevant species, the estimated total number of collisions over the up to 35-year lifetime of the Proposed Development and the estimated rate of collision (further details are provided in Technical Appendix 7.2: 'Details of the Collision Risk Modelling'). A collision avoidance rates follow current guidance (NatureScot, September 2018). Species with only a single flight at collision risk height across the wind farm during the survey period have not been included in the analysis and for some species the reported collision rate is a peak level across the full baseline survey period (e.g. there were no flights by curlew at collision risk height during April – August 2018).

Table 7.15: Summary of the collision risk model results – annual/seasonal collisions estimated for target species at the assumed avoidance rates.

Species	Data Period	Applicable Season	Avoidance rate (%)	Collision rate (per annum/ season)	Total over 35 years	Years between collisions
Whooper Swan	Oct 18 - Apr 19	Passage/ Winter	99.5%	0.04	1.5	23.4
	Oct 20 - Mar 21	Passage/ Winter	99.5%	0.03	1.0	35.7
Icelandic Greylag goose	Sep 18 - Apr 19	Passage/ Winter	99.8%	0.002	0.06	597.53
Pink-footed goose	Sep 18 - Apr 19	Passage/ Winter	99.8%	0.003	0.1	361.75
	Sep 20 - Mar 21	Passage/ Winter	99.8%	0.11	4.0	8.75
Hen harrier	Sep 18 - Mar 19	Post-breeding/ Winter	99%	0.00	0.02	1526.62
	Sep 20 - Mar 21	Post-breeding/ Winter	99%	0.00	0.06	573.59
Red kite	Apr - Aug 18	Breeding	99%	0.23	8.1	4.31
	Mar - Aug 19	Breeding	99%	0.17	6.0	5.89
	Sep 18 - Feb 19	Non-breeding	99%	0.08	2.9	12.22
	Sep 20 - Feb 21	Non-breeding	99%	0.11	3.72	9.40
Curlew	Mar - Aug 19	Breeding	98%	0.02	0.6	55.80
Merlin	Sep 20 - Mar 21	Non-breeding	98%	0.00	0.05	647.52
Peregrine	Apr 18 - Aug 19	Year-round	98%	0.01	0.3	108.22

Whooper swan

7.7.63. Whooper swans are potentially vulnerable to collision during flights between waterbodies, particularly in low visibility conditions. Their typical commuting flight height, large size, fast flight speed and low manoeuvrability also increases the risk of collision with overhead wires and other structures. A relatively low number of collisions have been reported from incidental records of fatalities at wind farms in Denmark, Germany and Norway (a total of 10, Dürr 2021[64]). However, the tendency for this species to display macro-avoidance of wind farms reduces its relative collision risk.

7.7.64. The collision risk model provided a peak estimate of annual collision mortality of 0.04 birds per year for whooper swan, assuming an avoidance rate of 99.5%. This equates to one collision approximately every 23 years, and 1.4 over the operational period of the wind farm (35 years). At this rate, any additional mortality arising from the Proposed Development would have a negligible influence on existing over-winter survival rates, and consequently no effect on the long-term status of the regional wintering populations.

7.7.65. Collision mortality effects on whooper swan populations, based on the current and predicted levels of flight activity within Proposed Development Area, are considered to be Low, resulting in an effect level of Minor in the long-term, which is **not significant** in the context of the regional population.

Geese

7.7.66. Geese are potentially vulnerable to collision during flights between waterbodies, particularly in low visibility conditions. Their typical commuting flight height, large size, fast flight speed and low manoeuvrability also increases the risk of collision with overhead wires and other structures. A relatively low number of collisions, in comparison to the population size, have been reported from incidental records of fatalities at wind farms in Germany and lower numbers in other countries in mainland Europe (a total of 34 greylag geese and 1 pink-footed goose, Dürr 2021[64]). However, the tendency for this species to display macro-avoidance of wind farms reduces the collision risk. NatureScot currently recommends an assumed avoidance rate of 99.8% for geese when using the Band CRM (NatureScot 2018[65]).

7.7.67. Assuming an avoidance rate of 99.8%, the collision risk model provided a negligible estimate of annual collision mortality for greylag goose (one collision every c. 600 years). For pink-footed goose the estimates range from 0.003 and 0.11 collisions per year. Therefore, assuming a precautionary worst case of the higher estimate applying

[61] Thaxter, C. B., Buchanan, G. M., Carr, J., Butchart, S. H. M., Newbold, T., Green, R. E., Tobias, J.A., Foden, W.B., O'Brien, S. & Pearce-Higgins, J. W. (2017). Bird and bat species' global vulnerability to collision mortality at wind farms revealed through a trait-based assessment. Proceedings of the Royal Society B: Biological Sciences, 284(1862),

[62] Hötker H, Thomsen K-M, Jeromin H (2006) Impacts on biodiversity of exploitation of renewable energy sources: the example of birds and bats – facts, gaps of knowledge, demands for further research, and ornithological guidelines for the development of renewable energy exploitation. Michael-Otto-Institut im NABU, Bergenhusen.

[63] Rasran, L., & Dürr, T. (2017). Collisions of Birds of Prey with Wind Turbines - Analysis of the Circumstances. Birds of Prey and Wind Farms, 259–282.

[64] Dürr, T. (2021). Vogelverluste an Windenergieanlagen (bird fatalities at wind turbines in Europe). Data collected from the central archives of Brandenburg State Office for the Environment (dated 7 May 2021). Available from: http://www.lfu.brandenburg.de/cms/detail.php/bb1.c.312579.de

[65] SNH (2018). Avoidance Rates for the Onshore SNH Wind Farm Collision Risk Model. Scottish Natural Heritage, September 2018 v2.

for the duration of the Proposed Development, there would be c. 4 pink-footed goose deaths during the assumed 35-year operational phase (i.e. one collision every c. 9 years). At this rate, any additional mortality arising from the Proposed Development is considered to have a negligible influence on existing over-winter survival rates, and consequently no appreciable effects on the long-term status of the regional populations of ether species. Collision mortality effects on greylag goose, based on the current and predicted levels of flight activity within Proposed Development Area, are considered to be Negligible and **not significant**. Collision mortality effects on pink-footed goose, based on the current and predicted levels of flight activity within Proposed Development Area, are considered to be Low, resulting in an effect level of Minor in the long-term, which is **not significant** in the context of the regional population

Hen Harrier

7.7.68. Assuming an avoidance rate of 99%, the collision risk model provided very low estimates of annual collision mortality for hen harrier (one collision every c. 574 to 1,527 years). Therefore, assuming baseline levels of flight activity remain broadly similar, the Proposed Development would be very unlikely to result in any hen harrier deaths during the operational phase. Any additional mortality arising from the Proposed Development would have a negligible influence on existing over-winter survival rates for the hen harrier population in the region, and consequently no effect on long-term conservation status. The recent establishment of new forest plantations within part of the site may result in an increase in hen harrier hunting activity for a period prior to tree canopy closure. Most of this species hunting activity is well below rotor swept height. Should breeding activity occur in the future the potential for collisions to occur would be expected to increase, due to the general increase in flight activity with bird commuting regularly to and from the nest but also due to the occurrence of display flights near to the nesting area, which can be at rotor swept height. conclusion

7.7.69. Collision mortality effects on the wintering hen harrier population, based on the current and predicted levels of flight activity within Proposed Development Area, are considered to be Negligible and therefore **not significant**.

Red kite

7.7.70. Red kites are vulnerable to collision as they spend a relatively high proportion of their time hunting or searching for carrion as well as displaying and soaring at a height that is broadly similar to the typical turbine blade swept zone. Red kites also do not appear to display macro-avoidance behaviour to wind farms, that is, they tend not to show displacement and avoidance of wind farms as a whole and will hunt close to individual operating turbines. There have been 714 reported red kite collision incidents since 2002, the majority of which have been from wind farms in Germany (Dürr 2021[64]). The risk of red kite collision is considered to be highest at wind turbines located within 1,500 m of a nest (Hötker *et al*. 2013[66]). Significant effects from wind farm mortality on juvenile and adult survival rates in Germany, at the national population level, have been predicted as a result of the continuing expansion of onshore wind farm development (Busch *et al*. 2017[67], Katzenberger 2019[68]). One wind farm in Scotland has reported 4 red kite collision fatalities during 5-years of operational monitoring (Duffy & Urquhart 2014[69]).

7.7.71. The situation in Scotland is slightly different to mainland Europe as the population, whilst gradually expanding in most locations, remains relatively restricted to areas around the four re-introduction sites. There is much less overlap between the current distribution of the species and operational wind farms. However, this is likely to change in the future as the population grows, along with the ongoing expansion of onshore wind farms. A population viability analysis was carried out in 2016 for the North Scotland red kite area due to concerns about the long-term status of this population from the effects of illegal killing (primarily poisoning). The analysis determined that a relatively small increase in mortality from wind farm development could result in significant demographic effects (Sansom *et al*. 2016[70]). When the number of red kite wind farm fatalities increased to ten per year, the modelled reduction in growth rate in comparison to the baseline scenario led to a predicted population decrease of 280 pairs by 2044. Potential cumulative effects with illegal killing would mean that a lower level of wind turbine mortality could result in a similar outcome. However, illegal killing was still considered the main factor limiting growth of the North Scotland population.

7.7.72. The Proposed Development is located within 1.5 km of two known nest sites, one of which has not been used for five years. The wind farm layout has been adjusted to try to reduce the risk of collision, particularly in relation to red kite breeding locations, by implementing a minimum set back distance of 750m from all nest sites and minimising the number of turbines within 1.5 km. Consideration was given to installing wind turbines with a higher maximum and minimum blade swept zone than the proposed model, which would have resulted in lower estimates of collision risk for red kite. However, use of that model of turbine for this site was eventually discounted by the Applicant due to the greater potential for visual impact, in comparison to the model being considered in this assessment.

7.7.73. The collision risk model for red kite generated a peak estimate of 0.23 collisions for the breeding season, which equates to c. eight collisions over the 35-year lifetime of the Proposed Development. The peak collision rate for the non-breeding season was 0.11, which equates to c. 3.72 collisions during the lifetime of the Proposed Development. Combined this equates to an annual rate of 0.34 or the equivalent of one collision every 2.9 years (the lower estimated values equate to one collision every 4 years). Existing adult annual mortality experienced by the Dumfries and Galloway population can be estimated based on an assumed annual survival rate of 0.83 (from Smart *et al*. 2010[71]) and a breeding population of at least 119 pairs (Challis *et al*. 2020[33]). This gives an estimate of 40 birds being lost from the breeding population each year. The mortality rate predicted by the collision risk model, assuming on a precautionary basis that such mortality would act additively and only on the adult breeding population, would represent 0.95% of the existing annual mortality borne by the breeding population. This level of additional annual mortality is considered to be potentially significant at the regional population scale.

7.7.74. The Dumfries and Galloway red kite population appears to be in favourable conservation status at present (Challis *et al.* 2022[72]) as it is continuing to expand both in numbers and in range (as evidenced in part by the changes observed at the Proposed Development Area over the past c. 10 years). This expansion has also partly coincided with the increase in onshore wind farm development in Dumfries and Galloway in recent years. In its present condition there is likely to be sufficient 'capacity' for the population to absorb some additional sources of mortality. It is not possible to quantify this potential without undertaking detailed population viability analysis. However, reference to the modelling undertaken for the North Scotland population provides some useful comparative information and an indication of what the capacity may be (Sansom *et al*. 2016[70]). Whilst the key demographic metrics may differ slightly between the two populations, Sansom reported that, in the absence of mortality from poisoning events (an important issue limiting the growth of the North Scotland population), a low level of mortality caused by collisions with wind turbines (which was defined as two to three birds killed per year) was predicted to have only a small effect on the future growth of the North Scotland red kite population.

7.7.75. Sansom *et al*. (2016[70]) concluded that the cumulative effects of poisoning and increased mortality due to collisions with wind turbines could, under circumstances when the wind turbine-related mortality exceeds five fatalities per

[66] Hötker, H., Krone, O. & Nehls, G. (2013). Greifvögel und Windkraftanlagen: Problemanalyse und Lösungsvorschläge. Schlussbericht für das Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit. Michael-Otto-Institut im NABU, Leibniz-Institut für Zoo- und Wildtierforschung, BioConsult SH, Bergenhusen, Berlin, Husum.

[67] Busch, M., Trautmann, S., Gerlach, B. (2017). Overlap between breeding season distribution and wind farm risks: a spatial approach. Vogelwelt 137:169–180.

[68] Katzenberger, J., Gottschalk, E., Balkenhol, N., & Waltert, M. (2019). Long-term decline of juvenile survival in German Red Kites. Journal of Ornithology.

[69] Duffy, K. & Urquhart, B. (2014). Braes of Doune Windfarm – Report on Red Kite Studies (2004-2012). Natural Research Projects Ltd. On behalf of the Braes of Doune Ornithology Steering Group.

[70] Sansom, A., Etheridge, B., Smart, J. & Roos, S. (2016). Population modelling of North Scotland red kites in relation to the cumulative impacts of wildlife crime and wind farm mortality. Scottish Natural Heritage Commissioned Report No. 904.

[71] Smart, J., Amar, A., Sim, I. M. W., Etheridge, B., Cameron, D., Christie, G. & Wilson, J. D. (2010). Illegal killing slows population recovery of a re-introduced raptor of high conservation concern - The red kite Milvus milvus. Biological Conservation, 143, 1278-1286.

[72] Challis, A., Wilson, M.W., Eaton, M.A., Etheridge, B., Kortland, K., Mattingley, W., Steele, L.D., Stevenson, A., Stirling-Aird, P., Thornton, M., Titherington, J., Wernham, C.V. & Wilkinson, N.I. (2022). Scottish Raptor Monitoring Scheme Trends 2009-2018: Species-focus. Online document available from: https://raptormonitoring.org/trends/species-accounts

year, severely lower the population growth rate of red kites in North Scotland. That analysis was based on an assumed North Scotland population size of 64 breeding pairs in 2014. Unlike the North Scotland population there is little evidence of the same downward pressure on population growth from the effects of illegal persecution in Dumfries and Galloway. These two factors suggest that the capacity of the Dumfries and Galloway red kite population to 'absorb' additional morality from wind turbine collisions, without significantly affecting population growth / conservation status, may be greater than what was estimated for the North Scotland population (i.e., > two to three birds per year).

7.7.76. Based on the available evidence, pre-mitigation operational collision mortality effects on red kite are conservatively assessed to be Medium, resulting in an effect level of Moderate in the long-term, which is not **significant** in the context of the regional population.

Curlew

7.7.77. Curlew are considered to be potentially vulnerable to collision with wind turbines, particularly early in the breeding season in suitable breeding habitat. They can spend a considerable amount of time on the wing, at collision risk height, in courtship flights and territorial displays and also when mobbing potential predatory birds such as crows and ravens that approach the nesting area. There has been at least one reported collision of curlew associated with a wind turbine in the UK (Humphreys *et al*. 2015[73]). A total of 12 collision fatalities have been reported from mainland Europe, although this is largely on an incidental basis (Dürr 2021[64]). Based on such limited evidence curlew appear to be at comparatively low risk of collision with wind turbines. However, the extent to which curlew are vulnerable to collisions is likely to be severely underestimated due to their size and cryptic colouration, reducing the likelihood that they would be noticed unless systematic carcass searches were being carried out.

7.7.78. Curlew flights within the CRA were only recorded during summer 2019, although breeding within the Proposed Development Area occurred in both 2018 and 2019. Potentially, greater levels of flight activity at collision risk height are anticipated during the breeding season due to display flights, territorial behaviour, and therefore the risk of collision is anticipated to be higher at those times.

7.7.79. The peak estimate of annual collision mortality for curlew (applying the 98% avoidance rate) is 0.02, which equates to one bird every c. 56 years, and approximately 0.6 collisions over the operational period of the Proposed Development. For the breeding period the risk of mortality is considered to be very low, and at an annual rate that is unlikely to result in an appreciable change to existing annual survival rates beyond the immediate local population level (the NHZ population is estimated at 4,282 pairs, Wilson *et al.* 2015[17]).

7.7.80. The potential effect of collision mortality on the curlew population is assessed to be Negligible, resulting in an effect significance level of Negligible, which is **not significant**.

Merlin

7.7.81. Assuming an avoidance rate of 99%, the collision risk model provided a negligible estimate of annual collision mortality for merlin (one collision every c. 650 years), which is consistent with the typical hunting flight behaviour of this species. Although it is also important to note that as a small, cryptic falcon merlin are not as easily detected in flight in comparison to larger raptors such as red kite, consequently it is very likely that the collision rate is an underestimate. However, assuming baseline levels of flight activity remain the same in subsequent years, is considered reasonable to assume that the Proposed Development would be unlikely to result in any merlin deaths during the operational phase. The Proposed Development would therefore have a negligible influence on existing over-winter survival rates for the merlin population in the region, and consequently no effect on the long-term conservation status of the regional population.

7.7.82. Collision mortality effects on the wintering merlin population, based on the current and predicted levels of flight activity within Proposed Development Area, is considered to be Negligible, which is **not significant**.

Peregrine

7.7.83. Breeding peregrines are potentially vulnerable to collision with turbines when displaying, mobbing avian intruders, and hunting. Peregrine, as a highly manoeuvrable species in flight, may be expected to be at inherently lower risk of collision with wind turbines in comparison to less agile species. However, there is a lack of scientific studies which have considered this issue in any detail.

7.7.84. Post-construction monitoring records show there has been a minimum of four collision mortalities with wind turbines recorded for peregrine in Britain (Humphreys *et al.* 2015[38]), all of which occurred in Scotland, but these figures are likely to be an underestimate. A total of 34 collision fatalities have been reported for peregrine, on a mostly incidental basis, at 21 wind farm developments across six European countries, including one fatality in the UK (Dürr 2021[64]). The extent to which peregrine are vulnerable to collisions, however, is likely to be underestimated as they may not be picked up as incidental records that frequently (e.g., during wind turbine maintenance visits).

7.7.85. Peregrine flight speed and hunting behaviour, where they can be intently focused on the pursuit of other birds as prey with dramatic high speed 'stooping' attacks from above, may place them at some increased risk of collision with turbines. Peregrine typically hunt over open ground or water away from woodland and woodland edge with the majority of prey taken on the wing (Ratcliffe 1993[74]). The proximity of wind turbines to nest sites also increases the risk of collision to recently fledged young, particularly during practice flights. Also, during display flights, aerial courtship behaviour and interactions with intruding peregrines around the nest area, adults may be at greater risk of collision. Unlike other raptors, such as golden eagle, there appears to be little evidence for a behavioural displacement effect from operating wind farms (i.e., birds avoiding wind farms as a whole and thereby reducing the risk of collision).

7.7.86. The collision risk model for peregrine provided an estimate of collision mortality of 0.01 birds per year, assuming an avoidance rate of 98%. This equates to one collision every c. 108 years, and 0.4 birds over the 35-year operational period of the Proposed Development. The effect of collision risk on the regional peregrine population, based on current and predicted levels of activity within Proposed Development Area, is considered to be Negligible in the context of the regional population and **not significant**.

Consideration of Aircraft Warning Lighting

7.7.87. There is also the potential for the proposed aircraft warning lighting, required to be fitted to wind turbine nacelles, to influence bird behaviour, particularly for migrant birds, and potentially increase the risk of collisions occurring. The proposed aircraft warning lighting is detailed in Chapter 13 (Other Issues), section 13.4.

7.7.88. Current CAA policy for onshore wind turbine lighting allows for the lights to operate in a lower intensity mode (e.g. 200 candela) when metrological visibility is more than 5km in all directions. In this assessment the potential effect of the proposed aircraft warning lighting on birds (in particular the potential during poor visibility to increase collision risk) has been considered on a worst-case scenario, i.e. 2000 candela lighting in poor visibility without an aircraft proximity detection system.

7.7.89. The phenomenon of migrating birds being attracted to artificial lights at night has been long known but has only received detailed study over the past few decades. There is extensive literature from across the globe reporting on observations of nocturnal migrants flying around bright lights, such as lighthouses, oil rigs, flares, ceilometers and telecommunication towers. Detailed scientific studies of the mechanisms by which this occurs are relatively rare in the literature. The mechanisms by which birds are 'drawn' to such lights are not fully understood but some disruption to navigational cues, rather than direct attraction, appears to be the main likely cause.

[73] Humphreys, E.M., Marchant, J.H., Wilson, M.W. & Wernham, C. V. (2015). Curlew (Numenius arquata): SWBSG Species Dossier 16. Report by BTO Scotland to SWBSG as part of Project 1403. Updated by SWBSG March 2017.

[74] Ratcliffe, D. (1993). The Peregrine Falcon, Second Edition. T & A D Poyser, London.

7.7.90. Kerlinger *et al*. (2010[75]), in a study of the effect of wind turbine lighting on bird collisions at 30 operating wind farms North America, did not find any associated mass collision events similar to what has been documented at some guyed telecommunication towers. They did find that lighting and weather conditions may have been factors in four multi-bird fatality events. Flashing red lights, which are typically installed as aircraft warning lighting for wind farms in North America, were not involved in these events. They speculated that steady burning red lights, which are installed on telecommunication towers present a greater risk to nocturnal migrants. However, it was difficult to disentangle the influence of the greater height of the telecommunication towers (some are over 300 m tall) and the presence of guy wires from the influence of the lighting type. Rebke *et al*. (2019[76]), in a more recent study of offshore wind farm lighting and birds, found that no light type was constantly avoided by nocturnally migrating songbirds. Birds were drawn more towards continuous than flashing lights, particularly in overcast conditions. However, steady burning red lights did not differ from flashing red light in apparent level of attractiveness. Rebke *et al*. recommended light sources at offshore wind farms should be restricted to the minimum required and if lighting is required, flashing lights are preferred over continuous lights, and if continuous light is required, red light should be used.

7.7.91. For many species, there will be negligible increased risk from the presence of the lights due to their predominantly diurnal habits (e.g. diurnal raptors, black grouse). There is some uncertainty, which is generally applicable to all wind farm proposals with lighting, as to the potential for infrequent conditions to occur that increase collision risk and for lighting to exacerbate this (e.g. low cloud/foggy conditions during migration periods). The risk to birds from onshore wind turbines, in upland sites, that are illuminated at night or in conditions of poor visibility during the day has been poorly studied but is assumed to be a potential risk factor. However, this is unlikely to be a significant issue unless the wind farm is located where large numbers of nocturnal migrant birds are likely to occur. Evidence from published research that has considered the potential for lighting on wind turbines to increase the risk of collision does not indicate that it is an appreciable issue for any species considered in this assessment with the exception of geese and whooper swan.

7.7.92. Geese can be active at night and in poor-visibility conditions, during migration and moving between roosting and foraging areas. However, to date there is no evidence that lighting, of the type which would be installed at the Proposed Development, has resulted in a significantly increased rate of collision at any site in the UK. The Proposed Development is in a general area that is overflown occasionally by pink-footed geese and whooper swans during passage periods in the spring and autumn. There was no evidence from the flight activity surveys of any clear concentration of flight activity across the Proposed Development Area. Movements appeared to be on a relatively broad front and there was also no evidence of regular movements typically associated with commuting flight between favoured roosting and foraging sites.

7.7.93. Most migrant songbirds migrate at night, raptors and wildfowl normally migrate during the day, and all species tend to time the onset of migration flights during good weather. However, landfall at staging, wintering or breeding sites may be under very different weather conditions and may also be at night (Gill 2007[77]). Typically, migrants follow broad routes, or 'flyways', which may differ between spring and autumn migration, but tend to follow large-scale geographical features (e.g. coastlines, mountain ranges, large valleys). Although certain features, such as passes in high mountains running perpendicular to flyways and narrow points between land for seas crossings, can focus birds into a much smaller area. The proposed wind farm is located within an area where there is passage of migrant geese and swans occurring in the autumn and spring but is not in a location where such movement is likely to be unusually concentrated.

7.7.94. In conclusion, the risk of increased mortality rates due to aircraft warning lighting is considered to be negligible for all IOFs considered in this assessment apart from geese. This is due to the absence of evidence of a particular risk to any other species from lighting at upland wind farms (i.e. away from lowland agricultural areas and the coast) and the specific circumstances of the Site, with respect to the low levels of flight activity recorded within or near to the proposed wind farm for most species that could be active at night or during periods of poor visibility.

Summary of pre-mitigation assessment

7.7.95. Table 7.16 provides the assessed pre-mitigation effect magnitude and effect level of collision risk for each of the potentially affected species.

Table 7.16: Operational phase – pre-mitigation assessment of collision risk from wind turbines

Species	Sensitivity	Effect Level	Significance level	Duration	Confidence
Whooper Swan	Low (Local Medium)	Low	Minor	Long-term	Near certain
Greylag goose	Low (Local Medium)	Negligible	Negligible	Long-term	Near certain
Pink-footed goose	Low (Local Medium)	Low	Minor	Long-term	Near certain
Black grouse	Low (Local High)	Negligible	Negligible	Long-term	Near certain
Osprey	Low (Local High)	Negligible	Negligible	Long-term	Near certain
Hen harrier	Low (Local High)	Negligible	Negligible	Long-term	Near certain
Red kite	Medium	Medium	Moderate	Long-term	Probable
Curlew	Low (Local High)	Negligible	Negligible	Long-term	Near certain
Common gull	Low (Local Medium)	Negligible	Negligible	Long-term	Near certain
Herring gull	Low (Local Medium)	Negligible	Negligible	Long-term	Near certain
Barn owl	Medium	Negligible	Negligible	Long-term	Near certain
Merlin	Low (Local High)	Negligible	Negligible	Long-term	Near certain
Peregrine	Low (Local High)	Negligible	Negligible	Long-term	Near certain

Operational Displacement & Barrier Effects

7.7.96. The following section considers potential effects on the relevant IOFs from operational displacement. For any IOFs not specifically mentioned below the effects are considered to be nil-negligible.

7.7.97. Turbine-related displacement, assuming no habituation over time, has the potential to affect breeding success and reduce individual fitness as it results in the effective loss of habitat for nesting, foraging, and roosting. The scale of the effects would be likely to vary considerably between species and could be dependent on factors such as the number of turbines affecting the same habitat / population of birds and the zone of displacement relative to territory size etc.

7.7.98. Displacement of birds from suitable habitat by operating wind turbines has been observed in a number of studies of onshore wind farms (e.g., Larsen & Madsen 2000[78]; Devereux, Denny & Whittingham 2008[79]; Pearce-Higgins

[75] Kerlinger, P., Gehring, J., & Erickson, W.P., Curry, R., & Guarnaccia, J.A. (2010). Night Migrant Fatalities and Obstruction Lighting at Wind Turbines in North America. The Wilson Journal of Ornithology. 122, 744-754.

[76] Rebke, M., Dierschke, V., Weiner, C.N., Aumüller, R., Hill, K., Hill, R. (2019). Attraction of nocturnally migrating birds to artificial light: The influence of colour, intensity and blinking mode under different cloud cover conditions. Biological Conservation, 233(2019), 220-227.

[77] Gill, F.B. (2007). Ornithology. W.H. Freeman and Company, New York.

[78] Larsen, J. K.; Madsen, J. (2000). Effects of wind turbines and other physical elements on field utilization by pink-footed geese (*Anser brachyrhynchus*): A landscape perspective. Landscape Ecology 15: 755-764.

[79] 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.

et al. 2008[80] and 2009[81]). From various published field studies and literature reviews (e.g., Winkelman 1995[82], Green 1995[83], Leddy *et al*. 1999[84], Larsen and Madsen 2000[85], de Lucas *et al.* 2004[86], Hötker *et al.* 2006[58], Zwart *et al.* 2015, Hötker 2017[87]) it is apparent that displacement effects can vary between locations and species, with some species showing remarkable tolerance of wind turbines and others being partially or entirely displaced from a wind farm area (i.e., display strong macro-avoidance).

7.7.99. The results of wind farm monitoring studies in the Scottish uplands have shown variable results with respect to breeding wader displacement effect. However, with studies of operational wind farms, it is often difficult to account for concurrent changes to habitat condition within and outside of the wind farm area, either as a result of construction or from deliberate habitat enhancement, influencing habitat use within the wind farm area.

7.7.100. Based on studies at 12 operational wind farms in Scotland an apparent 42% decrease in breeding curlew and 39% decrease in breeding golden plover densities within 500 m of turbines was reported by Pearce-Higgins *et al.* (2008[88], 2009[89]). Subsequent, longer-term studies by the same lead author, including some of the same wind farm sites, failed to find a significant longer-term effect on golden plover following wind farm construction but did report an effect on curlew (Pearce-Higgins *et al*. 2012[90]). Various, single-site, monitoring studies have also indicated the scale of potential displacement effects during the wind farm operational phase is lower than had been previously assumed, with several studies failing to show significant effects on golden plover or curlew (e.g., Fielding & Haworth 2015[91], Whitfield *et al.* 2010[92], Douglas *et al.* 2011[93]). Conversely, a detailed five-year study at Gordonbush Wind Farm, did show a significant decline in breeding golden plover density, in comparison to pre-construction levels, following wind farm operation (Sansom & Douglas 2014[94], 2016[95]). The abundance of breeding pairs within that wind farm was 79% lower during post-construction compared to the pre-construction period and displacement effect was significant 400-600 m from turbines.

7.7.101. There is also the potential for the presence of the Proposed Development to affect flight behaviour and force birds to make deviations which are more costly in terms of energy expenditure or, in extreme cases, prevent access to important habitats. For infrequent movements, this is less of a concern. However, for birds such as geese and swans, that can use favoured daily commuting routes between winter roost sites and feeding areas, this has the potential to be an important effect. Similar effects can result if wind farms are placed across migration corridors. For this assessment, the potential for the Proposed Development to result in significant barrier effects for the species that have been recorded using Proposed Development Area is considered to be very low. As discussed in section 7.6 there is no evidence that Proposed Development Area is overflown with any regularity by appreciable numbers of migrating or wintering geese or swans. Therefore, there is no further consideration of the potential barrier effect of the Proposed Development for any of these IOFs.

Wintering / passage geese and swans

7.7.102. Given the low importance of Proposed Development Area for wintering/passage geese and swans and low levels of flight activity recorded the operational effects on wintering/passage geese and swans are considered to be Negligible and **not significant** in the long-term.

Black grouse

7.7.103. There are historical lek sites in Proposed Development Area, although there has been no evidence of the presence of lekking back grouse since 2018. While there was no direct evidence during the 2018-2020 survey period, there is the possibility of breeding and foraging activity by black grouse increasing within Proposed Development Area in the short to medium-term future due to the completed and proposed tree planting increasing habitat suitability for a period. However, as discussed previously this is likely to only result in a relatively short-term benefit for this species and a potential long-term disbenefit.

7.7.104. There is limited evidence for wind farm displacement effects on black grouse in the UK. There is some evidence from Austria of significant declines in black grouse populations (i.e., displaying males fell by at least 75%) during and following wind farm construction (Zeiler & Gruenschachner-Berger 2009[96]). Many wind farms potentially affecting black grouse tend to include habitat mitigation measures, which can confound the interpretation of pre- and post-construction monitoring data (Humphreys *et al.* 2015[97]).

7.7.105. There is some anecdotal evidence of black grouse continuing to attend leks close to operating to wind farms in the UK. For example, at Drumderg wind farm, in Perthshire, black grouse have continued lekking in proximity to the operational wind farm (RWE Npower renewables 2011).

7.7.106. Operational displacement effects on black grouse, based on the current use of Proposed Development Area, have been assessed on a precautionary basis as Low, resulting in an effect significance level of Minor, which is **not significant**.

Hen harrier

7.7.107. The hen harrier population as a whole is considered to be sensitive to wind farm development because their preferred habitats, particularly during the breeding season, correspond to optimal sites for wind turbines in Scotland (Bright *et al*. 2008). However, there is little evidence that operational wind farms result in macro-avoidance by breeding or foraging harriers or act as an important barrier to movement for this species. However, foraging hen harriers have been reported avoiding wind turbines by various distances, up to c. 500m (Madders &

[80] Pearce-Higgins, J.W., Stephen, L., Langston, R.H.W., and Bright, J.A. (2008). Assessing the cumulative impacts of wind farms on peatland birds: a case study of golden plover *Pluvialis apricaria* in Scotland. Mires and Peat Volume 4, pp 1-13.

[81] 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 Volume 46 Issue 6, Pages 1323 - 1331.

[82] Winkelman, J. E. (1995). Bird / wind turbine investigations in Europe. Pages 43-47 and 110-120 in LGL Ltd., environmental research associates, Ed. Proceedings of the National Avian-Wind Power Planning Meeting, Lakewood, Colorado. National Renewable Energy Laboratory, Golden, Colorado. Available at: https://www.osti.gov/biblio/70750

[83] Green, M. (1995) Effects of Windfarm operation on the winter bird community of the Byrn Titli Uplands: 1994 / 1995. Report to National Wind Power Ltd.

[84] Leddy, K. L.,Higgins, K. F. and Naugle D. E. (1999). Effects of wind turbines on upland nesting birds in Conservation Reserve Program grasslands. Wilson Bulletin 111: 100-104.

[85] Larsen, J. K.; Madsen, J. (2000). Effects of wind turbines and other physical elements on field utilization by pink-footed geese (*Anser brachyrhynchus*): A landscape perspective. Landscape Ecology 15: 755-764.

[86] de Lucas, M., Janss, G.F.E. and Ferrer, M. (2004). The effects of a wind farm on birds in a migration point: the Strait of Gibraltar. Biodiversity and Conservation 13:395-407.

[87] Hötker, H., Krone, O., & Nehls, G. (2017). Birds of Prey and Wind Farms: Analysis of Problems and Possible Solutions. Springer International Publishing.

[88] Pearce-Higgins, J.W., Stephen, L., Langston, R.H.W. & Bright, J.A. (2008). Assessing the cumulative impacts of wind farms on peatland birds: a case study of golden plover Pluvialis apricaria in Scotland. Mires and Peat, 4, 1–13.

[89] Pearce-Higgins, J.W., Stephen, L., Langston, R.H.W., Bainbridge, I.P. & Bullman, R. (2009). The distribution of breeding birds around upland wind farms. Journal of Applied Ecology, 46, 1323–1331.

[90] Pearce-Higgins, J.W., Stephen, L., Douse, A. & 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.

[91] Fielding, A.H., and Haworth, P.F. (2015). Farr Wind Farm: a review of displacement disturbance on golden plover arising from operational turbines between 2005 and 2015. Haworth Conservation.

[92] 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.

[93] 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, pp 37-43.

[94] Sansom, A. & Douglas, D. (2014). Gordonbush wind farm golden plover research project. RSPB report.

[95] Sansom, A., Pearce-Higgins, J. W., & Douglas, D. J. T. (2016). Negative impact of wind energy development on a breeding shorebird assessed with a BACI study design. Ibis, 158(3), 541–555.

[96] Zeiler, H. & Gruenschachner-Berger, V. (2009). Impact of wind power plants on black grouse, Lyrurus tetrix in Alpine regions. Folia Zoologica. 58. 173-182.

[97] Humphreys, E.M., Marchant, J.H., Wilson, M.W. & Wernham, C.V. (2015). Black Grouse (Tetrao tetrix): SWBSG Species Dossier 3. Report by BTO Scotland to SWBSG as part of Project 1403. Updated by SWBSG March 2017.

Whitfield 2006[98], Whitfield & Madders 2006[99], Pearce-Higgins *et al*. 2009[100], Garvin *et al*. 2011[101]). In a literature review, Hötker (2017[102]) reported only four of 12 studies indicating a negative (i.e., displacement) response of breeding hen harriers to operational wind farms. Hen harriers have been recorded nesting within 250m of operational wind turbines in Scotland. Some wind farm studies have reported an apparent reduction in hen harrier nest success and productivity within a 1km radius of wind turbines, although this was not a statistically significant effect (Fernández-Bellon *et al*. 2015[103]).

7.7.108. A conservative potential displacement zone of 500 m radius from each wind turbine base would include winter foraging areas but no known/historical nest sites or roost sites. As there is no regular breeding activity or evidence of any roost sites within 2km of the Proposed Development, displacement effects would principally affect only a small number of foraging birds during the winter months.

7.7.109. The potential effect of displacement for wintering hen harrier has been assessed on a precautionary basis as Low, resulting in an effect level of Minor, which is **not significant** in the long-term.

Red kite

7.7.110. There is insufficient evidence to be certain whether red kites in Scotland exhibit wind turbine or wind farm displacement behaviour (Humphreys *et al.* 2015[104]), although monitoring studies at individual wind farms in Germany have also shown little evidence of macro-avoidance by this species. In a literature review, Hötker (2017[105]) reported only one of seven studies indicating a negative (i.e., displacement) response of breeding red kites to operational wind farms. Hötker *et al.* (2017[106]) found that breeding red kites spent most of their time within a radius of c. 1000m around their nests. They frequently visited wind farms for foraging and spent about 25% of their flight time within the blade swept height band of the most common wind turbines present in the study area. A study in Scotland reported reduced use of part of a wind farm by red kite during the operational period (Duffy & Urquhart 2014). However, this was not attributed to wind turbine avoidance due to concurrent changes in a communal roost location, moving further away from the wind farm during the study period. There appears to be a lack of evidence of any wind farm barrier effect on this species, but this is consistent with the general finding that red kites tend not to avoid wind farms, which also partly explains their comparatively high collision risk (see above).

7.7.111. The Proposed Development has been modified during the design process to reduce the potential for displacement / disturbance effects on red kite breeding sites, at the distances where such effects are likely. There is the potential for some displacement of hunting birds that use the Proposed Development Area. It is also possible that some displacement from the Proposed Development Area may occur anyway (i.e., irrespective of the Proposed Development) within the next 10-15 years because of the maturing tree plantations at Marbrack and Furmiston.

7.7.112. Based on the available evidence, pre-mitigation operational displacement / barrier effects on red kite are considered to be Negligible-Low, resulting in an effect level of Minor, which is **not significant** in the long-term.

Curlew

7.7.113. Curlew has been identified as being of relatively high sensitivity to displacement from onshore wind farm development, with some studies reporting significant reductions in breeding densities within 500 m of wind turbines (Pearce-Higgins *et al.* 2009[81], 2012[107]), but there is some uncertainty about scale of the effect at some sites as well as the potential long-term effect.

7.7.114. One breeding curlew territory was recorded within 500 m of the Proposed Development during surveys completed in 2018 and 2019. Assuming the 'worst case', i.e., the Proposed Development resulting in the long-term displacement of up to one pair, this is considered too small an effect to be considered significant at the regional or NHZ population scale.

7.7.115. In conclusion, the effect of operational displacement on the local breeding curlew population is considered to be Low, resulting in an effect level of Minor, which is **not significant** in the long-term.

Barn owl

7.7.116. The potential effect on breeding barn owl from operational disturbance and displacement is anticipated to be low for the Proposed Development based on the findings of the baseline surveys and desk study. There is at least one breeding barn owl pair within the immediate surrounding area (within c. 500 m) of the Site boundary and within foraging range of the Proposed Development Area. There is the potential for disturbance and displacement of hunting barn owl, although there is little evidence from the scientific literature to suggest that this species is particularly susceptible to displacement from operational wind farms. The rough grassland areas within Proposed Development Area provide suitable hunting habitats for this species but there is also extensive suitable habitat present in the surrounding area, which is closer to the breeding site(s).

7.7.117. The effect from operational displacement on barn owl has been assessed, on a precautionary basis, as Negligible-Low, resulting in an effect level of Minor, which is **not significant** in the long-term.

Merlin

7.7.118. There appears to have been very little research on the potential displacement effects of wind farms on merlin. Jacobsen et al. (2019) report that about 50% of merlins approaching an offshore wind farm in the Baltic Sea displayed avoidance behaviour (macro and meso-avoidance). This is based on a sample of only 14 flights. However, in comparison to other raptor species recorded during this study, this is a relatively low rate of avoidance (i.e., the lowest of all species that showed any avoidance response at all). This may be indicative of a comparatively low vulnerability to displacement, possibly reflecting the high manoeuvrability and agility that this species displays on the wing. However, it is difficult to draw any firm conclusions based on one study of an offshore wind farm. These results may have no relevance to the potential effects of onshore wind farms displacement effects within merlin breeding habitat.

7.7.119. Due to the absence of any breeding records within 2km of the Proposed Development there is not expected to be any direct displacement effect on any merlin breeding sites or core hunting ranges. There is the potential for displacement of hunting birds that occasionally use Proposed Development Area during winter and may nest in the wider area. Pre-mitigation operational displacement / barrier effects on breeding merlin are assessed to be Negligible-Low, resulting in a significance level of Minor in the long-term, which is **not significant**.

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[98] Madders, M. & Whitfield, D.P. (2006). Upland raptors and the assessment of wind farm impacts. Ibis 148: 43-56.

[99] Whitfield, D. & Madders, M. (2006). A Review of the Impacts of Wind Farms on Hen Harriers Circus Cyaneus and an Estimation of Collision Avoidance Rates.

[100] Pearce-Higgins, J.W., Stephen, L., Langston, R.H., Bainbridge, I.P. & Bullman, R. (2009). The distribution of breeding birds around upland wind farms. Journal of Applied Ecology 46: 1323-1331.

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[102] Hötker, *H.* (2017) Chapter 7, Birds: displacement. In: Perrow, M.R. (ed.) Wildlife and Wind Farms, Conflicts and Solutions. Volume 1, Onshore: Potential Effects, Pelagic Publishing, Exeter, UK.

[103] Fernández-Bellon, D., Irwin, S., Wilson, M., & O'Halloran, J. (2015). Reproductive output of Hen Harriers Circus cyaneus in relation to wind turbine proximity. Irish Birds 10: 143–150.

[104] Humphreys, E.M., Marchant, J.H., Wilson, M.W. & Wernham, C.V. (2015). Red Kite (Milvus milvus): SWBSG Species Dossier 6. Report by BTO Scotland to SWBSG as part of Project 1403. Updated by SWBSG March 2017

[105] Hötker, H. (2017) Chapter 7, Birds: displacement. In: Perrow, M.R. (ed.) Wildlife and Wind Farms, Conflicts and Solutions. Volume 1, Onshore: Potential Effects, Pelagic Publishing, Exeter, UK.

[106] Hötker, H., Mammen, K., Mammen, U., Rasran, L. (2017). Red Kites and Wind Farms — Telemetry Data from the Core Breeding Range. In: Köppel J. (eds) Wind Energy and Wildlife Interactions. Springer, Cham.

[107] Pearce-Higgins, J.W., Stephen, L., Douse, A. & 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.

Peregrine

7.7.120. Studies of the ranging behaviour of breeding peregrines in the Scottish Highlands have shown that approximately 70% of their prey is taken within 2 km of the nest (Weir 1978[108]). This is often used as an indication of a nominal core hunting range for this species, although breeding birds can range much further than this. None of the currently occupied breeding locations is within 2km of the Proposed Development (see Confidential Annex for further details).

7.7.121. There is little evidence in the scientific literature to indicate that peregrine are significantly affected by the presence of wind farms, e.g., displaced by the wind farm as a whole or that wind farms within breeding ranges present a significant barrier to movement. However, this issue has not received much attention, in comparison to displacement effects on other raptor species of conservation concern such as golden eagle. It is therefore difficult to draw firm conclusions about the potential magnitude of this effect. The extent of suitable habitat, prey availability and hunting opportunities in the assumed home range, which would be unaffected by the Proposed Development, suggests that displacement is unlikely to be significant other than at a local scale.

7.7.122. The potential displacement effect of the Proposed Development on peregrine is assessed, on a precautionary basis given the potential for alternative historical breeding sites closer to the Proposed Development to be re-occupied in the future, to be Negligible-Low, resulting in an effect level of Minor, in the long-term, which is **not significant**.

Summary of pre-mitigation assessment

7.7.123. Table 7.17 provides a summary of the assessed pre-mitigation effect for each of the potentially affected species.

Table 7.17: Operation phase – pre-mitigation assessment of displacement/disturbance

Species	Sensitivity	Effect Level	Significance level	Duration	Confidence
Whooper Swan	Low (Local Medium)	Negligible	Negligible	Long-term	Near certain
Greylag goose	Low (Local Medium)	Negligible	Negligible	Long-term	Near certain
Pink-footed goose	Low (Local Medium)	Negligible	Negligible	Long-term	Near certain
Black grouse	Low (Local High)	Low	Minor	Long-term	Near certain
Osprey	Low (Local High)	Negligible	Negligible	Long-term	Near certain
Hen harrier	Low (Local High)	Low	Minor	Long-term	Near certain
Red kite	Medium	Negligible-Low	Minor	Long-term	Near certain
Curlew	Low (Local High)	Low	Minor	Long-term	Near certain
Common gull	Low (Local Medium)	Negligible	Negligible	Long-term	Near certain
Herring gull	Low (Local Medium)	Negligible	Negligible	Long-term	Near certain
Barn owl	Medium	Negligible-Low	Minor	Long-term	Near certain
Merlin	Low (Local High)	Negligible-Low	Minor	Long-term	Near certain
Peregrine	Low (Local High)	Negligible-Low	Minor	Long-term	Near certain

Operational Disturbance from Maintenance Activities

7.7.124. The wind turbines would require periodic routine maintenance and occasionally there may be the need to replace large components such as rotor blades. Consequently, the amount of potential disturbance would vary depending on the scale, duration, and timing of the maintenance activities. However, it is reasonable to assume that disturbance from such activities during the operation of the Proposed Development would be significantly lower than that which could occur during the construction phase.

7.7.125. Assuming that maintenance works are carried out at the least favourable time for birds during the breeding season, this effect has been assessed as no greater than negligible-low for any IOF, resulting in an effect level of not greater than minor, and not significant for all IOFs.

7.7.126. Table 7.18 provides a summary of the assessed pre-mitigation effect magnitude and effect level for each of the potentially affected species.

Table 7.18: Operation phase – pre-mitigation assessment of disturbance from maintenance activities

Species	Sensitivity	Effect Level	Significance level	Duration	Confidence
Whooper Swan	Low (Local Medium)	Negligible	Negligible	Long-term	Near certain
Greylag goose	Low (Local Medium)	Negligible	Negligible	Long-term	Near certain
Pink-footed goose	Low (Local Medium)	Negligible	Negligible	Long-term	Near certain
Black grouse	Low (Local High)	Low	Minor	Long-term	Near certain
Osprey	Low (Local High)	Negligible	Negligible	Long-term	Near certain
Hen harrier	Low (Local High)	Negligible	Negligible	Long-term	Near certain
Red kite	Medium	Negligible-Low	Minor	Long-term	Near certain
Curlew	Low (Local High)	Low	Minor	Long-term	Near certain
Common gull	Low (Local Medium)	Negligible	Negligible	Long-term	Near certain
Herring gull	Low (Local Medium)	Negligible	Negligible	Long-term	Near certain
Barn owl	Medium	Negligible-Low	Minor	Long-term	Near certain
Merlin	Low (Local High)	Negligible-Low	Minor	Long-term	Near certain
Peregrine	Low (Local High)	Negligible-Low	Minor	Long-term	Near certain

Decommissioning Effects

Disturbance during decommissioning

7.7.127. Works associated with the decommissioning of the Proposed Development have the potential to disturb breeding and wintering birds. The exact timing of this work (approximately 35 years after the Proposed Development is operational), relative to the more sensitive periods of the year for breeding birds, is not known at this time; it has therefore been assumed that work may occur at the least favourable time relative to the relevant IOFs.

7.7.128. Broadly similar potential sources of disturbance and effects on birds to the construction phase could arise during the decommissioning works. These effects are discussed in the previous section and are therefore not repeated

[108] Weir, D. (1978) Wild peregrines and grouse. The Falconer. 7, 98 102.

here; however, it is likely that the duration and intensity of works would be less than that required during the construction phase.

7.7.129. A summary of potential decommissioning phase disturbance effects for each species, prior to mitigation, is given in Table 7.19 below.

Table 7.19: Decommissioning phase – pre-mitigation assessment of disturbance effects

Species	Sensitivity	Effect	Significance level	Duration	Confidence
Whooper Swan	Low (Local Medium)	Negligible	Negligible	Short-term	Near certain
Greylag goose	Low (Local Medium)	Negligible	Negligible	Short-term	Near certain
Pink-footed goose	Low (Local Medium)	Negligible	Negligible	Short-term	Near certain
Black grouse	Low (Local High)	Low	Minor	Short-term	Near certain
Osprey	Low (Local High)	Negligible	Negligible	Short-term	Near certain
Hen harrier	Low (Local High)	Negligible-Low	Minor	Short-term	Near certain
Red kite	Medium	Low	Minor	Short-term	Near certain
Curlew	Low (Local High)	Low	Minor	Short-term	Near certain
Common gull	Low (Local Medium)	Negligible	Negligible	Long-term	Near certain
Herring gull	Low (Local Medium)	Negligible	Negligible	Long-term	Near certain
Barn owl	Medium	Low	Minor	Short-term	Near certain
Merlin	Low (Local High)	Negligible-Low	Minor	Short-term	Near certain
Peregrine	Low (Local High)	Negligible-Low	Minor	Short-term	Near certain

7.7.130. The decommissioning of the Proposed Development would have a positive benefit in terms of removing the potential collision risk. Habitat reinstatement would be decided in consultation with the statutory authorities at the time of decommissioning. Disturbance effects due to decommissioning would last no longer than 12 months. Apart from the shorter duration, the effects on birds would be similar to those during construction.

7.7.131. There will likely be disturbance to birds arising from decommissioning works. Assuming the least favourable timing of the works, the effect of the removal of the wind turbines, sub-station and associated infrastructure has the potential to result in effect levels of minor and not significant for all IOFs. However, the effects should be restricted to the short-term, one breeding season only and would not be of the same potential scale as the construction effects.

7.8 MITIGATION & BEST PRACTICE

Design Mitigation

7.8.1. The layout of the Proposed Development has been informed by a constraints assessment related to certain key species, primarily breeding red kite and curlew. Regularly used breeding locations have been mapped as constraints on the wind farm design and protected by set-back zones.

Construction Disturbance

7.8.2. The following section provides a summary of the proposed best-practice measures which would help to further reduce potential effects on all IOFs and help ensure that the proposed works proceed lawfully with respect to the legal protections. An outline BPP, which further details the proposed approach to minimising effects on breeding birds during the wind farm construction works, is provided in Technical Appendix 7.3.

General Bird Protection Measures

7.8.3. Pre-construction black grouse and breeding raptor surveys, completed by suitably experienced ornithologists, are proposed in order to help inform the approach to the construction works associated with the Proposed Development so that black grouse leks and breeding Schedule 1 species (e.g. red kite, merlin, hen harrier, peregrine, short-eared owl, barn owl) active nest sites are protected and would not be disturbed by construction works, including vehicle movements along the main access tracks, during the breeding season.

7.8.4. In the spring / summer prior to any construction works being undertaken (including enabling works and ground investigations) surveys would be undertaken to identify any black grouse lek sites and Schedule 1 species breeding activity and to demarcate areas potentially sensitive to disturbance. The Applicant would appoint a suitably experienced ECoW to oversee the works and help ensure that suitable protection zones are established and adhered to during the works. Species and site-specific buffer zones, following current best practice, would be established, appropriate to the specific circumstances, under the advice of a suitably experienced ornithologist.

7.8.5. In addition to the pre-construction surveys, all works areas would be checked by a suitably experienced ecologist/ornithologist or the ECoW for the presence of any nesting birds in advance of works commencing during the main bird breeding season. Should any active nest sites be found in areas where construction works are proposed, the location of the nest would be protected from damage and disturbance.

7.8.6. All works would be monitored by a suitably experienced ecologist / ornithologist or the ECoW to help ensure that protection measures are properly implemented and maintained and that works proceed in accordance with best practice and the requirements of the legislation protecting breeding birds. The ECoW would provide a toolbox talk before any personnel start on site which will cover the issue of breeding birds, their legal protections, what to look for and what to do should breeding bird behaviour or a potential nest site be found.

Operational Monitoring & Habitat Management

Breeding Bird Surveys & Monitoring

7.8.7. A detailed breeding bird monitoring plan would be developed, focusing on the key species of concern for this assessment (i.e. black grouse, curlew, red kite), in consultation with NatureScot, at least 12 months prior to the start of construction works.

7.8.8. The monitoring plan would detail survey methods, and the reporting mechanism, for each focal species. The surveys would be completed by suitably experienced ornithologists.

7.8.9. The surveys would start (as a minimum) in the breeding season prior to works commencing and for at least the first ten years of wind farm operation (i.e., annually for the first three years, then fifth and tenth years). At which point the need for further monitoring would be reviewed. The surveys would include the Proposed Development Area and appropriate buffer zones, including the surrounding red kite breeding locations (i.e., within 2 km of the Proposed Development).

7.8.10. Annual surveys for red kite would continue for a period following the Proposed Development becoming operational. The methods and duration of the operational monitoring would be approved by DGC in in consultation with NatureScot in advance of the Proposed Development becoming operational. The operational monitoring surveys would include continuing to gather data on ranging, breeding success and productivity. The surveys would be co-ordinated with the DGRSG to avoid any unnecessary duplication and disturbance.

7.8.11. The Applicant would also consider funding (part-funding) studies to improve understanding of breeding red kite ranging behaviour in the vicinity of the proposed wind farm (e.g. focal flight activity surveys and use of satellite GPS tags). Such studies could inform other red kite protection measures that may be implemented (see below).

Bird Carcass Monitoring

7.8.12. Systematic bird carcass searches would be completed after the wind farm becomes operational. The methods and duration of this monitoring would be approved by DGC, in consultation with NatureScot, prior to the wind farm becoming operational. The carcass searches would be within a 100m radius area of each turbine and would be focused on periods of elevated activity and collision risk. The monitoring would be preceded by trails to determine values for site-specific biases that affect estimates of bird mortality, such as scavenger removal rates and search accuracy.

Breeding Red Kite Protection & Conservation

7.8.13. The potential effects of the Proposed Development on red kite, in particular, would be monitored as part of the pre- and post-construction breeding bird surveys (as outlined above).

7.8.14. It is also proposed that further measures would be implemented to reduce the risk to red kite from turbine collision. This would include the employment of a suitably experienced and independent ornithologist to manage and assist with the annual monitoring of red kite activity and carcass searches and to ensure that information collated is interpreted effectively and put to best use. This person would have the authority to implement additional red kite protection measures subject to monitoring findings. They would also assist in the monitoring for any sheep or cattle carcases within the wind arm area that might attract red kite and increase the risk of collisions occurring. All such carcases will be removed from the wind farm area and taken to an appropriate disposal site.

7.8.15. Should the red kite monitoring show evidence of collision mortality occurring at a rate greater than that predicted in this assessment then further measures would be implemented to attempt further reduce collision risk. This may include the use of carefully targeted diversionary / supplementary feeding to reduce activity near to turbines that are a hazard to red kite. There would also be consideration of targeted vegetation management, near to wind turbines (within c. 100 m), that are presenting a relatively high risk of collision to reduce small mammal prey availability.

7.8.16. Vattenfall would also explore the potential for to support red kite monitoring within the wider region, in consultation with DGRSR and RSPB.

Habitat Management Plan (HMP)

7.8.17. A HMP is proposed to address the effects of the construction and operation of the Proposed Development on sensitive habitats and to improve habitat quality for black grouse in suitable areas within Proposed Development Area and away from the influence of the wind turbines. See Chapter 6: Ecology & Biodiversity for further details. The Applicant also proposing, as alternative to on-site habitat creation and enhancement measures, an alternative option of contributing funds, equivalent to the costs of the onsite measures, to regional nature conservation and biodiversity projects. Should this alternative proposal be taken forward, it would not affect the key conclusions of the assessment as the key measures proposed to monitor and reduce impacts on from the operation of Proposed Development on species such as red kite would remain in place.

Decommissioning

7.8.18. The potential effects associated with decommissioning primarily relate to disturbance of species of conservation concern. Effects are likely to be much reduced in comparison with the construction phase. Disturbance during decommissioning works would be minimised through a similar approach to that set out above for the construction phase. Pre-decommissioning surveys for all potentially relevant species would be completed in the breeding season prior to works commencing.

7.9 RESIDUAL EFFECTS

Construction Disturbance

7.9.1. Assuming the proposed breeding bird protection measures, as set out above and in Technical Appendix 7.3, are implemented effectively impacts on breeding birds, whilst not possible to eliminate, would be minimised and there should be no significant residual effects from the construction phase of the Proposed Development for any IOF. The effects would be short-term and of no greater than Minor significance for any IOF. Table 7.20 provides a summary of the residual assessment for construction disturbance.

Table 7.20: Construction phase – residual assessment of construction disturbance

Species	Sensitivity	Effect	Significance level	Duration	Confidence
Whooper Swan	Low (Local Medium)	Negligible	Negligible	Short-term	Near certain
Greylag goose	Low (Local Medium)	Negligible	Negligible	Short-term	Near certain
Pink-footed goose	Low (Local Medium)	Negligible	Negligible	Short-term	Near certain
Black grouse	Low (Local High)	Negligible-Low	Minor	Short-term	Near certain
Osprey	Low (Local High)	Negligible	Negligible	Short-term	Near certain
Hen harrier	Low (Local High)	Negligible-Low	Minor	Short-term	Near certain
Red kite	Medium	Negligible-Low	Minor	Short-term	Near certain
Curlew	Low (Local High)	Negligible-Low	Minor	Short-term	Near certain
Common gull	Low (Local Medium)	Negligible	Negligible	Short-term	Near certain
Herring gull	Low (Local Medium)	Negligible	Negligible	Short-term	Near certain
Barn owl	Medium	Negligible-Low	Minor	Short-term	Near certain
Merlin	Low (Local High)	Negligible-Low	Minor	Short-term	Near certain
Peregrine	Low (Local High)	Negligible-Low	Minor	Short-term	Near certain

Direct Habitat Loss / Degradation

7.9.2. No significant effects from direct habitat loss or habitat degradation during construction are predicted for any IOF. Good practice construction environmental management measures, which will be detailed in the CMS/CEMP (see Chapter 3 Project Description and Chapter 6 see Chapter 8: Hydrology), will help to reduce potential effects on sensitive habitats (e.g., surface waters). The proposed PMP and HMP will also help to address blanket bog habitat loss effects and impacts on curlew and black grouse from habitat loss in the long-term. The residual effect assessment provided below for black grouse and curlew assumes that the onsite HMP proposals would be implemented in full. If the alternative off-site proposal is taken forward (i.e. funding of regional projects) the residual effect of the Proposed Development would be unchanged at Minor, and **not significant** for both species. Table 7.21 provides a summary of the residual effects assessment for direct habitat loss / degradation.

Table 7.21: Construction phase – residual assessment of habitat loss / degradation

Species	Sensitivity	Effect	Significance level	Duration	Confidence
Whooper Swan	Low (Local Medium)	Negligible	Negligible	Long-term	Near certain
Greylag goose	Low (Local Medium)	Negligible	Negligible	Long-term	Near certain

Species	Sensitivity	Effect	Significance level	Duration	Confidence
Pink-footed goose	Low (Local Medium)	Negligible	Negligible	Long-term	Near certain
Black grouse	Low (Local High)	Negligible-Low	Minor	Long-term	Near certain
Osprey	Low (Local High)	Negligible	Negligible	Long-term	Near certain
Hen harrier	Low (Local High)	Negligible-Low	Minor	Long-term	Near certain
Red kite	Medium	Low	Minor	Long-term	Near certain
Curlew	Low (Local High)	Negligible-Low	Minor	Long-term	Near certain
Common gull	Low (Local Medium)	Negligible	Negligible	Long-term	Near certain
Herring gull	Low (Local Medium)	Negligible	Negligible	Long-term	Near certain
Barn owl	Medium	Low	Minor	Long-term	Near certain
Merlin	Low (Local High)	Negligible-Low	Minor	Long-term	Near certain
Peregrine	Low (Local High)	Negligible-Low	Minor	Long-term	Near certain

Operational Collision Risk

7.9.3. No significant effects related to operational collision risk were identified for any IOF other than red kite (i.e., risk of significant effects on the regional population). The assessment concluded that there is likely to be sufficient capacity within the regional population to absorb some additional mortality from wind farm collisions but that there are uncertainties surrounding this conclusion. Therefore, measures have been proposed to ensure that this risk is minimised as much as possible and monitored in detail. Also, that there as appropriate response to monitoring findings such that additional measures to reduce collision risk are implemented. 7.22 provides confirmation of the residual assessment of collision risk for each species.

Table 7.22: Operational Phase – residual assessment of collision risk for each species.

Species	Sensitivity	Effect Level	Significance level	Duration	Confidence
Whooper Swan	Low (Local Medium)	Low	Minor	Long-term	Near certain
Greylag goose	Low (Local Medium)	Negligible	Negligible	Long-term	Near certain
Pink-footed goose	Low (Local Medium)	Negligible	Negligible	Long-term	Near certain
Black grouse	Low (Local High)	Negligible	Negligible	Long-term	Near certain
Osprey	Low (Local High)	Negligible	Negligible	Long-term	Near certain
Hen harrier	Low (Local High)	Negligible	Negligible	Long-term	Near certain
Red kite	Medium	Low	Moderate-Minor	Long-term	Probable
Curlew	Low (Local High)	Negligible	Negligible	Long-term	Near certain
Common gull	Low (Local Medium)	Negligible	Negligible	Long-term	Near certain
Herring gull	Low (Local Medium)	Negligible	Negligible	Long-term	Near certain
Barn owl	Medium	Negligible	Negligible	Long-term	Near certain
Merlin	Low (Local High)	Negligible	Negligible	Long-term	Near certain
Peregrine	Low (Local High)	Negligible	Negligible	Long-term	Near certain

Operational Displacement / Barrier Effects

7.9.4. No significant effects on any IOFs are predicted to arise because of operational displacement or barrier effects. Therefore, no specific mitigation is proposed to address these effects. However, the proposed HMP will also help to address habitat displacement effects on black grouse and breeding waders in the long-term. The residual effect assessment provided below for black grouse and curlew assumes that the onsite HMP proposals would be implemented in full. If the alternative off-site proposal is taken forward (i.e. funding of regional projects) the residual effect of the Proposed Development would be unchanged at Minor, and not Significant for both species. Table 7.23 provides confirmation of the assessment for each IOF.

Table 7.23: Operational phase – residual assessment of displacement and barrier effects

Species	Sensitivity	Effect Level	Significance level	Duration	Confidence
Whooper Swan	Low (Local Medium)	Negligible	Negligible	Long-term	Near certain
Greylag goose	Low (Local Medium)	Negligible	Negligible	Long-term	Near certain
Pink-footed goose	Low (Local Medium)	Negligible	Negligible	Long-term	Near certain
Black grouse	Low (Local High)	Negligible-Low	Minor	Long-term	Near certain
Osprey	Low (Local Medium)	Negligible	Negligible	Long-term	Near certain
Hen harrier	Low (Local High)	Negligible-Low	Minor	Long-term	Near certain
Red kite	Medium	Negligible-Low	Minor	Long-term	Near certain
Curlew	Low (Local High)	Negligible-Low	Minor	Long-term	Near certain
Common gull	Low (Local Medium)	Negligible	Negligible	Long-term	Near certain
Herring gull	Low (Local Medium)	Negligible	Negligible	Long-term	Near certain
Barn owl	Medium	Negligible-Low	Minor	Long-term	Near certain
Merlin	Low (Local High)	Negligible-Low	Minor	Long-term	Near certain
Peregrine	Low (Local High)	Negligible-Low	Minor	Long-term	Near certain

Operational maintenance activities

7.9.5. No significant effects from operational maintenance activities are predicted for any ornithological feature. No specific mitigation is proposed to address these effects. However, similar best practice measures to the construction phase would be put in place to ensure that nesting birds are protected during any maintenance works that have the potential to cause disturbance. Effects on all IOFs would be reduced to Negligible-Low and **not significant**.

Decommissioning Disturbance

7.9.6. Assuming the proposed breeding bird protection measures, as set out above, are implemented effectively prior to and during the decommissioning works potential effects on breeding birds would be minimised and there should

be no significant residual effects for any ornithological feature. Effects on all IOFs would be short-term and of no greater than Minor and **not significant**.

7.10 CUMULATIVE EFFECTS

Introduction

7.10.1. It was advised (during Scoping) by NatureScot that any cumulative assessment is carried out at the regional or NHZ scale (i.e., Western Southern Uplands & Inner Solway, NHZ 19).

7.10.2. The focus of the cumulative assessment has been to determine the potential for significant cumulative effects on the NHZ 19 red kite population resulting from wind farm collision mortality. There are no anticipated potentially significant cumulative effects on any other IOFs.

7.10.3. Cumulative impacts may be additive, antagonistic, or synergistic. While antagonistic or synergistic effects may occur, the approach adopted in this assessment is the simpler additive approach, which attempts to sum similar impacts from different developments based on the available information from published EIA documents. Whilst simple summation may not reflect biological realism for many species this is often the most practical approach and generally reduces the risk of arriving at an underestimate of the effect. Summation can, however, lead to individual errors being compounded and methodological limitations being amplified (see previous discussion on the limitations of collision risk modelling) and in some cases a correction may be needed, particularly when populations are small.

7.10.4. In this case, only the potential for significant cumulative collision mortality or displacement effects to arise have been considered in any detail. The other potential effects of the Proposed Development (e.g., habitat loss, disturbance of breeding birds during construction) are not considered to represent a realistic risk of significant cumulative impact once proposed mitigation is factored into the assessment.

Methods & Limitations

7.10.5. The order in which developments have been factored into the assessment when considering cumulative impacts is set out below:

- Developments that are already operational, and those that are consented and likely to be built should be considered first as the impacts arising from these (once mitigation has been factored in) are unavoidable; and
- Applications that have been formally submitted to a planning authority or Scottish Government but have yet to be determined, consented, and built should then be factored in. Confidential data (e.g. on Schedule 1 species) from such assessments will not necessarily be in the public domain.

7.10.6. A full list of the wind farm projects for the NHZ was collated and cross-referenced from EIARs, where available. The NatureScot onshore wind farm proposals data was used to assist in collating the latest status and locations of the wind farm projects, coupled with information gathered for this EIA Report. Sites which have been refused or withdrawn are not included.

7.10.7. Wind farm projects at the feasibility / scoping stage, where noted, have been excluded from the cumulative assessment, as they generally do not have sufficient information on potential impacts to be included. Projects which have been withdrawn or refused have also been scoped out of this assessment.

7.10.8. Small wind farm proposals (i.e. small farm-based proposals, three wind turbines or less) were excluded from further consideration unless they were close enough to the Proposed Development to potentially directly affect breeding or wintering birds within Proposed Development Area boundary. Any of the proposed developments for which no quantified impact assessment was available at the time of this assessment were also not considered further.

7.10.9. Cumulative impact assessment is limited in its predictive power by several factors but perhaps the most important one is the timescales between baseline surveys being undertaken and wind farm operational lifetimes. As can be clearly illustrated in the case of the Proposed Development, potentially significant impacts on red kite were not anticipated during the assessment of the original wind farm proposed for Quantans Hill. The baseline situation has changed markedly in the intervening c. 5-10 years. Additionally, there is often a barrier to obtaining details of operational wind farm monitoring studies which would be very useful to inform cumulative assessments, more so than pre-operational baseline surveys, which may be many years old and not reflective of the current use of Proposed Development Area by the key species of concern. The advantage of operational data is that it can also provide an insight into the effectiveness of mitigation and compensation measures that may have been implemented to reduce the impact of the wind farm.

Assessment

7.10.10. Table 7.24 provides the results of the review of available information on red kite collision risk from wind farm developments (existing and proposed) within NHZ 19 where there is published information available. This information is largely drawn from the Fell wind farm EIAR (Energiekontor UK, 2020[109]) updated to include information from more recently published assessments of proposed wind farm developments. Table 7.24 does not include those operational wind farms, or proposed wind farm developments with published assessments, within the study area where there is either no information available or no collision risk assessment was undertaken for red kite (i.e. due to a lack of flight activity recorded during baseline surveys).

Table 7.24: Collated information on red kite wind farm collision risk modelling for NHZ 19

Site	Annual Rate	35-year total
Cornharrow	0.09	3.15
Fell	0.15	5.25
Galawhistle	0.01	0.35
Glenshimmeroch	0.14	4.90
Harryburn	0.07	2.45
Mochrum Fell	0.17	5.95
Overhill Wind Farm	0.02	0.70
Quantans Hill	0.34*	11.9
Sanquhar II (Glenmanna)	0.36	12.6
Shepherds Rig	0.028	0.98
Troston Loch	0.14	4.90
Wether Hill Ext.	0.03	1.05
Windy Rig	0.01	0.35
Total	2.78	83.82

**Peak annual estimate*

[109] Available to download from the DGC Planning Portal website: https://eaccess.dumgal.gov.uk/online-applications/applicationDetails.do?activeTab=summary&keyVal=Q4VAYBGBFS200

7.10.11. Assuming all of the predicted wind farm morality acts additively on the population, the CRM results are reflective of current rates of red kite activity, no localised reduction in activity following collisions and that all schemes are operational at the same time, then the results indicate that cumulatively these wind farms could result in c. 2.78 red kite collisions per year. This is considered likely to be an over-estimate of the actual risk. This is due to the precautionary approach that has been taken with the various assumptions made with the collision risk modelling method and these assumptions are then compounded in deriving a cumulative estimate of annual mortality. However, it is also likely that for some of the older wind farm assessments the survey data on which they are based may not reflect current levels of red kite activity at those sites. Given the expansion of the population in Dumfries & Galloway over recent years some of the assessments will have under-estimated collision risk for this species.

7.10.12. As discussed within the collision risk assessment section above, the Dumfries and Galloway red kite population is expanding and appears to be in favourable condition at present. There is likely to be sufficient capacity for the population to 'absorb' some level of additional mortality including the estimated cumulative wind farm annual collisions reported here. Based on a review of detailed population modelling undertaken for the North Scotland population, following a spate of poisoning incidents (Sansom *et al.* 2016[37]), it was inferred that the Dumfries and Galloway population should also have capacity to absorb the loss of at least two to three birds from wind farm collisions. In the absence of detailed population viability modelling being undertaken for the Dumfries and Galloway population this is considered to be a reasonable conclusion, based on current available evidence. It is also relevant to note that comparable potential rates of annual wind turbine mortality affecting red kites that are part of the Central Scotland population do not appear to have been an important constraint on the that population, which expanded during and following periods of documented wind farm mortality (see Duffy & Urquhart 2014[69]) and is currently considered to be stable (Challis *et al.* 2022[72]).

7.10.13. Based on the available evidence, on balance, cumulative operational collision mortality effects on red kite are considered to be Low-Medium, resulting in a significance level of Moderate in the long-term, which is **not significant** in the context of the regional population.

7.11 CONCLUSION

7.11.1 This Chapter assessed the likely effects on IOFs predicted to arise from the Proposed Development, in order to identify any likely significant effects. Following consideration of a range of best practice and mitigation measures for the construction, operational and decommissioning phases of the development, the residual (mitigated) effects for all IOFs would be not greater than minor-moderate and would not be significant in terms of the EIA Regulations.

7.11.2 The baseline description of the bird fauna present within the Proposed Development Area, and the surrounding zone of potential effect, has been derived from desk study and field surveys completed between April 2018 and March 2021 (inclusive). Surveys were carried out across the wind farm site and the wider survey area in order to assess the distribution of wintering, migratory and breeding bird species of conservation concern, as well as the potential sensitivity to wind farm development. The species present can be grouped broadly into raptors and owls, waders, wintering/passage geese and black grouse.

7.11.3 Within these groups there are several species periodically using the Site that merit special attention due to their European or national conservation status as a species, and/or for their potential sensitivity to wind farm development. Recognition of their conservation status is through listing on either Annex I of the EU Birds Directive, and/or Schedule 1 of the Wildlife and Countryside Act. Annex I and/or Schedule 1 species that occasionally hunt or pass through the Proposed Development Area. The Proposed Development Area is considered to be of regional importance to red kite and barn owl and of sub-regional importance for black grouse. There was little evidence of regular movement by migratory geese and swan species across the Proposed Development Area, only occasional flight activity at collision risk height was observed during passage periods.

7.11.4 This assessment has considered the various potential impacts arising from the construction, operation and decommissioning of the proposed wind farm, and evaluated the significance of these impacts on the identified key species of interest in the context of their conservation value, sensitivity to wind farm development and the scale of the potential effects.

7.11.5 During construction of the wind farm, adverse effects on birds may arise from loss of habitat and from disturbance associated with construction activities. No significant habitat loss is predicted for any species, taking into consideration the scale of the proposal and the extent of direct habitat loss in comparison to the abundance of similar habitats unaffected in the wider area. Disturbance effects will be mitigated through careful management of construction works and through pre-construction surveys, to avoid disturbance to birds during the breeding season.

7.11.6 During wind farm operation, impacts may arise from collision with turbines and other structures resulting in injury or death, displacement/disturbance from areas where turbines are operating and disturbance by maintenance activities and pedestrian access via newly created site roads.

7.11.7 Collision risk has been assessed using data systematically gathered during flight activity surveys and a standard model used in wind farm EIA. Due to the low levels of fight activity for most species considered in the assessment the effect of wind turbine collision is not considered to be significant at the regional population scale. The modelled collision risk for red kite is comparatively high, reflecting the levels of activity recorded during the baseline surveys and the relatively high susceptibility of this species to wind turbine strike risk. However, due to the favourable conservation status of the red kite population in Dumfries and Galloway the predicted losses are not anticipated to result in significant adverse effects on this regional population. Measures are proposed to monitor red kite during the operation of the wind farm and where appropriate take further measures to ensure that the predicted effects are not exceeded.

7.11.8 The operation of the wind farm could result in impacts through displacement and/or disturbance of breeding birds, potentially reducing breeding success and/or feeding opportunities. There is also the potential for the presence of the wind farm to result in displacement of non-breeding birds, or birds breeding in the wider area (e.g. geese, hen harrier). No significant residual impacts from the operation of the wind farm are predicted in this assessment.

7.11.9 A habitat management plan is proposed to be developed and implemented to improve the quality of blanket bog and heath vegetation within the Site (in locations separated from the proposed wind turbines) and to establish native woodland along corridors adjacent to the main watercourses. These measures are primarily proposed to offset the effects of the construction of the proposed wind farm on sensitive habitats of conservation importance but would also increase habitat quality and extent for black grouse, and breeding moorland waders, helping to address the potential long-term effects from the operation of the Proposed Development on these IOFs. An alternative funded option for broader regional habitat management, equivalent in financial cost to the onsite habitat enhancement and creation measures, is proposed which would contribute to habitat and biodiversity improvements at a regional level.

7.11.10 The residual impacts on all species of decommissioning the wind farm are considered to be broadly similar to those during construction and are not more than Minor for all species and not significant.

7.11.11 The potential for cumulative impacts on red kite, as a result of interactions with the Proposed Development and existing/proposed wind farms in the wider region, has also been considered in this assessment. Based on the available information obtained from the published impact assessments of these proposals and taking into consideration the current favourable conservation status of the regional population, no significant cumulative impacts are indicated.

7.11.12 Finally, the assessment has concluded that the Proposed Development would not result in any material adverse effect on any bird populations associated with SPAs in the region or adversely affect, directly or indirectly, any other statutory or non-statutory site designated for its ornithological importance.

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Chapter 8.

Hydrology, Geology and Hydrogeology

Contents

Glossary

Term	Definition
Abstraction	The process of and location of the removal or diversion of water from the natural water environment, by a variety of means including pumps, pipes, boreholes and wells.
Aquifer	A geological formation, group of formations or part of a formation that can store and transmit water in significant quantities.
Acrotelm	The acrotelm is one of two distinct layers in undisturbed peat bogs. It overlies the catotelm.
Baseflow	The component of the river flow that is derived from groundwater sources rather than surface run-off. The Base Flow Index (BFI) value provided by the Flood Estimation Handbook (FEH) is a measure of the proportion of a catchments long-term runoff that derives from stored sources.
Base enrichment	Refers to the interactions of water with bedrock / granular sediments and consequential dissolution of constituent anions and cations. The water may emerge as a spring at outcrop or diffusely beneath the soil and will provide plant communities with nutrients that would not be available from rainfall alone.
Buffer area	An area which protects the receptor such as watercourses from pollutants and sediment from the adjacent land.
Catotelm	The lower, water-saturated zone of a mire/peat bog.
Environmental Impact Assessment	Environmental Impact Assessment (EIA) is a means of carrying out, in a systematic way, an assessment of the likely significant environmental affects arising from a proposed development
Environmental Impact Assessment Report	A document reporting the findings of the EIA and produced in accordance with the EIA Regulations
Groundwater	Water located beneath the ground surface in soil pore spaces and in the fractures of rock formations.
Headwaters	A tributary stream of a river close to or forming part of its source. Normally wet flushes, bogs or springs at the head of first-order streams.
Hydrological regime	The statistical pattern of a river's constantly varying flow rate.
Hydromorphology	Term used in river basin management to describe the hydrological and geomorphological processes and attributes of rivers, lakes, estuaries and coastal waters.
Inhomogeneous	Not uniform in character.
Interfluve	An area of a catchment boundary that is poorly distinguished on account of subdued or complex topography / micro-topography
Overland flow	Water passing rapidly over or through the surface layer of soil.
Peak flow	The maximum flow recorded during a high flow event.
Pour Point	The catchment pour point is the contributing area is normally defined as the total area contributing water flow to a given outlet.
Peat	A largely organic substrate formed of partially decomposed plant material.
Precipitation	Deposition of moisture including dew, hail, rain, sleet and snow.
Private water supply	Any water supply which is not provided by a water company and is not connected to mains supply. Most private water supplies are situated in more remote, rural parts of the country and may just serve one property or several properties through a network of pipes.
Proposed Development Area	The area within which the Proposed Development will be located
Return period	Is a measure of the rarity of an event: the longer the return period, the rarer the event.
Riparian zone	Land immediately adjoining the aquatic zone of a watercourse and influenced by it.
Runoff	Surface runoff is the flow of water over the surface that can result due to the surrounding soils lacking the capacity to infiltrate further water or due to the surface water flowing off infrastructure such as access tracks and hardstandings.
Sedimentation	The tendency for particles in suspension to settle out of the fluid in which they are entrained.
Standard Percentage Runoff	The percentage of rainfall that is likely to contribute to runoff. For example, an SPR value of 50 % would suggest that half of the rainfall during an event will contribute to runoff.
Surface water catchment	The area from which runoff would naturally discharge to a defined point of a river.
Topography	The physical features of a geographical area
Water resources	The supply of groundwater and surface water in a given area

List of Abbreviations

Abbreviation	Description
AEP	Annual Exceedance Probability
AOD	Above Ordnance Datum
BFI	Base Flow Index
BGS	British Geological Society
CAR	Water Environment (Controlled Activities) (Scotland) Regulations 2011
CC	Climate Change
CEMP	Construction Environmental Management Plan
CIRIA	Construction Industry Research and Information Association
DGC	Dumfries and Galloway Council
DTM	Digital Terrain Model
DWPA	Drinking Water Protected Area
ECoW	Environmental Clerk of Works
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
FEH	Flood Estimation Handbook
FRA	Flood Risk Appraisal
GIS	Geographical Information System
GWDTE	Groundwater Dependent Terrestrial Ecosystems
HMP	Habitat Management Plan
IN	Infrastructure
IoH	Institute of Hydrology
JHI	James Hutton Institute
MSS	Marine Scotland Science
NE	Natural Environment
NFM	Natural Flood Management
NS	NatureScot (formerly Scottish Natural Heritage)
PAN	Planning Advice Notes
PMP	Peat Management Plan
PPG	Pollution Prevention Guidelines
PPP	Pollution Prevention Plan
PPIP	Pollution Prevention & Incident Plan
PWS	Private Water Supply
PWSRA	Private Water Supply Risk Assessment
QMED	Median flood flow
QBAR	Mean Annual Flood Flow
RBMP	River Basin Management Plans
SAAR	Standard Average Annual Rainfall
SAC	Special Area of Conservation
SEPA	Scottish Environment Protection Agency
SIFSS	Soil Information for Scottish Soils
SPA	Special Protection Areas
SPP	Scottish Planning Policy
SPR	Standard Percentage Runoff
SSSI	Site of Special Scientific Interest
SuDS	Sustainable Drainage Systems
SW	Scottish Water
TWI	Topographic Wetness Index
WFD	Water Framework Directive

8.1. Introduction

8.1.1. This chapter of the Environmental Impact Assessment Report (EIAR) assesses the impacts on the hydrological, geological and hydrogeological environment at Quantans Hill Wind Farm, the "Proposed Development", and the likely significant environmental effects resulting from the construction and operation of the proposed turbines and associated infrastructure.

8.1.2. The assessment is also supported by the following technical appendices (TA):

- Technical Appendix 8.1: Water Crossing Assessment;
- Technical Appendix 8.2: Peat Stability Risk Assessment;
- Technical Appendix 8.3: Peat Management Plan;
- Technical Appendix 8.4: Private Water Supply Risk Assessment;
- Technical Appendix 8.5: Flood Risk Appraisal;
- Technical Appendix 8.6: Pollution Prevention and Incident Plan; and
- Technical Appendix 8.7: Borrow Pit Assessment.

8.1.3. The assessment is supported by the following figures:

- Figure 8.1: Hydrology Overview;
- Figure 8.2: Bedrock Geology;
- Figure 8.3: Superficial Geology;
- Figure 8.4: Carbon Soils;
- Figure 8.5: Predominant Soils;
- Figure 8.6: Peat Depth Interpolation;
- Figure 8.7: Topographic Wetness Index; and
- Figure 8.8: Flow Accumulation.

8.2. Legislation and Policy content

Policy Content

8.2.1. The assessment takes account of the requirements of the Water Framework Directive (2000/60/EC) (WFD). The WFD aims to protect and enhance the quality of surface freshwater (including lakes, rivers and streams), groundwater, groundwater dependent terrestrial ecosystems (GWDTE), estuaries and coastal waters.

8.2.2. The key objectives of the WFD relevant to this assessment are:

- To prevent deterioration and enhance aquatic ecosystems; and
- To establish a framework of protection of surface freshwater and groundwater.

8.2.3. The WFD resulted in The Water Environment and Water Services (Scotland) Act 2003, which gave Scottish Ministers powers to introduce regulatory controls over water activities in order to protect, improve and promote sustainable use of Scotland's water environment. These regulatory controls, in the form of The Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended) or CAR, made it an offence to undertake the following activities without a regulatory authorisation:

- Discharges to all wetlands, surface waters and groundwaters;
- Disposal to land;
- Abstractions from all wetlands, surface waters and groundwaters;
- Impoundments (dams and weirs) of rivers, lochs, wetlands and transitional waters; and
- Engineering works in inland waters and wetlands.

8.2.4. Under the Water Environment (Miscellaneous) (Scotland) Regulations 2017 amendments were made to CAR and the Proposed Development will require a construction site licence for water management across the entirety of the Proposed Development site prior to any construction works taking place, including enabling works. A Pollution Prevention Plan (PPP) would be prepared in support of any licensing requirements.

8.2.5. In addition to the national and regional policies presented in Chapter 4, the assessment takes account of the following hydrology specific legislation and policy:

- The Water Environment and Water Services (Scotland) Act 2003;
- The Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended);
- The Water Environment (Miscellaneous) (Scotland) Regulations 2017;
- Flood Risk Management (Scotland) Act 2009;
- The Water Supply (Water Quality) (Scotland) Regulations 2001;
- The Public Water Supplies (Scotland) Regulations 2014;
- Private Water Supplies (Scotland) Regulations 2006;
- The Water Intended for Human Consumption (Private Supplies) (Scotland) Regulations 2017;
- Part IIA of the Environment Protection Act 1990;
- Waste Management Licensing (Scotland) amendment Regulations 2016;
- Pollution Prevention and Control (Scotland) Regulations 2012;
- SEPA Technical Flood Risk Guidance for Stakeholders – Version 12, May 2019. SS-NFR-P-002;
- SEPA Land Protection. Reference EP054;
- SEPA Policy No. 19 Groundwater Protection Policy for Scotland;
- SEPA Policy No. 41 Development at Risk of Flooding: Advice and Consultation; and
- SEPA Policy No. 61 Control of Priority & Dangerous Substances & Specific Pollutants in the Water Environment.

8.2.6. In addition to the above national legislation and policy, the design and assessment presented herein has taken cognisance of the Scottish Water List of Precautions for Drinking Water Assets – Wind Farms EdC (Scottish Water, 2019).

Other Guidance and Good Practice

8.2.7. Table 8.1 below lists other key guidance and good practice documentation which have been considered as part of this assessment.

Table 8.1: Guidance and good practice

Topic	Source of Information
Scottish Government Planning Advice Notes (PANs)	• PAN 50: Controlling the Environmental Effects of Surface Mineral Workings; • PAN 51: Planning (revised 2006), Environmental Protection and Regulation; • PAN 1/2013: Environmental Impact Assessment; • PAN 61: Planning and Sustainable Urban Drainage Systems; • PAN 69 Flood Risk; and • PAN 79: Water and Drainage.
SEPA Guidance for Pollution Prevention (GPPs) and Pollution Prevention Guidelines (PPGs)	• PPG 1: Understanding your Environmental Responsibilities - Good Environmental Practices; • GPP 2: Above Ground Oil Storage Tanks; • GPP 4: Treatment and Disposal of Wastewater Where there is no Connection to the Public Foul Sewer; • GPP 5: Works and Maintenance in or Near Water; • PPG 6: Working at Construction and Demolition Sites; • PPG 7: Safe Storage - The Safe Operation of Refuelling Facilities; • GPP 8: Safe Storage and Disposal of Used Oils; • GPP 13: Vehicle Washing and Cleaning; • GPP 21: Pollution Incident Response Planning; • GPP 22: Dealing with Spills; and • GPP 26: Safe Storage - Drums and Intermediate Bulk Containers.
SEPA Position Statements (Published)	• WAT-PS-06-02: SEPA (2015), Culverting of Watercourses, Version 2; • WAT-PS-07-02: SEPA (2012), Bank Protection, Version 2; • WAT-SG- 78: SEPA (2012), Sediment Management Authorisation, Version 1; • WAT-SG-23: SEPA (2008), Engineering in the Water Environment, Good Practice Guide - Bank Protection Rivers and Lochs, Version 1; • WAT-SG-25: SEPA (2010), Engineering in the Water Environment, Good Practice Guide, Construction of River Crossings, Version 2; • WAT-SG-26: SEPA (2010), Engineering in the Water Environment, Good Practice Guide, Sediment Management, Version 1; • WAT-SG-75: SEPA (2011), Water Run-Off from Construction Sites September 2021; and • WAT-SG-31: SEPA, (2006) Special Requirements for Civil Engineering Contracts for the Prevention of Pollution, Version 2.
Construction Industry Research and Information Association (CIRIA)	• CIRIA C692 Environmental Good Practice on Site (third edition); • CIRIA C753 SuDS Manual (2015); • CIRIA C532 Control of Water Pollution from Construction Sites; • CIRIA C648 Control of Water Pollution from Linear Construction Projects; and • CIRIA C689 Culvert Design and Operation Guide.
Other Guidelines	• SNH and Scottish Renewables Joint Publication, (2019) Good Practice During Wind Farm Construction Version 4; • FCE, SNH, (2010), Floating Roads on Peat; • Scottish Renewables, Joint Publication (2012), Development of Peatland: Guidance on the Assessment of Peat Volumes, Reuse of Excavated Peat and the Minimization of Waste; • SEPA, The Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended), A Practical Guide, Version 9.1, March 2022; • Scottish Government, Scottish Natural Heritage, SEPA (2017) Peatland Survey Guidance on Developments on Peatland, on-line version only; • River Crossings and Migratory Fish: Design Guidance, A Consultation Paper, The Scottish Executive; • SEPA Land Use Planning Guidance CC1 (LUPS-CC1) (2019). Climate change allowances for flood risk assessment in land use planning. Issue 1. • SEPA Land Use Planning Guidance Note 4 (2017): Planning Guidance on On-Shore Windfarm Developments, Version 9; • SEPA Land Use Planning Guidance Note 31 (2017): Guidance on Assessing the Impacts of Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems, Version 3; and • SNIFFER. 2009. WFD95 A Functional Typology for Scotland.

8.3. Scoping and consultation

8.3.1. The scoping and consultation responses relating to the hydrological, geological and hydrogeological environment are summarised in Table 8.2 below.

Table 8.2: Consultation responses relating to hydrology, geology and hydrogeology

Organisation	Relevant response	Comments
The Galloway Fisheries Trust (GFT)	GFT provided specific comment on the scoping application: *We consider the proposed development area as being sensitive with regards to fish populations. …many of these water courses will require upgrading or new water course*	• The baseline hydrology of the Proposed Development is presented within Section 8.5. • The potential impacts are outlined in Section 8.8, with pollution prevention and mitigation in Section 8.7.

Organisation	Relevant response	Comments
	crossing points constructed. These watercourses could all support important trout populations which could be impacted by the proposed development and should be considered fully in the EIA. *Details of infrastructure positions in relation to watercourses and watercourse crossing details should be provided.*	• Aquatic ecology and fish habitat information and assessment of effects is presented in Chapter 7: Ecology. • Technical Appendix (TA) 8.1: Water Crossing Assessment presents information of proposed crossing locations and outlined the approach to design.
Marine Scotland Science (MSS)	MSS provided a copy of their Standing Advice for Onshore Wind Farm Development; *In addition to identifying the main watercourses and waterbodies within and downstream of the proposed development area, developers should identify and consider, at this early stage, any areas of Special Areas of Conservation where fish are a qualifying feature and proposed felling operations particularly in acid sensitive areas.*	• Details of the main watercourses and associated sensitivities are identified in Section 8.5. These are presented illustratively within Figure 8.1: Hydrology Overview. • TA 8.6 Pollution Prevention and Incident Plan (PPIP) presents high level monitoring considerations for pre-construction and construction phase quality monitoring for the Proposed Development Area.
Scottish Water (SW)	The Scottish Water response highlighted; *The presence of a Scottish Water asset within the proposed development boundary.* *That the proposed development also overlaps with the Benloch Burn drinking water protected area.* *Scottish Water have produced a list of precautions for a range of activities. This details protection measures to be taken within a DWPA, the wider drinking water catchment and if there are assets in the area*	• Embedded mitigation is presented in Section 8.7 and presents additional measures and control employed during the design to accommodate for provisions in the referenced precautions document. • Design evolution demonstrating how infrastructure has been minimised in the Benloch Burn DWPA is presented in Chapter 2: Design Evolution of the EAIR. • TA 8.6: PPIP has also been prepared to present details on mitigation proposals for the Benloch Burn DWPA.
Scottish Environment Protection Agency (SEPA)	The following information was requested; • *Map and assessment of all engineering activities in or impacting on the water environment.* • *Map and assessment of impacts upon Groundwater Dependent Terrestrial Ecosystems and buffers.* • *Map and assessment of impacts upon groundwater abstractions and buffers.* • *Peat depth survey and table detailing volumetric re-use proposals.* • *Map and table detailing forest removal.* • *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 water abstractions including details of the proposed operating regime.* • *Decommissioning statement.*	• Figure 8.1: Hydrology Overview identified hydrological receptors within the Proposed Development Area. Details discussed in this chapter and supporting appendices. • A GWDTE assessment and accompanying map is presented in Chapter 7: Ecology • Private Water Supplies are assessed in TA 8.4: PWSRA. • Peat depths are presented in Figure 8.6: Peat Depth Interpolation. Management details in TA 8.2 (PSRA) and TA 8.3 (PMP). • Forestry information is presented in Chapter 12: Forestry. • Details of mitigation are presented within Section 8.7. • Details of Borrow Pits are presented in TA 8.7: Borrow Pit Assessment • A decommissioning statement is presented with Chapter 3.

8.3.2. In addition to the statutory consultation response details outlined in Table 8.2, additional discussions were undertaken with several stakeholders regarding the approach to the EIAR for specific elements, or the acceptability of proposed mitigation:

- Scottish Water;
  - Regular consultation with Scottish Water was undertaken concerning the evolving design of the proposed infrastructure within the Benloch Burn Drinking Water Protected Area (DWPA);
  - Scottish Water provided initial review of Technical Appendix 8.6: Pollution Prevention and Incident Plan (PPIP) to ensure its acceptability prior to submission in the EIA.
- SEPA;
  - Confirmation was sought to clarify the use of dynamic buffer distances owning to the abundance of artificial drainage ditches mapped by the Ordnance Survey as watercourses (See Section 8.7);
  - Confirmation on the approach adopted to assess flood risk to downstream receptors, notably Carsphairn. See Technical Appendix 8.5: Flood Risk Appraisal;

  - Clarification was sought to confirm that licensing and associated hydraulic assessment modelling for proposed single span crossings situated partially within the 0.5% AEP (1 in 200 year) flood inundation envelope within the Benloch Burn and Marbrack Burn could be submitted post consent.
- Dumfries & Galloway Council Environmental Health Team;
  - Discussion on the acceptability of the provision of a permanent alternative supply for the Knockgray and Knockgray Farm Private Water Supply (PWS) sources. Included a review of the Water Supply Feasibility Report provided as an appendix to Technical Appendix 8.4: PWSRA.

8.4. Assessment methodology and significance criteria

Effects to be Assessed

8.4.1. The greatest risk of the Proposed Development affecting the hydrological, geological and hydrogeological environment will occur during the construction phase, with effects reduced during the operational and decommissioning phase. Taking this into account the following issues will be addressed during all phases of development of the Proposed Development:

- Changes to existing drainage patterns;
- Effects on baseflow;
- Effects on run-off rates;
- Effects on erosion and sedimentation;
- Effects on groundwater levels;
- Effects on water resources;
- Effects on impediments to flow;
- On-site and downstream flood risk;
- Pollution risk;
- Effects on local geology;
- Effects on hydrological integrity of peat bodies; and
- Effects on groundwater and surface water quality.

Methodology

Overview

8.4.2. The assessment has involved the following:

- Detailed desk studies and site visits to establish baseline conditions of the area;
- Evaluation of the likely significant environmental effects of the Proposed Development and the impacts that these could have on the current site conditions;
- Identification of embedded good practice mitigation measures to avoid and mitigate against any identified adverse effects resulting from the Proposed Development;
- Evaluation of the likely significant environmental effects with consideration of the potential embedded mitigation measures, taking account of the sensitivity of the baseline features, the potential magnitude of these effects and the probability of these effects occurring; and
- The residual significance of the environmental effects following the consideration of additional mitigation measures.

Baseline Assessment

8.4.3. A desktop survey to establish the baseline conditions was undertaken in order to:

- Describe surface water hydrology, including watercourses, springs and waterbodies;
- Identify existing catchment pressures (e.g. point source and diffuse pollution issues);
- Identify all private drinking water abstractions and public water supplies within 3 km of the Proposed Development;
- Identify all flooding risks;
- Describe the hydromorphological conditions of watercourses;
- Collect information relating to recreational and fisheries resources;
- Collate hydrological flow and flooding data for the immediate area and main downstream watercourses;
- Collect soil, geological and hydrogeological information;
- Confirm surface water catchment areas and watersheds; and
- Confirm the extent and nature of peat deposits across the site of the Proposed Development.

8.4.4. Published information sources consulted for baseline information are outlined in Table 8.3 below.

Table 8.3: Baseline Information Sources

Topic	Source of Information
Topography	5m contour data derived from Digital Terrain Model (DTM) data and Ordnance Survey (OS) mapping
Designated Nature and Conservation Sites	NatureScot, https://map.environment.gov.scot/sewebmap/
Solid and Superficial Geology	BGS Geology of Britain Viewer, http://mapapps.bgs.ac.uk/geologyofbritain3d/index.html
Soils and Peat	James Hutton Institute (JHI), Soil Information for Scottish Soils (SIFSS), http://sifss.hutton.ac.uk/ Scotland's Soils Interactive Map, Carbon and Peatland 2016 and National Soil Map of Scotland, http://soils.environment.gov.scot/
Climate	Met Office, https://www.metoffice.gov.uk/public/weather/climate/gcv3mcrf9 Flood Estimation Handbook (FEH): FEH Web Service, https://fehweb.ceh.ac.uk/
Surface Water Hydrology	1:10,000, 1:25,000 & 1:50,000 OS Raster Data Flood Estimation Handbook (FEH): FEH Web Service, https://fehweb.ceh.ac.uk/

Topic	Source of Information
	Flood Modeller Suite, https://www.floodmodeller.com/
Flooding	Indicative River and Coastal Flood Map (SEPA) http://map.sepa.org.uk/floodmap/map.htm
Water Quality	SEPA, River Basin Management Plans, Web Mapping Application, https://www.sepa.org.uk/data-visualisation/water-classification-hub/
Water Resources	Private water supply (PWS) information provided by Dumfries and Galloway Council (D&GC). Responses to PWS questionnaires sent to local residents included on the PWS database provided by the Council.
Hydrogeology	Scotland's Environment Web Interactive Map, https://map.environment.gov.scot/sewebmap/ BGS Geology of Britain Viewer, http://mapapps.bgs.ac.uk/geologyofbritain3d/index.html SEPA, River Basin Management Plans, Web Mapping Application, http://gis.sepa.org.uk/rbmp/

Effects Evaluation

8.4.5. The likely significant environmental effects of the Proposed Development have been defined by taking account of two main factors; the sensitivity of the receiving environment and the potential magnitude should that effect occur. The sensitivity of the receiving environment i.e. its baseline quality as well as its ability to absorb the effect without perceptible change is defined in Table 8.4 below.

Table 8.4: Definition of Sensitivity of the Receiving Environment

Sensitivity	Definition
High	**National importance**. Receptor with a high quality and rarity, local scale and limited potential for substitution/replacement or receptor with a medium quality and rarity, regional or national scale and limited potential for substitution / replacement.
Medium	**Regional importance**. Receptor with a medium quality and rarity, local scale and limited potential for substitution/replacement or receptor with a low quality and rarity, regional or national scale and limited potential for substitution / replacement.
Low	**Local importance**. Receptor with a low quality and rarity, local scale. Environmental equilibrium is stable and is resilient to changes that are greater than natural fluctuations, without detriment to its present character.

8.4.6. The magnitude of impact includes the timing, scale, size and duration of the likely significant environmental effects. For the purposes of this assessment the magnitude of impact criteria is defined in Table 8.5 below.

Table 8.5: Magnitude of Impact

Magnitude	Criteria	Definition
High	**Total loss** of or major/substantial alteration to key elements/features of the baseline (pre-development) conditions such that the post development character/composition/attributes will be fundamentally changed.	Fundamental (long term or permanent) changes to geology, hydrology, water quality and hydrogeology.
Medium	**Loss or alteration** to one or more key elements/features of the baseline conditions such that post development character/composition/attributes of the baseline will be materially changed.	Material but non-fundamental and short to medium term changes to the geology, hydrology, water quality and hydrogeology.
Low	**A minor shift** away from baseline conditions. Change arising from the loss/alteration will be discernible/detectable but not material. The underlying character/composition/attributes of the baseline condition will be similar to the pre-development circumstances/situation.	Detectable but non-material and transitory changes to the geology, hydrology, water quality and hydrogeology.
Negligible	**Very little change** from baseline conditions. Change barely distinguishable, approximating to a 'no change' situation.	No perceptible changes to the geology, hydrology, water quality and hydrogeology.

8.4.7. Assuming the successful implementation of industry good practice and design mitigation measures the sensitivity of the receiving environment, together with the magnitude of the effect, defines the significance of the effect as outlined in Table 8.6 below.

Table 8.6: Assessment matrix for determining likely significant effects

	Sensitivity		
Magnitude	**High**	**Medium**	**Low**
High	Major	Moderate/Major	Minor/Moderate
Medium	Moderate/Major	Moderate	Minor
Low	Moderate	Minor	Negligible/Minor
Negligible	Negligible	Negligible	Negligible

8.4.8. Potential effects are therefore concluded to be Major, Moderate, Minor or Negligible. Effects considered as being Major or Moderate/Major are considered to be **significant** for the purposes of the EIA.

8.5. Baseline conditions

Site Area

8.5.1. The Proposed Development is located in the Dumfries & Galloway local authority area in the southern uplands of Scotland.

8.5.2. The hydrological study area is larger in extent than the actual Proposed Development Area and includes the upper and lower reaches of watercourse catchments that are present within the Proposed Development Area. The extent of the catchments is shown in Figure 8.1 which outlines the extent of the study area. Designated sites and relevant developments are considered from the perspective of assessing any potential hydrological linkages or cumulative effects.

Field Survey & Techniques

8.5.3. Hydrology walkover surveys and peat surveys were undertaken by Natural Power at the Proposed Development as part of the submission of this EIAR. The hydrology surveys comprised a walkover survey, undertaken on foot by a hydrologist, where watercourses and other hydrological features were inspected in terms of their morphology and morphometry. Peat surveys include the collection of thickness values by advancing “peat probes” through to the underlying substrate. In addition to these, peat cores collected by a hand auger were also undertaken at strategic locations along with hand shear vanes. More information of peat surveys are presented in Technical Appendix 8.2: Peat Stability Risk Assessment and Technical Appendix 8.3: Peat Management Plan.

8.5.4. The phase 1 peat depth survey and an initial hydrological walkover was undertaken in October 2020. Weather conditions were heavy rainfall.

8.5.5. The phase 2 peat survey and more detailed hydrological surveys were undertaken in April, June, July and August 2021. Weather conditions were predominately dry and bright throughout but did follow rainfall on some occasions.

8.5.6. An additional phase 2 survey was undertaken in May 2022 to collect data at the proposed Substation. Weather conditions were predominantly dry with sporadic light showers.

Context

8.5.7. This subsection presents the information gathered on the existing (baseline) topographical, hydrological, geological and hydrogeological (including peat) conditions within the Proposed Development Area.

Climate

8.5.8. The standard average annual rainfall (SAAR) for the Proposed Development has been derived from the FEH Web Service as ranging from 1563 mm to 1808 mm based on the Proposed Development catchments. To put this into context, rainfall in Scotland varies from under 800 mm per year on mainland eastern Scotland in areas such as Fife, to over 3000 mm on the mainland Western Highlands.

8.5.9. The Met Office 1981-2010 annual rainfall total from the Eskdalemuir climate station is 1,742 mm with 187.4 days of rainfall greater than 1 mm recorded. This climate station is located approximately 70 km east of the Proposed Development at an elevation of 242 m AOD. According to the 1981-2010 average for Eskdalemuir climate station, the highest rainfall totals are recorded during the winter months from October through to January as shown in Chart 8.1. Given the station’s distance from and lower elevation than the Proposed Development, average rainfall is likely to differ, however, rainfall patterns will be similar.

Source: Met Office

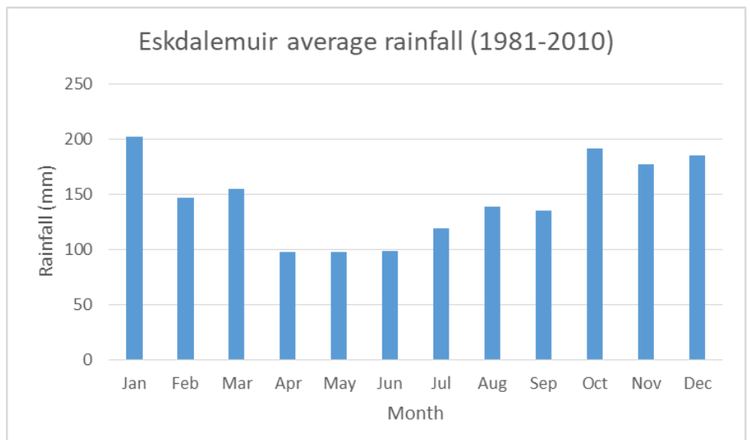

Chart 8.1: Average monthly rainfall data for climate period 1981-2010 for Eskdalemuir Climate Station

Designated Sites

8.5.10. There are no international, national or regionally designated areas relating specifically to hydrological receptors within the Proposed Development Area or within 3 km of the Proposed Development.

Surface Water Hydrology

8.5.11. Hydrologically the Proposed Development lies within the Water of Deugh catchment. This catchment is discussed in detail in the following paragraphs, and is accompanied by the following figures:

- Figure 8.1: Hydrology Overview;
- Figure 8.7 Topographic wetness index (TWI); and
- Figure 8.8: Flow Accumulation.

8.5.12. The Proposed Development Area is located within the catchment of the Water of Deugh. The Water of Deugh originates approximately 7.6 km to the north east of the site centre from the Windy Standard (698 m AOD) hill and is fed by a network of burns and streams. The Water of Deugh is approximately 35 km long, and flows south west from Windy Standard passing Carsphairn before draining into Kendoon Loch (National Grid Reference (NGR) NX 60702 90812) 2.5km to the south west of the south western site boundary. The Kendoon Loch continues to flow south, feeding into the River Dee approximately 45 km south of the site boundary (NGR NX 73247 64792). The River Dee drains into the Irish Sea at Kirkcudbright Bay (NGR NX 66617 46197) approximately 56 km to the south of the proposed site boundary.

8.5.13. The watercourses which drain the majority of the Proposed Development Area are tributary channels of the Water of Deugh. The watercourses on the site are typical upland watercourses, situated in saturated ground with heavily vegetated riparian zones. Bed material encountered during the site survey ranged from watercourses with peat and vegetation to beds of cobbles and small boulders (<0.5 m in diameter). Many of the channels supplying the main watercourses are artificial ditches and are highest in density where topography is more subdued.

8.5.14. Watercourses or their tributary catchments within the Proposed Development Area, all of which are sub-catchments to the Water of Deugh, are the Knockgray Burn, Benloch Burn, Marbrack Burn, Polhay Burn, Furmiston Lane and unnamed tributary burns.

8.5.15. The Benloch Burn is designated as a Drinking Water Protection Area (DWPA) under The Water Environment (Drinking Water Protected Areas) (Scotland) Order 2013 and is used as a potable water supply, operated by Scottish Water. Further details on each catchment are presented below.

Knockgray Burn

8.5.16. Knockgray Burn is fed by several natural drainage channels which is crossed by the proposed access track at NGR NX 57835 94364 before forming the main channel within the site boundary at NGR NX 58037 94100. The watercourse then runs from the north east to the south west and is joined by Bent's Burn at NGR NX 57681 93100 before draining into the Water of Deugh at NGR NX 57652 92799. Photographs of the burn are shown below (Photograph 8.1 & 8.2).

8.5.17. The Headwaters of the Knockgray Burn are situated within a small bowl shaped valley which flattens out further down the course of the burn. The banks are peaty and heavily vegetated, becoming saturated in places where the water table is at or near the ground surface. The channel depth varies between 0.3 m to 0.4 m and the channel width ranges between 0.2 m and 0.3 m. The burn has low flow at a slow speed over peaty clay bed material. The Knockgray burn is fed by several burns which have low flow within vegetated channels, such as Bent's Burn.

Source: Natural Power

Photograph 8.1 & 8.2: Photograph of the Knockgray Burn (left). In the upper catchment most of the tributaries were from artificial drainage ditches

Benloch Burn

8.5.18. The Benloch Burn originates 2 km to the north of the site boundary within a hanging valley between the peaks of Black Shoulder (688 m) and Beninner (710 m). The riparian ravine valley, which boards the channel is approximately 15 m high and 20 m to 25 m wide and the watercourse ranges between 5 m to 7 m in width and 0.2 m to 0.3 m in depth. The watercourse meanders widely and the channel is incised with evidence of bank instability. There is good flow in the burn over pools and riffles and large areas of deposition in the form of gravel bars. Bed material ranges from cobbles to large boulders around 0.7 m in diameter. The Benloch Burn drains into the Water of Deugh, approximately 1.5 km north of Carsphairn. Photographs of the burn are shown below (Figure 8.3 & 8.4).

8.5.19. On the northern side of the catchment there are artificial moorland drainage channels, spaced regularly at 10 m intervals. The drainage channels run from the north to the south and feed into the Benloch Burn. The landcover in the catchment predominantly consists of grassland which is used for agricultural purposes such as rough grazing.

8.5.20. Along the Benloch burn catchment there was also a system of weirs regulating the flow regime downstream. At NGR NX 57979511 abstraction facilities for public drinking water supplies were identified on the southern bank of the burn. Scottish Water have confirmed that there is a licensed abstraction connecting to a water mains pipe which runs to the south east and supplies the village of Carsphairn.

Source: Natural Power

Photographs 8.3 & 8.4: Hydromorphological conditions (left) and overview of the wider Benloch Burn catchment (right)

Marbrack Burn

8.5.21. The Marbrack rises southeast of Beninner (530 m asl) and flows south for 5 km before a confluence with the Polhay Burn, which eventually discharges into the Water of Deugh. The catchment is 6.9 km^2 with the channel ranging in width from 0.5 to 2.5 m, with a typical depth of 0.25 to 0.5 m. In the lower reaches around the confluence with the Polhay Burn, the channel is broad and wide as it meanders through the valley basin with braided sections and gravel bars. In the central catchment the channel and immediate riparian zone is confined within a ravine with plunge pools and falls, which become faster flowing and narrower in the headwater reaches. The bedload is a combination of gravel and peat in the lower catchment, with more bedrock, peat and vegetation in the central and upper catchment areas. Photographs illustrating the character of the Marbrack Burn are show below (Photographs 8.5 & 8.6).

Source: Natural Power

Photographs 8.5 & 8.6: Photographs of the Marbrack Burn catchment

8.5.22. Similar to the Benloch Burn, the land-use is predominantly rough grazing, being generally open grasslands. A small area (~1.2 km^2) of the catchment has been recently planted in the western central area on the southern flanks of Knockwhirn (photos shown in Photograph 8.13 – Future Baseline). An area of peatland is also present in the central eastern catchment north of Furmiston Craig.

Polhay Burn

8.5.23. The Polhay Burn rises on the southern flanks of Knockwhirn (410 m asl) and discharges southeast into the Marbrack Burn ~2 km from the source. The catchment extent is 2.1 km^2, with the northern catchment being bounded by steep and rocky ground on the south side of the hill of Knockwhirn. To the south and in the central catchment area, the topography is considerably more subdued, with moorland that interfluves with adjacent catchments (Knockgray & Benloch Burn) and consequently poorly defined. The Polhay Burn also has the highest concentration of artificial ditches of any of the catchments within the Proposed Development, particularly west of the main channel and many of which are shown on Ordnance Survey 1:10,000 and 1:25,000 scale maps. Photographs of the Polhay Burn are shown below (Photographs 8.7 & 8.8).

Source: Natural Power

Photographs 8.7 & 8.8: Polhay Burn catchment (left) and main channel (right)

8.5.24. Given the density of artificial ditches installed as part of a legacy of land improvement measures, it is unsurprising that agriculture and rough grazing is the dominant land-use within the Polhay Catchment. During hydrological surveys, it was noted that many of these ditches did relate to the OS mapping. Flow was very variable and ranged from being stagnant/low to high. Photographs of some of the artificial drainage ditches are shown below.

Source: Natural Power

Photographs 8.9 & 8.10: Artificial drainage ditches within the Polhay Burn catchment

Furmiston Lane

8.5.25. The Furmiston Lane rises on the northern flanks of Marscalloch Hill, just south of Furmiston Craig at 300 m asl. The headwater areas are characterised by open moorland, which become progressively more improved as the burn flows southwards, eventually discharging into the Water of Deugh 2.3 km from the source. The catchment extent is ~1.1 km^2, with the channel in the headwater reaches being narrow and incised into the surrounding soils. In this section the channel exhibits vegetated banks, with the bed material comprising of vegetation or peat. Further downstream, the flow gradient increases, and the channel becomes wider, still with vegetated banks, but with more falls and plunge pools, with bed material being soils as well as bedrock and gravel. As with many of the other catchments, there is evidence of enhanced drainage. Photographs showing the Furmiston Lane are shown below.

Source: Natural Power

Photographs 8.11 & 8.12:Photographs of the Furmiston Lane catchment

Similar to the Marbrack Burn, the Furmiston Lane catchment is also currently being forested as part existing land management. The planting comprises of commercial coniferous forestry as well as smaller areas of mixed and broadleaf species.

Flood Risk

8.5.26. Flood risk has been considered within Technical Appendix 8.5 Flood Risk Appraisal (FRA). The FRA and considers the potential for flooding within the Proposed Development Area as well as associated on-site and downstream changes in flood risk arising from the construction and operation of the Proposed Development.

8.5.27. As identified within the FRA, there is the potential for localised pluvial / fluvial flooding within riparian corridors of the main channels (specifically the Benloch Burn and Marbrack Burn). The majority of the Proposed Development infrastructure is situated within catchments that discharge into the Water of Deugh downstream of the village of Carsphairn.

Water Quality

8.5.28. A number of waterbodies within the vicinity of the Proposed Development Area have been classified under SEPA's River Basin Management Plans (RBMP) (SEPA 2011). The RBMP are one of the requirements of the Water Framework Directive (WFD) (2000/60/EC) and are the plans designed for protecting and improving the water environment. Table 8.7 details the classified watercourses, water bodies and groundwaters associated with the Proposed Development.

Table 8.7: RBMP classification of surface waterbodies within the vicinity of the Proposed Development

Water Body	Current Overall Status (2018)	Reason for Classification	Target Status	
			2021	2027
Water of Deugh	Poor	Barrier to fish migration as a result of hydroelectric power generation (not situated within Study Area)	Poor	Good
Galloway Groundwater	Good	-	Good	Good

Source: SEPA[1]

The Water of Deugh, which the Benloch Burn feeds into, is classified as having poor overall status under the most recent RBMP cycle. Other watercourses within the Proposed Development are not classified within the RBMP.

Effects of Peat

8.5.29. As discussed in later sections of this EIAR, blanket peat is present with the Proposed Development Area and as such will exert an influence on the water quality within surface and groundwater bodies, particularly during storm events or prolonged dry spells where peat is noted to be eroded or degraded. Effects within the UK are most commonly associated with discolouration arising from high levels of dissolved iron and dissolved organic carbon (DOC), of which the concentrations for the latter have been noted to increase steadily across Europe since the 1970s and is a trend which is predicted to continue (Xu *et al*. 2020). Whilst the mechanism facilitating these increases is highly speculated, the ultimate removal of DOC is a major component of potable water treatment particularly in catchments dominated by peat.

Effects of Forestry

8.5.30. Given that planting of forestry only occurred within the Marbrack and Furmiston Lane catchments in 2021, it is unlikely that the presence of the sapling trees would be currently imparting an effect on water quality. It is possible that the addition of ridge and furrow structures associated with the planting could result in greater sediment export in the short term as a result of soil disturbance. In the longer term, the effects of commercial forestry within upland catchments in the region are known to vary depending on the effectiveness of the associated management strategy, but may including enhanced base-ion removal from groundwater, the accumulation of atmospherically scavenged species in soils, all of which may result in a reduction of the acid neutralising capacity and consequential acidification of surface water networks (Puhr et al. 2000).

Hydrogeology

8.5.31. The hydrogeological Map of Scotland (BGS, 1988) indicates that the Proposed Development Area is underlain by aquifers with low productivity and of Silurian and Ordovician Age. Flow is dominantly in fissures and fractures within the bedrock and the aquifers are not extensive.

8.5.32. The Proposed Development Area is underlain by weakly permeable strata of low primary permeability. These do not contain ground water in exploitable quantities. The Proposed Development Area is partially covered by peat or peat rich soils, which also form an aquifer. Groundwater within such peat aquifers is generally perched on the less permeable bedrock they overlie. The peat aquifers, together with the weathered bedrock zone, provide base flow to the local surrounding watercourses. As such the groundwater Vulnerability Map of Scotland[2] indicates the site is vulnerable to pollutants not readily transformed or absorbed (4b).

8.5.33. In lower lying areas of lesser relief the water table generally occurs at or just below the surface. This is demonstrated by the presence of areas of saturated ground across the Proposed Development. Further evidence for this is the high density of drainage ditches used as part of historical land improvement measures.

8.5.34. As indicated within Table 8.7, the underlying groundwater body (Galloway Aquifer) is classified under the latest RBMP as having "good" overall status.

Water Resources

Public Water Supply

Consultation was undertaken with Scottish Water, which confirmed the designation of the Benloch Burn catchment as a Drinking Water Protected Areas (DWPA). Scottish Water confirmed that an intake situated in the Benloch Burn (NGR NX 5797 9511) was used along with a 4" clay main pipe to supply a source of potable water for the village of Carsphairn. Information on water quality was requested from Scottish Water, however this could not be provided.

8.5.35. Specific mitigation will be outlined in the Construction Environmental Management Plan (CEMP) during detailed design for the sensitive locations, further details are provided in below Section 8.7 Mitigation Methods. Additional mitigation specific to the Benloch Burn DWPA has also been outlined in Technical Appendix 8.6: Pollution Prevention and Incident Plan (PPIP) and is relevant to all proposed construction activities which will be undertaken within the Benloch Burn DWPA.

[1] SEPA. 2021. Water Environment Hub. Available at https://www.sepa.org.uk/data-visualisation/water-environment-hub (accessed 17/06/2021)

[2] 2004 SNIFFER (maps produced by BGS/MI) Includes material based upon Ordnance Survey mapping with permission of H.M.Stationary Office, (c) Crown Copyright License No 1000020538

Water Use Authorisations

8.5.36. SEPA were contacted to establish if there are any abstractions or discharges within 3 km of the Proposed Development. A response was received which indicated that the only abstraction present which could be hydrologically connected to the Proposed Development is the Scottish Water abstraction within the Benloch Burn.

8.5.37. No other abstractions or discharges were identified as being potentially hydrologically connected with the Proposed Development.

Private Water Supplies

8.5.38. DGC provided information on private water abstractions, both domestic and commercial, use within 3 km of the Proposed Development. In total, 91 private water supplies were identified. Detailed information concerning the assessment of Private Water Supplies within the vicinity of the Proposed Development is presented in Technical Appendix 8.4.

Fisheries & Recreation

8.5.39. The upper reaches of the Water of Deugh and Loch Ken have been identified as important fisheries which support good populations of wild brown trout and coarse fish. Further downstream within the River Ken and the River Dee systems there are also rising populations of salmon and sea trout present. The New Galloway Angling Association offers salmon and trout fishing at the Ken Bridge approximately 18 km southeast of the Proposed Development Area.

8.5.40. The Water of Deugh is part of the Galloway Hydro scheme, which has brought changes to the hydromorphological characteristics and fisheries across sections of the catchment. The Galloway Fisheries Trust (GFT) aims to restore and maintain the aquatic biodiversity within the river by means of responsible and sustainable approaches. One example is a successful salmon hatchery programme which has been implemented and runs annually on the River Dee.

Soils & Peat

8.5.41. The distribution of soils across the Proposed Development is dependent upon land use, geology, topography and hydrological regime of the area. Information on the Proposed Development soils has been obtained from Scotland's Environment Website which brings together data from public organisations across Scotland including BGS, JHI, NatureScot and SEPA.

8.5.42. The generalised soil type according to the National Soil Map of Scotland within the site boundary includes peaty gleys, peaty podzols, peat, montane soils and mineral gleys as presented in Figure 8.5 (Scotland's Environment, 2020). The central, eastern and southern areas of the site are dominated by podzols, with blanket peats also being mapped on the higher plateaux areas around Quantans Hill and Furmiston Craig. These soils are likely to be poorly drained and in areas of level ground will be waterlogged. The soils in the north of the Proposed Development Area are comprised of more poorly developed rankers and mineral gleys, which are likely to be thin and more freely draining. Natural exposures encountered during hydrology surveys often identified relatively thin organic horizons overlying more granular matrix supported glacial deposits, with both layers appearing to be poorly drained.

8.5.43. The Carbon and Peatland Map presented in Figure 8.4 shows a dominance of Class 3 (occasional peatland habitat), often occupying steeper slopes in the Benloch Burn and upper Marbrack Burn. There are also occurrences of Class 2 (nationally important carbon-rich soils) and Class 5 (no peatland habitat recorded) constrained mainly to the Polhay Burn. There are also a few occurrences of Class 1 (nationally important carbon-rich soils) situated within the Proposed Development Area situated northeast of Furmiston Craig, within the Marbrack Burn and also east of the Craig of Knockgray.

8.5.44. Peat is a soft to very soft, highly compressible, highly porous organic material that can consist of up to 90 – 95% water, with 5 – 10% solid material (Warburton et al., 2004). Unmodified peat consists of two layers; a surface acrotelm which is usually 10 – 30 cm thick, highly permeable and receptive to rainfall. Decomposition of organic matter within the acrotelm occurs aerobically and rapidly. The acrotelm generally has a high proportion of fibrous material and often forms a crust in dry conditions.

8.5.45. A second layer, or catotelm, lies beneath the acrotelm and forms a stable colloidal substance which is generally impermeable. As a result, the catotelm usually remains saturated with little groundwater flow. Peat is thixotropic, meaning that the viscosity of the material decreases when stress is applied. The thixotropic nature of peat may be considered less important where the peat has been modified through artificial drainage or natural erosion and is drier but will be significant when the peat body is saturated.

8.5.46. Due to the distribution of peat and peaty soils underlying the Proposed Development, a Phase 1 peat depth survey, followed by Phase 2 detailed probing and a peat stability risk assessment (Refer to Technical Appendix 8.2) have been carried out to thoroughly understand the peat and its locality within the site boundary.

8.5.47. Technical Appendix 8.2: Peat Stability Risk Assessment provides details on the methodologies adopted and fieldwork undertaken to assess the potential for peat slides and Technical Appendix 8.3: Peat Management Plan outlines the approximate volumes of peat that will be excavated and reinstated, based on the survey results and the infrastructure. The following information provides a summary of the peat depths recorded during field surveys.

Peat Survey Results

8.5.48. Peat survey data has been collected in line with the recommended statutory approach, comprising of initial Phase 1 (100 m grid) surveys, followed by more detailed Phase 2 (targeted) surveys. The results of the Phase 1 were used to inform preliminary design, before refinement following completion of the Phase 2 surveys. The detailed Phase 2 surveys were undertaken in August and September 2020. An additional Phase 2 survey was undertaken to address layout changes relating to the proposed Substation. Existing data obtained during surveys in 2016 have also been included. A breakdown of points in each category of peat depth is provided in Table 8.8 below.

Table 8.8: Total number of peat depths surveyed within each category during the Phase 1 and Phase 2 Surveys (including existing data)

Peat Depth (m)	Results	% of Points
<0.5	3953	61.5
≥0.5 - <1.0	1320	20.5
≥1 - <2	770	12.0
≥2 - <3	262	4.1
≥3 - <4	86	1.3
≥4	33	0.5
Total	**6424**	**100**

Source: Natural Power

8.5.49. Table 8.8 shows that the highest proportion (61.5 %) of recorded peat depths fell within the <0.5 m range, with the next highest proportion (20.5 %) within the ≥0.5 – <1.0 m range. The areas of deep peat (greater than 0.5 m) are constrained to a few discrete locations within the Proposed Development Area, namely on the interfluve between

the Knockgray Burn and Benloch Burn, just east of Craig of Knockgray hill as well as the summit of Quantans Hill and in the far east of the Proposed Development Area, northeast of Furmiston Craig. In all cases, these locations also correspond with the identification of Class 1 peat (Nature.Scot, 2016).

8.5.50. On-site peat surveys undertaken by Natural Power have demonstrated that **there is sufficient capacity for excavated peat to all be re-used as part of infrastructure dressing and reinstatement** on the Proposed Development. Further details on the peat survey results collected, including the phase 2 survey, can be found in Technical Appendix 8.2 and Technical Appendix 8.3.

Groundwater Dependent Terrestrial Ecosystems (GWDTE)

8.5.51. SEPA's wind farm planning guidance (SEPA, 2017) states a National Vegetation Classification (NVC) survey should be undertaken to identify wetland areas that might be dependent on groundwater. If potential GWDTE are identified within (a) 100 m of proposed excavations less than 1m deep (e.g. roads, tracks and trenches), or (b) within 250 m of excavations deeper than 1 m (e.g. excavated tracks, borrow pits and foundations), then it is necessary to assess how the potential GWDTE may be affected by the Proposed Development.

8.5.52. SEPAs wind farm planning guidance (SEPA, 2017) has been used to inform the Proposed Development design. For details see Chapter 2: Site Design and Evolution areas of potential GWDTE have been identified and assessed accordingly. In line with SEPA guidance, an NVC survey data has been used to identify areas of possible GWDTE and site works have then been completed to assess whether the potential GWDTE is sustained by groundwater or not.

8.5.53. A description of the NVC mapping is given in Chapter 6: Ecology. Figure 6.5 shows areas of potential GWDTE, the proposed site infrastructure, and 100 m / 250 m buffers to the infrastructure as stipulated in SEPA guidance.

8.5.54. According to the ecological surveying carried out by MBEC and reported in Chapter 6, the vast majority of the potential GWDTE areas (M23, M15, M25) are associated with land management impact (overgrazing/artificial drainage) or are features in connection to either surface water features or ombrogenous (rain-fed) habitats along surface water pathways and areas of topographic wetness as a result of flow convergence. The retention of surface water in areas of reduced topographic gradient is also likely to be exacerbated by the low permeability of the underlying indurated Silurian and Ordovician bedrock as well as the spatially discontinuous overlying peat. The buffers to GWDTE specified in SEPA guidance need not apply to these communities.

8.5.55. Other potential GWDTE areas were associated with several discrete acidic flushes (M6), often associated with springs or diffuse flow at the sources of the numerous minor watercourses that drain the Proposed Development Area. In addition to these, occasional shallow seepages (M29) and flush mires (M10) were also identified close to M6 or M15 habitats. As these habitats are often identified in conjunction with seeps, sills or runnels; upslope / upstream presence of ombrotrophic bog / mire (wet heath or blanket bog); situated away from likely groundwater rises (flat areas, topographic highs) or where they are situated in a watercourse, floodplain, or other ponding locations, likely dependency will be no more than moderate and is likely to be low (Botanneco, 2018).

Modifying Influences

8.5.56. Information regarding climate change was obtained from the UK Climate Projections (UKCP18) website (Met Office, 2020). The UKCP18 is a climate analysis tool which features comprehensive projections for different regions of the UK. General climate change trends projected over UK land for the 21st century show an increased chance of warmer, wetter winters and hotter, drier summers along with an increase in the frequency and intensity of weather extremes. This is seen in the Probabilistic (25 km), Global (60 km), Regional (12 km) and Local (2.2 km) projections.

8.5.57. Warmer and wetter winters suggest less snow and more rain. This will create increased risk for flood events, and issues with water quality as less precipitation will be held in its frozen state during the winter season. If climate predictions are correct, summer months will become drier. This will create pressure on the needs of water abstractions and on sensitive ecosystems that rely on aquatic habitats. Evidence also suggests that although the summer months will have an average decrease in rainfall, summer storms will be more frequent and intense. This may lead to more extreme flow values during and immediately following such events, with consequential flooding and water quality issues. This is of key importance for the hydrological environment during summer construction periods.

8.5.58. It is suggested that increased temperatures in the summer could also increase evapotranspiration and potentially cause desiccation of peat (Scottish Government, 2008). The desiccation could result in the peat being more susceptible to erosion due to increased intensity in summer storms and increased rainfall during the winter months. As peat and peat dominant soils are composed of vegetation remains, they contain a high proportion of carbon compared to other soils.

8.6. Receptor Sensitivity

8.6.1. On the basis of the baseline surveys and available information, Table 8.9 below presents the sensitivity of the identified receptors based on the criteria outlined earlier in Table 8.4.

Table 8.9: Justification for Receptor Sensitivity

Receptor	Sensitivity	Reason for Sensitivity
Surface Water Quality		
Benloch Burn DWPA	High	The Benloch Burn contains a raw water extraction owned and managed by Scottish Water and is the water supply for Carsphairn. The catchment is classified as a DWPA. Water quality is expected to be high.
On-site Watercourses (excluding the Benloch Burn DWPA)	Medium	None of the on-site watercourses are designated under RBMP, however receiving watercourses downstream are classified as having Poor status. The watercourses draining the Proposed Development support water quality in downstream fisheries.
Flood Risk		
The Proposed Development	Low	Only very limited areas of the Proposed Development fall within the flood inundation envelope (i.e. only at lower catchment watercourse crossing locations).
Watercourses Downstream of the Proposed Development	Medium	Downstream watercourses are at potential risk of flooding and any changes to the hydrological environmental that results in additional flow could exacerbate the likelihood of flooding.
Water Resources		

Receptor	Sensitivity	Reason for Sensitivity
Private Water Supplies	High	Private Water Supplies are of low regional importance, but high in a local context from the perspective of the user.
Benloch Burn	High	The Benloch Burn is DWPA. The burn is used as a potable water resource and is fed from catchments which contain the Proposed Development and is of national importance.
Soils & Peat		
Site soils and peat < 0.5 m depth	Low	Over half of the surveyed soils (60 %) are less than 0.5 m deep and therefore not classified as peat.
Site soils and peat > 0.5 m depth	High	There are several small areas of deeper peat which are also identified as consisting of Class 1 soils which are considered to be of national importance.
Geology		
Geology	Low	Geology is typical of wider area with no designated sites of geological interest located within the Proposed Development or in a location downstream that could be impacted by the Development.
Hydrogeology		
Groundwater within Peat	Medium	Owing to the low permeability of the underlying bedrock across most of the Proposed Development, the peat may host a shallow superficial aquifer which is vulnerable to pollutants that are not readily absorbed or transformed.
Underlying Groundwater	High	Bedrock groundwater characterised as high quality status.
GWDTE	Medium	Vast majority of potential GWDTE habitats are ombrotrophic / surface water fed. Discrete areas of acid flushes (M6), shallow seepages (M29) and mires (M10) likely to be partially sustained by groundwater and are therefore moderately dependent.

8.7. Mitigation Methods

Mitigation by Design

8.7.1. The distribution of the Proposed Development Infrastructure has evolved as additional site specific information on peat and water resources became available through consultation and on-site survey works. Hydrological receptors and peat soils were identified as key constraints from the outset, and the design has evolved to minimise impacts on these receptors as far as possible. A summary of the hydrological influences on the project layout are given below with full details of the project design evolution provided in Chapter 2: Site Design and Evolution of the EIAR. Due to the nature of the environment occupied by the Proposed Development (specifically its designation as a DWPA), it is important that the design and infrastructure helps maintain or even improve the local hydrology. Poor design of development infrastructure can result in significant implications to the hydrological environment with secondary effects on soils and ecology.

8.7.2. The findings of the peat depth survey (Table 8.8) show that the infrastructure has, as far as possible, when taking into account other environmental and engineering constraints, been sited outside areas of deep peat (>1.0 m thickness). However, ten turbines are situated proximal to areas of peat between 0.5 m and 1.0 m depth with only Turbines 8 and 11 situated in an area of peat >1.0 m. Peat depths across the rest of the site are generally shallow with an average site wide peat depth of 0.57 m.

8.7.3. To facilitate the reduction of potential impacts on the hydrological environment. a series of set-back distances have been adopted and have been designed proportionately to allow greater protection in more sensitive areas:

- All watercourses shown on a 1:10,000 and 1:50,000 scale Ordnance Survey (OS) map within the Benloch Burn (DWPA only) were allocated 100 m buffers;
- Watercourses for the remainder of the Proposed Development Area mapped on a 1:50,000 scale OS map were allocated a 50 m buffer; and
- All other minor watercourses (including mapped artificial ditches) were allocated a buffer of 10 m.

8.7.4. Other embedded mitigation integrated as part of the design of the Proposed Development is as follows:

- Borrow pits and their search areas associated with the Proposed Development, have been located across the site to minimise transportation movements of stone. They are located close to the proposed infrastructure and will be restored after use. All of the proposed borrow pits and search areas are located out with the 100 m buffer of watercourses in the DWPA and 50 m from all other watercourses marked on a 1:50,000 scale OS map. Further details are provided in Technical Appendix 8.7: Borrow Pit Assessment;
- The layout of new tracks has been designed to minimise impacts on the hydrological environment and as far as possible avoid sensitive receptors such as watercourses, GWDTE and deep peat;
- A number of new watercourse crossing locations will be required for the Proposed Development (Technical Appendix 8.1: Water Crossing Assessment). The layout of the proposed tracks has been optimised to reduce the number of new watercourse crossings as far as possible. As identified in Section 8.5, there are a high number of artificial ditches across the Proposed Development. As part of the construction program as well as habitat and flood alleviation proposals, it is envisaged some of these artificial ditches would be blocked to provide environmental betterment;
- A small amount of the Proposed Development sits within Benloch Burn catchment, which discharges through the village of Carsphairn and is susceptible to flooding downstream. The minimisation of infrastructure within the Benloch Burn combined with proposals for Natural Flood Management will minimise effects on negatively modifying downstream flood risk; and
- The design of linear infrastructure elements will be done so to avoid modifying surface water and groundwater flow pathways. This includes the use of permeable materials for track construction, adoption of a site-wide drainage strategy integrating the use of regular cross drains and soakaways, and the use of regular clay plugs within buried structures such as cable trenches.

Standard Good Practice Mitigation

8.7.5. A number of planning, design and construction proposals have been identified during the assessment. Full details of the good practice construction management and mitigation measures to be implemented will be outlined in a site specific CEMP which would be prepared post consent as part of the conditions discharge process. A summary

of the measures which are likely to be included in the CEMP are summarised in this chapter and have been assumed to be part of the proposals when the residual effects and their significance are reported.

8.7.6. To accommodate for increased environmental sensitivity within the Benloch Burn DWPA catchment area, a Pollution Prevention and Incident Plan (PPIP) has also been prepared and provided in Technical Appendix 8.5 and relates specifically to pollution prevention within the Benloch Burn DWPA catchment. The PPIP has been developed to protect and monitor water quality within the Benloch Buren DWPA catchment during the construction phase of the Proposed Development and is based on the source, pathway, receptor principle. It comprises the following key components:

- Pollution Prevention Plan – Describes the controls and mitigation to be implemented during construction in order to prevent or mitigate potential adverse effects on the quantity / quality of surface water or groundwater.
- Pollution Incident Response Plan – Describes the arrangements to be followed in the event of a pollution incident and outlines the procedures to be adopted in relation to response, investigation, reporting and remediation requirements.
- Pollution Control Monitoring Plan – Describes the environmental and pollution control monitoring arrangements to be implemented in supporting the protection of the hydrological environment.

Construction and Environment Management Procedures

8.7.7. A detailed CEMP will facilitate the implementation of industry good practice measures in such a manner as to prevent or minimise effects on the surface and groundwater environment. The CEMP will include information on:

- Planning – where works could potentially impact upon a receptor, works will be planned and undertaken in line with environmental management procedures. This includes the development of a wet weather protocol with working methods adapted or even postponed during periods of heavy rainfall;
- Drainage – all run-off derived from construction activities and site infrastructure will not be allowed to directly enter the natural drainage network. All run-off will be adequately treated via a suitably designed sustainable drainage scheme with appropriate sediment and pollution management measures. The Proposed Development is situated in an upland hydrological area and it is imperative that the drainage infrastructure is designed to accommodate storm flows based on a 1 in 200-year event plus climate change to help maintain the existing hydrological regime;
- Storage – all equipment, materials and chemicals will be stored well away from any watercourses. Chemical, fuel and oil stores will be sited on impervious bases with a secured bund at a designated location (likely to be construction compound);
- Vehicles and Refuelling – standing machinery will have drip trays placed underneath to prevent oil and fuel leaks causing pollution. Where practicable, refuelling of vehicles and machinery will be carried out in designated areas, on an impermeable surface, and well away from any watercourse. No refuelling will be permitted within the Benloch Burn DWPA catchment;
- Maintenance – maintenance to construction plant will be carried out in designated zones, on an impermeable surface well away from any watercourse or drainage, unless vehicles have broken down necessitating maintenance at the point of breakdown, where special precautions will be taken;
- Welfare Facilities – on-site welfare facilities will be adequately designed and maintained to allow the appropriate disposal of sewage. This may take the form of an on-site septic tank with soakaway, or tankering and off-site disposal depending on the suitability of the Proposed Development for a soakaway. Any discharge requirements will comply with relevant requirements under SEPAs CAR;
- Cement and Concrete – fresh concrete and cement are very alkaline and corrosive and can be lethal to aquatic life. The use of wet concrete in and around watercourses will be avoided and carefully controlled through implementation of the buffer zones where applicable and good practice construction methods;
- Demarcation – where potentially sensitive receptors have been identified in areas proximal to Proposed Infrastructure, such as GWDTE or PWS (such as at Marbrack), demarcation on the ground as well as within Constraints Plans will be undertaken to facilitate their protection;
- Monitoring Plan – all activities undertaken as part of the Proposed Development will be monitored throughout the construction phase to monitor environmental compliance. Water quality monitoring, including PWS, will also occur throughout each phase of the Proposed Development and will help to maximise the effectiveness of embedded mitigation measures whilst monitoring effects on the hydrological environment;
- Contingency Plans – a pollution prevention plan will be prepared and will be implemented to allow plans to be put in place to manage spills or other pollution incidents. The plans will ensure that emergency equipment is available on site e.g. spill kits and absorbent materials, advice on action to be taken and who should be informed in the event of a pollution incident; and
- Training – All relevant staff personnel will be trained in both normal operating and emergency procedures and be made aware of highly sensitive areas on site.

8.7.8. Further details regarding the pollution prevention and mitigation measures that will be adopted during the construction and operation of the Proposed Development are detailed in the following paragraphs.

Run-off & Sediment Management

8.7.9. The following measures will be adopted to appropriately attenuate and treat run-off during felling, construction and operation of the Proposed Development.

8.7.10. The Proposed Development drainage system will convey water away from construction activities and built infrastructure, however, due to the nature of the works at the Proposed Development, the steepness of the slopes and the negligible infiltration and storage capacity of the underlying peat and bedrock, there is significant potential for sediment and other pollutants to become entrained in the surface run-off.

8.7.11. To reduce this potential, prior to the commencement of and during construction, plans showing site drainage and hydrologically sensitive areas (watercourse buffers, GWDTE, PWS source and properties) will be designed, constructed and regularly checked to review potential for run-off and ponding of water within the Proposed Development so that that run-off patterns are well known.

8.7.12. The drainage systems installed within the Proposed Development will incorporate the principles of sustainable drainage systems (SUDS) and have sediment management measures incorporated into their design to help reduce or wholly mitigate effects on the hydrological environment. The type of sediment management will depend on the volume of construction activities occurring in particular areas within the Proposed Development. For all of the suggested control measures, regular inspection and maintenance is necessary, particularly after prolonged heavy rainfall.

8.7.13. Silt traps will be installed within the Proposed Development drainage system. Silt traps could take the form of terram fences or clean stone, however, the ability of the silt traps to successfully treat run-off will be dependent upon the permeability of the terram geotextile material and the size and source of the clean stone. If required, flocculents could also be used to treat run-off. Flocculents are very effective at removing suspended sediment from water but they can also have effects on water chemistry. As such, any requirement for flocculent application would be agreed with SEPA and Scottish Water prior to use.

8.7.14. It is also envisaged that Natural Flood Management measures embedded as part of the outline Habitat Management Plan (HMP) including ditch blocking, would facilitate a reduction in surface run-off rates. This would not only help to attenuate peak flows but also enable the gradual release of water, providing a source of long-term storage to sustain rivers during periods of low flow. Further details can be found in Technical Appendix 8.5: FRA and Technical Appendix 6.6: OHMP.

Pumping & Dewatering of Excavations

8.7.15. All pumping operations e.g. removal of water from turbine base excavations, will be carried out in line with best practice and where necessary in line with the requirements of The Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended) prior to the works being undertaken (SEPA, 2021). Suitable measures to minimise the impact of the pumped water on the hydrological environment shall be taken. These measures shall include, but are not limited to, the techniques discussed in the following paragraphs.

8.7.16. Due to the expected low permeability of soils across the majority of the Proposed Development, the potential for groundwater ingress would be low. However, there remains the possibility for groundwater ingress at the interface between soil/peat layers and the substrate layer as well as through potential peat pipes and other sub-surface features. The time that excavations are open will be kept to a minimum to prevent water ingress, as well as secondary impacts on up-slope soils/peat due to dewatering upslope. The ingress of surface water into the excavations will be minimised through the use of up gradient drainage measures e.g. cut-off ditches that will also prevent shallow throughflow entering excavations. It is recognised that water can still enter the excavation and would need to be removed. This can be achieved by allowing the water to gravity drain to a designated area before being pumped from the excavation to a predesigned settlement lagoon or other suitable silt treatment area. The settlement lagoons would attenuate and treat runoff before discharging back into the natural drainage network, mimicking natural flow patterns as far as possible.

8.7.17. Owing to the peat and peaty soils on site, the throughput rate of run-off within the settlement treatment areas would be reduced to give longer settlement time within the excavations and settlement tanks. If required, a series of settlement lagoons or other silt treatment measures can be deployed to allow maximum settlement of sediment during the construction period.

8.7.18. The treated water from the settlement lagoons or other silt treatment measures will not be discharged directly into watercourses but directed onto vegetated surfaces where appropriate. Sediment will be removed from site and the treated water will be deposited amongst the rough surface vegetation, away from sensitive habitats or watercourses.

8.7.19. To reduce the likelihood of erosion channels being formed by the discharge from the sediment treatment outfalls, it is recommended that the water is discharged at a slow rate or spread evenly across a surface. For discharge onto rough vegetation to be effective the discharge must be spread efficiently, and the vegetation, soils and topography be carefully considered to determine an appropriate discharge location. For example, filtering the water through a length of pipe with multiple discharge points will allow attenuation as well as diffuse dispersion, thus reducing the erosive potential of the run-off.

8.7.20. The discharge can also utilise silt traps, silt fencing or other attenuation measures. The utilisation of such measures could help to prevent the formation of erosion channels.

8.7.21. To maximise the efficiency of the settlement measures e.g. Siltbusters or other holding lagoons or tanks, the sediment sludge that collects at the base will be removed as required.

Storage of Fuels / Chemicals & Bund Arrangements

8.7.22. Throughout construction, and to a lesser extent during the operational phase of the Proposed Development, a number of oils and chemicals will be used. Such materials will be used and stored in a safe manner in the Construction Compound, compliant with the provisions of the PIPP and General Binding Rule 26, 27 and 28 (SEPA, 2021) to protect the surface and groundwater environment.

8.7.23. The following measures will be adopted to protect the surface and groundwater environment from the inappropriate storage and use of substances hazardous to the environment:

- All equipment, materials and chemicals to be stored away from any watercourses. Chemicals, fuel and oil will be stored in tanks of sufficient strength and structural integrity to reduce the chances of bursting or leaking in ordinary use. They will also be sited on impervious bases within a secured bund of 110% of the storage capacity. No fuel storage will be permitted within the Benloch Burn DWPA;
- Where oil is stored in a bunded area, oil residue can build up. This residue build-up will reduce the storage capacity of the bund and will be removed regularly. The residue will be disposed of by a specialist contractor;
- Locks shall be fitted to all fuel storage tanks or containers and there shall be a nominated trained person to oversee the refuelling and delivery to minimise the risk of spillage; and
- Standing machinery to have drip trays placed underneath to prevent oil and fuel leaks causing pollution. Where practicable refuelling of vehicles and machinery will be carried out at a central designated area, on an impermeable surface, which will be located at least 50 m away from any watercourses.

Refuelling

8.7.24. External fuel delivery lorries will only be allowed as far as the site compound where there will be a bunded refuelling/fuel storage area constructed on an impervious base. Delivery lorries will transfer fuel to the on-site fuel tank or truck located within the bunded refuelling area to minimise the amount of fuel being driven around the Proposed Development and minimise external drivers accessing the Proposed Development.

8.7.25. A designated fuel truck/bowser will be used for refuelling in designated refuelling areas. The bowser driver will receive extra training on spill prevention and response.

8.7.26. The refuelling area shall be equipped with a mobile spillage control kit containing oil absorbent booms and mats. Nominated personnel will be trained and responsible for refuelling. Other personnel will also be trained on spill response as part of the Proposed Development induction training or toolbox talks. Special attention will be paid to spillage control at/near watercourses.

8.7.27. Oil booms will be provided and maintained downstream of the works at all watercourse locations that the access track crosses for the duration of the construction period to act as a defence against the unlikely event of an oil or fuel spillage.

8.7.28. No refuelling activities will be permitted in the Benloch Burn DWPA catchment. All refuelling locations will be agreed with SEPA and Scottish Water. Further details are presented in Technical Appendix 8.6: PPIP.

Vehicle Maintenance & Management

8.7.29. All plant used during the construction of the Proposed Development will be in suitable condition and fit for purpose to carry out the works and will be maintained as per manufacturers' guidelines.

8.7.30. Maintenance of construction plant to be carried out only in designated areas, on an impermeable surface away from any watercourse or drainage. Only if vehicles have broken down will maintenance be permitted out with a

designated area, and this would only be carried out after implementing special precautions. Such precautions include, but are not limited to:

- Ensure that drip trays are placed underneath vehicles during maintenance;
- As a precautionary measure, and if deemed appropriate, straw bales, booms or entrapment matting would be placed downstream of the maintenance area;
- All heavy construction plant will be inspected daily by the operating personnel and any defects or issues resolved immediately prior to starting works. All heavy construction plant shall be issued with spill-kits. Should a spillage occur, larger spill kits shall also be positioned at various areas within the Proposed Development which will be highlighted to all operatives during the site induction; and
- Standing machinery and plant will have industry standard drip trays (or similar, e.g. plant nappies – open metal drip trays are not permitted) placed underneath to prevent oil and fuel leaks causing pollution.

8.7.31. Additional maintenance and vehicle management measures relevant to the Benloch Burn DWPA are presented in Technical Appendix 8.6: PPIP.

Concrete Works

8.7.32. Concrete would be required for the construction of the wind turbine foundations and foundations for the substation/control room buildings. The use of concrete as part of watercourse crossing construction would be minimised as far as practical, favouring non-cementitious materials. The following section provides best practice measures that are required to be implemented to prevent detrimental effects to the hydrological environment.

8.7.33. Care will be taken during the transportation of concrete to the turbine and building foundations and will be carried out following good practice measures. Freshly mixed concrete and/or dry cement powder will not be allowed to enter any watercourse. This will be avoided by:

- Locating turbines, concrete batching or wash-out areas outside of watercourse setback distances;
- Concrete wagons will only be permitted to wash-out into specifically designed wash-out areas and predetermined at agreed locations site wide;
- The drivers will be informed at their site induction of the location of the designated wash-out areas and issued with a location map;
- Loads will be managed and assessed with regards to the size of vehicle and ground conditions whilst keeping at appropriate speed limits to avoid spillage;
- Tools and equipment will not be cleaned in watercourses. Should it be necessary to clean tools and equipment on site, this will be done in the predetermined wash-out areas;
- Designated concrete batching areas are shown in relation to watercourses in Figure 8.1;
- Wash-out areas will be continually monitored, and findings recorded to reduce the chances of effluent spilling over into the environment; and
- No batching plants or concrete washout will be permitted within the Benloch Burn DWPA. Further details are presented in Technical Appendix 8.6: PPIP.

Site Drainage

8.7.34. The following section discusses the conventional site drainage measures that can be installed during the construction and operation of the Proposed Development.

8.7.35. Surface drainage ditches will be installed alongside tracks only where necessary. The length, depth and gradient of individual drains will be minimised to avoid intercepting large volumes of diffuse overland flow and generating high velocity flows during storm events. Sediment traps, settlement ponds and buffer strips will be incorporated into the drainage system as necessary and will serve the dual purpose of attenuating peak flows, by slowing the flow of run-off through the drainage system and allowing sediment to settle before water is discharged from the drainage system.

8.7.36. As well as utilising sediment traps, structures such as v-notched weirs and/or check dams will be installed within the drainage channels. Such structures will throttle the flow within the channel, thus reducing erosive potential of any run-off and allowing sediment and/or pollutants to settle.

8.7.37. To reduce the impact of the Proposed Development on the natural hydrological regime, the site drainage will mimic greenfield run-off response through the use of sustainable drainage practices.

8.7.38. Sustainable Drainage Systems (SuDS) will be integrated with the water management and details of the proposed SuDS regime have been presented in Technical Appendix 8.4: Flood Risk Appraisal. Further details would be included in the CEMP and Pollution Prevention Plan that will be produced as part of the application that would be made to SEPA for a construction runoff permit.

8.7.39. SuDS are used to attenuate rates of run-off from development sites and can also have water purification benefits. The implementation of SuDS as opposed to conventional drainage systems provides several benefits by:

- Reducing peak flows to watercourses and potentially reducing risk of flooding downstream;
- Reducing the volumes and frequency of water flowing directly to watercourses;
- Improving water quality by removing pollutants;
- Reducing potable water demand through rainwater harvesting; and
- Replicating natural drainage patterns, including the recharge of groundwater so that base flows are maintained.

8.7.40. Whilst it is understood that the scope for SuDS measures is limited as a result of the hydrological environment, it is recommended that the installed drainage measures adopt the principles highlighted above.

8.7.41. Access tracks crossing slopes will disrupt surface flow that consequently will collect in drains constructed upslope of the tracks. Cross-drains and/or water bars will be constructed at regular intervals to conduct this surface flow below or across the track where it will be discharged back into the drainage system, although all efforts will be made to segregate this run-off from more silty run-off originating from track surfaces and other exposed construction areas, thus reducing the silt load and volume discharging to all silt treatment areas. Regular discharge points will limit the concentration of surface run-off and the diversion of flows between catchments. Such cross drains need to be strong enough to withstand the expected traffic loadings.

8.7.42. During storm events there is likely to be some ponding on the uphill side of tracks, as percolation alone is unlikely to be able to accommodate surface flows. To minimise this ponding, small diameter cross drains or perforated pipes (similar to plastic pipe field drains) would be incorporated into the track base at regular intervals to allow more flow to pass through the track and maintain the current flow regime. It is recommended that such pipes are surrounded by free draining material that is wrapped in a separator geotextile. The number of pipes and associated dimensions will be dependent upon the width of the flush/boggy area, proximity to GWDTE and the hydrological regime.

8.7.43. Prior to track construction, site operatives will identify flush areas, depressions or zones which may concentrate water flow. These sections will be spanned with plastic pipes to help maintain hydraulic conductivity under the road and reduce water flow over the road surface during heavy precipitation.

8.7.44. Due to the poor permeability of the surrounding peat, peaty soils and bedrock, it is also recommended that drains and/or cut-off drains are installed on the upstream/upgradient sides of the turbine foundations, crane hardstands, and other excavations required across the Proposed Development. The purpose of this will be to help reduce the volume of surface water run-off entering the excavations and minimise any subsequent contamination.

8.7.45. The constructed drainage system will not discharge directly to any natural watercourse, but will discharge to buffer strips, trenches or SuDS measures, preferably on flatter, lower lying ground. These buffers will act as filters and will minimise sediment transport, attenuate flows prior to discharge and maximise infiltration of water back into the soils and peat.

8.7.46. Drainage from the construction compounds, welfare facilities, borrow pits and concrete wash-out areas will be collected and treated separately from the main site drainage, as the run-off from these areas is more likely to be contaminated and therefore will require treatment. Appropriate treatment, such as oil interceptors and treatment for high alkalinity, will be installed.

8.7.47. Mitigation will follow industry good practice. All mitigation and drainage will be subject to detailed design and approved by Scottish Water and SEPA prior to construction with the Environmental Clerk of Works (ECoW) ensuring compliance. Further suggested measures include ensuring the detailed design includes buffer areas indicating “no construction zones” whereby the infrastructure and construction activities, including stockpile storage are not located i.e. in the Benloch Burn catchment area or near to the Marbrack PWS.

8.7.48. New watercourse crossings will be required, as part of the access tracks associated with the Proposed Development (see Technical Appendix 8.1: Watercourse Crossing Assessment). The crossings will be appropriately designed so that they do not alter the natural drainage, hinder the passage of aquatic fauna and can accommodate flow at a minimum of 1:200yr + CC event. All watercourse crossings will be designed with edge upstands or bunds e.g. straw bales, booms, sandbags or silt fences to prevent sediment laden run-off from construction plant movement from directly entering watercourses. Relevant CAR Authorisation from SEPA will be sought for construction of the crossings that are required over watercourses that are displayed on the 1:50,000 OS Landranger maps. For the larger crossings within the Benloch Burn and Marbrack Burn (WCX13 and WCX23), additional hydraulic modelling would be undertaken prior to construction to demonstrate that constructed soffit levels would allow 0.6m of freeboard above the 1:200 yarr flood (0.5% AEP).

8.7.49. Further details are presented in Technical Appendix 8.1: Water Crossing Assessment and Technical Appendix 8.6: PPIP.

Water Abstractions

8.7.50. Water abstraction will only be made with authorisation from SEPA and in accordance with the Controlled Activity Regulations.

8.7.51. Good practice that will be followed in addition to the CAR Licence regulations includes:

- Water use will be planned to minimise abstraction volumes;
- Water will be re-used where possible; and
- Abstraction volumes will be recorded.

Welfare Facilities / Foul Water

8.7.52. The following measures will be adopted for the design of the foul water drainage system:

- Any sewage associated with the temporary construction compounds, substation and welfare facilities will be collected in appropriately sized interceptor tanks and shall be located at the construction compounds. All wash basins, toilets and shower areas shall also be connected to an interceptor tank;
- The interceptor tanks and the tanks within any site portable toilets, which shall be situated not less than 50 m from any watercourse, will be emptied regularly by a suitably licensed contractor. The final location will be in agreement with SEPA and Scottish Water; and
- Sewerage from these facilities will be disposed offsite in accordance with waste management legislation.

Emergency Water Management Measures

8.7.53. A significant volume of oils and chemicals will be stored on site during the construction phase and, to a lesser extent, the operational phase. Site traffic will also be present in significant numbers during the construction phase of the Proposed Development, with traffic volumes significantly reduced during wind farm operation.

8.7.54. The appropriate storage of oils, chemicals and maintenance of site plant has been discussed above. However, despite these measures, accidents can happen, and these can have significant impacts upon the quality of the surface and groundwater environment. A PPIP has been prepared and details the measures to protect and monitor water quality within the Benloch Burn DWPA catchment. The following emergency procedures are discussed in the PPIP and can be implemented to provide additional protection to the surface and groundwater environment during wind farm construction and operation:

- All relevant on-site staff to be trained in both normal operating and emergency procedures and be made aware of highly sensitive areas on site. The staff training, and implementation of site procedures will be overseen by the infrastructure contractor so that these measures are carried out effectively to minimise the risk of a pollution incident;
- Contingency plans will be designed that clearly highlight the location of emergency equipment available on site (e.g.. spill kits and absorbent materials), training on correct use and that advice is provided on actions to be taken and who would be informed, in the event of a pollution incident;
- Contingency planning procedures must be regularly reviewed to include changes to site operations that were not foreseen during design;
- The procedures set out in site contingency plans need to be prepared in conjunction with the assessment of the risk of a pollution incident occurring and the measures to be taken to minimise pollution. The location of the procedures will be publicised and it is essential that they are set out clearly so that they can easily be understood and acted upon; and
- The emergency procedures can include the following:
  - Containment measures;
  - Emergency discharge routes;
  - List of appropriate equipment and clean-up materials;
  - Maintenance schedule for equipment;
  - Details of trained staff, location, and provision for 24-hour cover;
  - Details of staff responsibilities;
  - Notification procedures to inform the relevant environment protection authority;

- Audit and review schedule;
- Telephone numbers of statutory and local water company; and
- List of specialist pollution clean-up companies and their telephone numbers.

- Further information is presented in Technical Appendix 8.6: PPIP. It is anticipated that further emergency and contingency information would be presented in a pollution prevention plan (PPP) that would support the CEMP, and would be prepared prior to construction.

Additional Mitigation

8.7.55. Where specific risks exist for individual receptors as a result of the construction and operation of the Proposed Development, additional mitigation will also be used alongside standard good practice and embedded mitigation to further reduce measurable impacts. The recommendations outlined will be incorporated into the CEMP and PPIP post-consent.

- The use of General Site Pollution Control and other Mitigation Measures outlined in this Chapter apply to the entire Proposed Development Area. The Benloch Burn is used as a raw water abstraction by Scottish Water and as identified in Table 8.9 is more sensitive than other watercourses to environmental impacts. Specific mitigation, including the use of sediment management measures, has been outlined in the PIPP for the Benloch Burn DWPA and will also be presented for the wider Proposed Development as part of the detailed design in the CEMP post consent. The establishment of communication channels for risk management and monitoring will be essential and is crucial to the delivery of the PIPP;
- Site-specific mitigation will be undertaken at the some of the private water supplies situated adjacent or within the Proposed Development Area. This will include;
  - The provision of a permanent alternative water supply for Knockgray and Knockgray Farm PWS (see TA 8.4: PWSRA) and would be ready for use prior to the construction of the Proposed Development;
  - The implementation of a series of additional measures for the Marbrack PWS;
    - Further investigation by PC prior to construction;
    - Demarcation of supply and infrastructure and appropriate design of standard good practice mitigation to avoid potential for impact;
    - Establishment of a program of inspection and monitoring.
- Following the consent of the Proposed Development, a detailed assessment of the potential natural flood management (NFM) measures would be undertaken in an attempt to further reduce downstream flood risk. This would include hydrological modelling as part of the outline and detailed design to determine the likely benefit that the implemented measures would provide on reducing flood risk to the Proposed Development and areas of flood risk immediately downstream. Following the completion of this assessment and agreement of the proposed NFM measures with all relevant stakeholders (including SEPA, DGC Flooding Team and Scottish Water), the NFM strategy would be implemented. It is hoped that engagement with the local community would facilitate involvement in both the planning and implementation phases of the NFM strategy. It is anticipated the NFM system would be implemented during the operational phase; and
- The location of GWDTE have been avoided, where possible, though the wind farm design process. However, it has not been possible to avoid all such features due to a range of other environmental, cultural heritage and technical constraints that have to be considered during the design process. It is important to note that many of the acid flush habitats (particularly M6c/d), whilst being sensitive to local changes to hydrology, are botanically species-poor and also frequently occurring across the site. However, where it has not been possible to avoid these features, it is intended that a mitigation strategy will be implemented to further avoid/reduce direct and indirect impacts on GWDTE habitats and the hydrological conditions supporting them. The approach will include a commitment to micro-site infrastructure (within the agreed limits) to further avoid these features prior to and during the wind farm construction phase under the advice of an onsite Environmental Clerk of Works (ECoW). Also, prior to construction, to develop location-specific detailed designs for turbine hardstandings, crane pads and blade finger lay down areas, to avoid/minimise impacts on these habitats and a much as possible. These would be implemented at T1, T3, T13, track sections around T9 and T1, with further details provided in the CEMP prior to construction. Also, that the perturbation of local ground and surface water hydrology supporting these habitats is minimised through appropriate environmental design and construction methods.

8.7.56. The implantation of this additional mitigation will be the responsibility of the Developer and nominated Principal Contractor.

8.8. Predicted Construction effects

8.8.1. The potential for effects on the hydrological environment is greatest during the construction phase due to the high levels of activity on-site and when there is greatest change to the existing environment. The potential effects associated with the construction of the Proposed Development is discussed and assessed in the following sections. This information has taken account of the mitigation and management measures outlined in Section 8.7: Mitigation Methods.

8.8.2. The evaluation of construction effects is provided in Table 8.10 below. The assessment results are based on the successful implementation of the embedded good practice mitigation measures as well as the additional mitigation measures provided in Section 8.7: Mitigation Methods.

Pollution Incidents

8.8.3. During the construction phase, a number of potential pollutants will be present onsite, including oil, fuels, chemicals, unset cement and concrete, waste and wastewater from construction activities and staff welfare facilities. The majority of these potential pollutants will be located or stored within the construction compound located within the Marbrack Burn. In addition, there is the potential for contamination of the hydrological and terrestrial environment caused by spillages along the on-site access tracks and construction areas.

Erosion & Sedimentation

8.8.4. Soil and sediment generation may occur in areas where the ground has been disturbed, particularly where surface run-off has been concentrated. Drainage ditches are particularly prone to this problem, due to the high velocities of surface water runoff passing through the drainage network. Considerable sediment generation is expected where the ground has been excavated for the Proposed Development infrastructure.

8.8.5. Sediment transport in watercourses can result in high turbidity levels which can impact on the water quality, particularly affecting the ecological potential of the watercourses. High turbidity in watercourses can reduce the light and oxygen levels in the watercourses, while sediment deposition can smother plant life and spawning grounds. Sediment deposition can also reduce the flood storage capacity of the watercourses and block culverts, resulting in an increased flood risk.

8.8.6. As a result of the construction operations, all catchments with new and upgraded infrastructure present are vulnerable to erosion and sedimentation.

Changes in Water Quality

8.8.7. Excavation and disturbance of soils, subsoils and peat could result in changes in the chemistry of surface water run-off including colour, dissolved organic carbon (DOC), turbidity and dissolved metals. As with erosion and sedimentation, this can have implications on both the quality of the aquatic habitat and also the resource potential of the water itself.

8.8.8. Potential pollutants coming into contact with bedrock or the superficial sediments also have the potential to alter the quality of the groundwater resource. Such alterations including changes in pH or addition of chemicals, could be difficult to rectify and due to the fractured nature of the bedrock and limited extent of any superficial aquifer would attenuate very slowly.

Increases in Run-off

8.8.9. Turbine bases, hardstand areas and access tracks will act as impermeable areas, restricting the natural movement of water within the hydrological environment, potentially resulting in increased rates of run-off into the onsite and downstream catchments. The pre-construction, construction and permeant site drainage will be designed to mimic greenfield runoff response through the use of sustainable drainage practices.

8.8.10. Localised increases in run-off could cause issues for downstream flood storage capacity and/or pollution incidents. Increases in the volume of runoff entering watercourses could also cause erosion and sedimentation, therefore having detrimental effects on surface water hydrology.

8.8.11. The impermeable nature of the underlying bedrock and low permeability of the overlying peat and glacial till within the Proposed Development Area will naturally encourage high rainfall run-off rates (as indicated in Section 8.5). Therefore, the addition of the Proposed Development Infrastructure will not significantly alter the existing baseline hydrological regime and is likely to have a minimal effect on the existing rainfall run-off scenario.

Modification of Surface Drainage Patterns

8.8.12. The interception of diffuse overland flow by the Proposed Development infrastructure and associated drainage may disrupt the natural drainage regime of the area, concentrating flows and potentially diverting flows from one catchment to another. This may have implications for water quality or quantity (including Private Water Supplies) and on flood issues downstream of the Proposed Development.

8.8.13. The high density of artificial drainage ditches is likely to have already significantly modified natural drainage patterns from the Proposed Development. As part of the construction program as well as habitat and flood alleviation proposals, these artificial ditches would be blocked to provide environmental betterment.

Impediments to Surface Water Flow

8.8.14. The design and construction of watercourse crossings will be completed in accordance with SEPA Position Statements outlined in Table 8.1 (WAT-PS-06-02, WAT-SG-23 and WAT-SG-25), being appropriately sized to accommodate the 1 in 200 year + CC flow. Where required, watercourse crossings should allow for the migration of fish and mammal movement in the riparian corridor.

Modification of Groundwater Flows and Levels

8.8.15. Deep excavations, such as those required for the turbine foundations are likely to disrupt the shallow groundwater systems and bedrock geology. Surface water ingress will be minimised by utilising upgradient cut-off drains or other drainage measures. The installation of cut-off drains has the potential to lower local groundwater levels within surrounding peat dominated soils.

8.8.16. The majority of temporary and permeant infrastructure (apart from foundations) would be permeable to some extent.

8.8.17. Access tracks and other linear infrastructure elements such as cable trenches have the potential to disrupt flow pathways as granular backfill may create preferential infiltration and throughflow pathways. These may interrupt shallow groundwater flow or alter the hydrological regime impacting baseflow to watercourses, GWDTE and Private Water Supplies.

Compaction of Soils

8.8.18. The movement of construction traffic within the Proposed Development is likely to cause localised compaction of the ground surface, leading to changes in both the hydrological and hydrogeological regime. The impacts of compaction are likely to be highly localised but will damage the vegetation and result in a reduction in the soil permeability and rainfall infiltration, thereby increasing the potential for flood risk and erosion as well as altering groundwater flows and levels.

Assessment of construction effects

8.8.19. Table 8.9 identifies the likely construction effects on the identified receptors and their significance assuming the successful implementation of good practice and embedded mitigation measures. A further column has also been provided considering the effect significance upon receptors following the implementation of additional mitigation outlined in paragraphs 8.7.55 and 8.7.56.

Table 8.9: Assessment of Construction Effects

Potential Effect	Identified Receptor	Potential Effect Assuming Implementation of Standard Good Practice and Embedded Mitigation			Additional Mitigation Requirements	Potential Effect Assuming Implementation of Additional Mitigation		
		Sensitivity	Magnitude of Effect	Significance of Effect		Sensitivity	Magnitude of Effect	Significance of Effect
Surface Water Quality								
• Pollution incidents • Erosion and sedimentation • Changes in Water Quality • Increase in Run-off • Modifications to Surface Drainage Pattern • Impediments to Surface Water Flow	Benloch Burn DWPA	High	Low	Moderate	Additional mitigation presented in Technical Appendix 8.6: PPIP.	High	Negligible	Negligible
	On-site Watercourses (excluding Benloch Burn DWPA)	Medium	Low	Minor	None.	-	-	-
Flooding								
• Increase in run-off • Modifications to Surface Drainage Patterns	The Proposed Development	Low	Low	Neg. / Minor	None.	-	-	-
• Impediments to Surface Water Flow • Compaction of Soil	Watercourses downstream of the Proposed Development	Medium	Low	Minor / Mod	None.	-	-	-
Water Resources								
• Pollution incidents • Erosion and sedimentation • Changes in Water Quality • Increase in Runoff • Modifications to Surface Drainage Pattern • Impediments to Surface Water Flow	Knockgray & Knockgray Cottage PWS	High	Medium	Mod. / Major	See Technical Appendix 8.4: PWSRA	High	Negligible	Negligible
	Marbrack PWS	High	Medium	Mod. / Major	See Technical Appendix 8.4: PWSRA	High	Negligible	Negligible
	All other Private Water Supplies (including those not hydrologically connected or outside of LUPS31 Buffer)	Low	Low	Neg. / Minor	None.	-	-	-
• Modification of Groundwater Flows and Levels • Compaction of Soils	Benloch Burn DWPA	High	Low	Moderate	Additional mitigation presented in Technical Appendix 8.6: PPIP.	High	Negligible	Negligible
	Ken Catchment Fisheries	Medium	Low	Minor / Mod	None.	-	-	-
Soils & Peat								
• Pollution incidents	Site soils and peat < 0.5 m depth	Low	Negligible	Negligible	None.	-	-	-
• Modifications to Surface Drainage Patterns • Modification of Groundwater Flows and Levels • Compaction of Soils	Site soils and peat > 0.5 m depth	High	Negligible	Negligible	None.	-	-	-

Potential Effect	Identified Receptor	Potential Effect Assuming Implementation of Standard Good Practice and Embedded Mitigation			Additional Mitigation Requirements	Potential Effect Assuming Implementation of Additional Mitigation		
		Sensitivity	Magnitude of Effect	Significance of Effect		Sensitivity	Magnitude of Effect	Significance of Effect
Geology								
• Excavation and removal required for construction	On-site Geology	Low	Negligible	Negligible	None.	-	-	-
Hydrogeology								
• Pollution incidents	Groundwater within Peat	Medium	Negligible	Negligible	None.	-	-	-
• Modification of groundwater flows and levels	Underlying Groundwater	High	Negligible	Negligible	None.	-	-	-
• Compaction of Soils	GWDTE	Medium	Medium	*Moderate*	Use of bespoke infrastructure design to maintain shallow groundwater flows (paragraphs 8.7.55).	Medium	Low	Minor

8.9. Predicted Operation Effects

8.9.1. The effects of the Proposed Development will be substantially lower during the operational phase. The following paragraphs discuss and assess the potential effects that are predicted to occur during the operational phase of the Proposed Development.

Predicted Operation Effects

Pollution Incidents

8.9.2. The potential risk of pollution is substantially lower during operation than during construction because of the reduced levels of activity in the operational phase. Most potential pollutants will have been removed when construction was completed; however, lubricants for turbine gearboxes, and transformer oils may be stored on site and there is the risk of possible fuel leaks from maintenance vehicles whilst onsite.

Erosion & Sedimentation

8.9.3. Levels of erosion and sedimentation during operation will be much lower than construction as there will be no excavations or bare exposed ground. Some erosion and sedimentation are still possible on the access tracks and drainage ditches as a result of scouring during extreme rainfall events. Similarly, there could be some short term increases to erosion and sedimentation around new stream crossings as watercourses reach new equilibrium primarily within the construction and early in the operational phases of the Proposed Development.

Changes in Water Quality

8.9.4. During the operation phase there will be no continued construction works associated with excavation and exposure of soils, peat and sediments. Opportunities for erosion and transportation of materials will be considerably reduced during the operational phase as previously exposed surfaces become vegetated.

Increases in Runoff

8.9.5. Some of the drainage management features such as silt ponds and silt fencing will be dismantled, with retained features designed to blend into the landscape, but also provide protection against erosion. A reduction in the number of drainage management features overall is likely to reduce the rate of runoff compared to the construction phase with permeant drainage designed to mimic greenfield hydrological regimes.

The Natural Flood Management strategy would have been implemented during the construction phase and would become more established during the operational phase.

Modification of surface drainage patterns

8.9.6. Modification of surface runoff will occur as a result of the construction of the new infrastructure associated with the Proposed Development. The operational effects could result in changes to volume and/or changes to runoff rate, however the permeant drainage will be designed to avoid this.

Impediments to Surface Water Flow

8.9.7. During the operational phase impediments to flows can generally occur as a result from blockages to watercourse crossings, ditches and watercourses themselves, resulting from vegetation and erosion debris. The cost of maintaining the mitigation measure shall be met by the Operator through the lifetime of the planning permission.

Modification of Groundwater Flows and Levels

8.9.8. Cut tracks and their drainage as well as turbine foundations and hardstands will potentially alter the water table within the upslope and downslope peat and bedrock groundwater, which can also have implications for the long-term functionality of peatland environments.

Compaction of Soils

8.9.9. The compaction of soils/peat will be significantly reduced during the operational phase as a result of settlement of infrastructure following initial construction and significantly reduced traffic movements.

Assessment of Predicted Operation Effects

8.9.10. Table 8.10 below identifies the likely operational effects on the identified receptors and their significance based on the successful implementation of good practice and embedded mitigation measures. The only additional mitigation during the Operational phase will be the permanent alternative supply for the Knockgray PWSs and the adoption of NFM enhancement measures as part of long-term flood risk management.

Table 8.10: Assessment of predicted operational effects

Potential Effect	Identified Receptor	Potential Effect Assuming Implementation of Standard Good Practice and Embedded Mitigation			Additional Mitigation Requirements	Potential Effect Assuming Implementation of Additional Mitigation		
		Sensitivity	Magnitude of Effect	Significance of Effect		Sensitivity	Magnitude of Effect	Significance of Effect
Surface Water Quality								
• Pollution incidents • Erosion and sedimentation • Changes in Water Quality • Increase in Run-off • Modifications to Surface Drainage Pattern • Impediments to Surface Water Flow	Benloch Burn DWPA	High	Negligible	Negligible	None.	-	-	-
	On-site Watercourses (excluding Benloch Burn DWPA)	Medium	Negligible	Negligible	None.	-	-	-
Flooding								
• Increase in runoff • Modifications to Surface Drainage Patterns • Impediments to Surface Water Flow • Compaction of Soil	The Proposed Development	Low	Negligible	Negligible	No mitigation required. However, NFM measures adopted for environmental betterment. See Technical Appendix 8.5: FRA	-	-	-
	Watercourses downstream of the Proposed Development	Medium	Negligible	Negligible		-	-	-
Water Resources								
• Pollution incidents • Erosion and sedimentation • Changes in Water Quality • Increase in Run-off • Modifications to Surface Drainage Pattern • Impediments to Surface Water Flow • Modification of Groundwater Flows and Levels • Compaction of Soils	Knockgray & Knockgray Cottage PWS	High	Negligible	*Negligible*	See Technical Appendix 8.4 PWSRA.	High	Negligible	Negligible
	Marbrack PWS	High	Negligible	Negligible	None.	-	-	-
	All other Private Water Supplies (including not hydrologically connected or outside of LUPS31 Buffer)	Low	Negligible	Negligible	None.	-	-	-
	Benloch Burn DWPA	High	Negligible	Negligible	None.	-	-	-

Potential Effect	Identified Receptor	Potential Effect Assuming Implementation of Standard Good Practice and Embedded Mitigation			Additional Mitigation Requirements	Potential Effect Assuming Implementation of Additional Mitigation		
		Sensitivity	Magnitude of Effect	Significance of Effect		Sensitivity	Magnitude of Effect	Significance of Effect
	Ken Catchment Fisheries	Medium	Negligible	Negligible	None.	-	-	-
Soils & Peat								
• Pollution incidents • Modifications to Surface Drainage Patterns • Modification of Groundwater Flows and Levels • Compaction of Soils	Site soils and peat < 0.5 m depth	Low	Negligible	Negligible	None.	-	-	-
	Site soils and peat > 0.5 m depth	High	Negligible	Negligible	None.	-	-	-
Geology								
• Excavation and removal required for construction	On-site Geology	Low	Negligible	Negligible	None.	-	-	-
Hydrogeology								
• Pollution incidents • Modification of groundwater flows and levels • Compaction of Soils	Groundwater within Peat	Medium	Negligible	Negligible	None.	-	-	-
	Underlying Groundwater	High	Negligible	Negligible	None.	-	-	-
	GWDTE	Medium	Medium	*Moderate*	Use of bespoke infrastructure design to maintain shallow groundwater flows (paragraphs 8.7.55).	Medium	Low	Minor

8.10. Cumulative Effects

Predicted Cumulative Effects

8.10.1. A cumulative impact is considered to be the impact on a hydrological, hydrogeological or geological receptor arising from the Proposed Development in combination with other developments which are likely to affect surface water, groundwater or geology. Developments (operational, consented and in planning) within the same catchment as the Proposed Development and within a distance of 2 km from the Proposed Development have been considered. Cumulative impacts are considered using the same methodology as for impacts of the Proposed Development in isolation.

8.10.2. The Proposed Development is adjacent to the consented Shepherds Hill Wind Farm. Windy Standard I and Windy Standard II are operational wind farms, with Wind Rig currently under construction and are all situated in the upper Water of Deugh Catchment.

8.10.3. Off-site cumulative hydrological effects are primary related to changes in water quality and increases in flood risk. Mitigation has been presented in Section 8.7 to adequately protect on-site hydrological receptors and therefore will be suitable to ensure the protection of those situated downstream, and should not contribute to or exacerbate any effects arising from other developments, land uses or activities. With regards to flood risk specifically, the design of the drainage will mimic the existing hydrological and greenfield regime of the Proposed Development Area, as outlined in Section 8.7. A NFM strategy would also be prepared and implemented to provide further environmental betterment regarding flood risk management.

8.10.4. It is concluded that following the successful implementation of the mitigation outlined in Section 8.7, cumulative impacts of the Proposed Development during construction and during operation will be **negligible**.

Monitoring

8.10.5. A programme of surface water quality monitoring within the Benloch Burn DWPA has been outlined within the PPIP. Monitoring for the wider Proposed Development will also be required and will be confirmed post-consent. A breakdown of the proposed monitoring methodologies has been provided to consider sensitivities of the on-site and downstream environments.

8.10.6. The details of any required water quality monitoring should be discussed and agreed with Scottish Water, SEPA, Marine Scotland, and DGC prior to commencement. The extent and the frequency of the monitoring will be proportionate to the level of activity on site during the construction, operation and decommissioning of the Proposed Development. Appropriate monitoring is important to:

- Provide reassurance that established in-place mitigation measures are effective and that the Proposed Development is not having any significant adverse impact upon the environment;
- Indicate whether further investigation is required and, where pollution is identified, the need for additional mitigation measures;
- Reduce or remove any impacts on the water environment (including the Benloch Burn DWPA, downstream fisheries and Private Water Supplies); and
- Understand the long-term effects of the Proposed Development on the natural environment.

8.10.7. A baseline surface water monitoring programme will be undertaken prior to the commencement of construction works. The establishment of a baseline is very important as it provides a suite of parameters against which to compare samples taken during the Proposed Development's lifetime, and with which to assess any impacts and the requirement for any appropriate remedial measures. However, due to the variance in climatic conditions, recording like for like water quality prior to and during construction is likely to be unusual. Therefore, it is also recommended that control sites, situated outside the area affected by the Proposed Development infrastructure are also established at the same time.

8.10.8. A suitably qualified ECoW will be employed throughout the construction of the Proposed Development. The appointed ECoW can provide advice to the contractors about how environmental effects can be minimised, and what methods can be employed to reduce effects on water quality, soils and associated habitats.

8.10.9. Monitoring will be undertaken throughout construction of the Proposed Development. The monitoring will help to identify areas where infrastructure is having a negative effect on peaty soils and utilise the appropriate methods to prevent further deterioration and/or promote further enhancement.

8.10.10. All construction management and water management techniques will be agreed prior to construction. The techniques would be agreed following consultation with Scottish Water, SEPA, Marine Scotland, and DGC. In conjunction with this, there should be a programme of visual monitoring to ensure that the designed drainage system is compliant with the requirements under CAR with respect to GBR 10 and in particular; clauses d, g and h. In addition to this, PWS monitoring will be undertaken to ensure that supply quality and quantity is not altered as a result of the construction and operation of the Proposed Development.

8.11. Residual Effects

8.11.1. The residual effects represent the overall likely significant effect of the development on the environment taking account of practical and available mitigation measures.

8.11.2. This has identified that there will be **no significant effects** from the Proposed Development on the hydrological, hydrogeological and geological environment and therefore it can be concluded that no residual effects will take place.

8.12. Decommissioning

8.12.1. During decommissioning of the Proposed Development, potential impacts on the Hydrological , Hydrogeological and Geological environment are expected to be less than those encountered during the construction phase and therefore **not significant**. No specific mitigation measures are therefore identified.

8.12.2. The decommissioning of the Proposed Development would adhere to the latest legislative and guidance requirements at the time.

8.13. Future Baseline

8.13.1. The widespread occurrence of artificial drainage ditches and the reduced permeability of the degraded bog habitats mean that potential increases in rainfall as depicted in Section 8.5 Modifying Influences as a result of CC, could continue to increase soil erosion and place additional stresses upon nearby water resources. As discussed previously, some artificial ditches would be blocked as part of a program of environmental betterment, which without the Proposed Development is unlikely to occur.

8.13.2. Small sections of the Proposed Development Area have also been planted with associated drainage and furrow ditches installed (See Photograph 8.13). The current position of the planted areas are on the lower slopes of Knockwhirn and near Furmiston Craig in modular blocks, away from watercourses. Whilst this forestry would provide some environmental benefit, afforestation proposals integrated within the habitat management plan and NFM strategy would focus on planting in areas to optimise ecosystem services, i.e. distributed riparian planting, which would more effectively manage fluvial flood risk as well as improve water quality (SEPA, 2015).

Source: Natural Power

Photograph 8.13: Recently planted section of hillslope within the Proposed Development area

8.13.3. It is considered that the environmental benefit afforded through associated habitat and NFM proposals would be more favourable than those which could be provided as part of any alternative development proposals or just leaving the Proposed Development Area in its current state.

8.14. Summary

8.14.1. An assessment has been carried out of the likely impacts of the Proposed Development on the hydrological, hydrogeological and geological environment. The assessment has considered site preparation, construction and operation of the Proposed Development.

8.14.2. The potential effects on the hydrological, geological and hydrogeological environment have considered:

- Pollution Incidents;

- Erosion and sedimentation;
- Changes in water quality;
- Changes to water resources i.e. Benloch Burn DWPA and private water supplies;
- Modification of surface water and groundwater flows;
- Modification of natural drainage patterns;
- Impediments to flow and flood risk;
- Peat instability; and
- Compaction of soils.

8.14.3. Following the identification and assessment of the key receptors, taking into account the potential effects listed above, a comprehensive suite of mitigation and good practice measures has been incorporated into the design, including extensive buffer areas. In addition, a PPIP and a Site-specific CEMP as well as detailed design of infrastructure and associated mitigation will be implemented to protect the groundwater and surface water resources from pollution and minimise changes to the hydrological environment.

8.14.4. The impact assessment has taken into account the hydrological regime, highlighting that the principal effects will occur during the construction phase. Following the successful design and implementation of mitigation measures the significance of construction effects on all identified receptors are not defined as significant. The assessment of predicted operational effects has determined that the significance of effects on all receptors to be of no significance.

8.14.5. Good practice design and construction of the Proposed Development delivered through a skilled team of competent workers, with mitigation and compliance monitored in collaboration with Scottish Water, SEPA, DGC and other engaged stakeholders, will result in a risk that is considered to be **not significant** in terms of the EIA Regulations.

Disclaimer

8.14.6. The initial fieldwork carried out was a standard reconnaissance level walkover survey covering the main hydrological features within the Proposed Development.

8.14.7. Private water supply information has been provided by DGC with the information confirmed by some PWS owners through response to questionnaires that were sent to identified properties within 3 km of the Proposed Development.

8.14.8. The assessment of effects has been made based on the finalised layout with the assumption that any micro-siting during detailed design will not result in the movement of infrastructure into areas of higher impact as presented within the watercourse buffers provided in Figure 8.1: Hydrology Overview.

8.14.9. The information presented in this assessment is based on desk studies, fieldwork and onsite investigations. There is the potential that further constraints may be identified during the pre-construction detailed design stage. Should further constraints be identified these will be assessed and appropriately mitigated prior to construction.

8.15. References

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VATTENFALL

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C	23/12/2021	Final draft
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E	18/01/2023	Released

Chapter 9 Cultural Heritage

Contents

List of Abbreviations

List and describe your abbreviations here.

Abbreviation	Description
AMRE	the Air Ministry Research Establishment
ASA	Archaeologically Sensitive Area
CIfA	Chartered Institute for Archaeologists
DGAS	Dumfries and Galloway Archaeology Service
ESRI	Environmental Systems Research Institute
GDL	Garden and Designed Landscape
GPS	Global Positioning System
HE	Historic England
HEPS	Historic Environment Policy for Scotland
HER	Historic Environment Record
HES	Historic Environment Scotland
HLA	Historic Land-use Assessment
ICOMOS	Incorporated International Council on Monuments and Sites
IEMA	Institute of Environmental Management & Assessment
LiDAR	Light Detection And Ranging
MoD	Ministry of Defence
NCAP	National Collection of Aerial Photographs
NRHE	National Record for the Historic Environment
PAN	Planning Advice Note
PMRA 1986	Protection of Military Remains Act 1986
RAF	Royal Air Force
RAO	Registered Archaeological Organisation
SNH	Scottish Natural Heritage
SPP	Scottish Planning Policy
WSI	Written Scheme of Investigation
ZTV	Zone of Theoretical Visibility

9.1 STATEMENT OF COMPETENCE

9.1.1 This chapter has been produced by AOC Archaeology Group. AOC Archaeology Group was formed in 1991 and is a Registered Organisation of the Chartered Institute for Archaeologists (CIfA). The assessment has been carried out by Mark Littlewood AOC Archaeology Group. Mark Littlewood is a Project Officer and an Associate of the Chartered Institute for Archaeologists. Since joining AOC Archaeology Group in 2017 Mark has completed a number of Environmental Impact Assessments (EIA)s for proposed wind farms and overhead powerlines. He has over 24 years of experience in commercial archaeology.

9.1.2 The assessment has been overseen by Tom Bradley-Lovekin. Tom Bradley-Lovekin is a Project Manager and has supervised numerous archaeological excavations and watching briefs. He now specialises in consultancy and has prepared desk-based assessments and environmental impact assessment chapters for a range of development proposals including urban extensions, mineral extractions, road schemes and energy projects.

9.1.3 This assessment has been carried out in accordance with the standards of professional conduct outlined in the CIfA Code of Conduct[1] and Regulations for Professional Conduct[2], as well as the CIfA Standard and guidance for commissioning work on, or providing consultancy advice on, archaeology and the historic environment[3]; Standard and guidance for historic environment desk-based assessment[4]; field evaluations[5] and other relevant guidance.

Standards

9.1.4 This chapter contains sufficient information to meet the requirements for assessing potential impacts upon heritage receptors required by current planning regulations. The scope and methodology have taken account of relevant definitions and guidance as set out in SPP, HEPS and local planning policy and the guidance documents as noted above. AOC Archaeology Group conforms to the standards of professional conduct outlined in the Chartered Institute for Archaeologists (CIfA) Code of Conduct[6], the CIfA Standard and Guidance for Commissioning Work or Providing Consultancy Advice on Archaeology and the Historic Environment[7], the CIfA Standards and Guidance for Historic Environment Desk Based Assessments[8], Field Evaluations[9] and all other relevant CIfA guidance.

9.1.5 AOC Archaeology Group is a Registered Organisation of the CIfA. This status ensures that there is regular monitoring and approval by external peers of our internal systems, standards and skills development.

9.1.6 AOC is ISO 9001:2015 accredited, in recognition of the Company's Quality Management System.

9.2 INTRODUCTION

9.2.1 This chapter considers the likely significant effects on archaeology and cultural heritage associated with the construction, operation and decommissioning of the Proposed Development. The specific objectives of the chapter are to:

- describe the historic environment baseline;
- describe the assessment methodology and significance criteria used in completing the impact assessment;
- describe the potential effects, including direct, setting and cumulative effects;
- describe the mitigation measures proposed to address likely significant effects; and
- assess the residual effects remaining following the implementation of mitigation.

9.2.2 This chapter is supported by the following figures and technical appendices:

- Volume 2a: Figures
  - Figure 9.1: The Proposed Development Area and heritage assets
  - Figure 9.2: Heritage assets and the 1km Study Area
  - Figure 9.3: Designated assets, HER national/regional assets and the 10km Study Area
  - Figure 9.4: Designated assets, HER national/regional assets and the ZTV
  - Figure 9.5: Extract from a map by Blaeu, 1654
  - Figure 9.6: Extract from a map by Roy, 1752-55
  - Figure 9.7: Extract from Ordnance Survey map, 1853
  - Figure 9.8: Extract from Ordnance Survey map, 1895
  - Figure 9.9: Extract from Ordnance Survey mapping, 1909-10
  - Figure 9:10a-f Cultural Heritage Viewpoint:1: Earlstoun Castle
  - Figure 9.11a-f Cultural Heritage Viewpoint 3: Holm of Daltallochan
  - Figure 9.12a-f Cultural Heritage Viewpoint 3: Stroanfreggan Craig Fort
  - Figure 9.13 Cultural Heritage Viewpoint 4: Polmaddy (SM5391)
  - Figure 9.14 Cultural Heritage Viewpoint 5: Woodhead Lead Mines (SM5184)
  - Figure 9.15 Cultural Heritage Viewpoint 6: Earlstoun Castle (SM1118)
  - Figure 9.16 Cultural Heritage Viewpoint 7: Holm of Daltallochan Cross Slab (SM1106)
  - Figure 9.17 Cultural Heritage Viewpoint 8: Craigengillan Cairn (SM2238)
  - Figure 9.18 Cultural Heritage Viewpoint 9: Dundeugh Castle (SM2476)
  - Figure 9.19 Cultural Heritage Viewpoint 10: Braidenoch Hill Cross Slabs (SM1105)
  - Figure 9.20 Cultural Heritage Viewpoint 11: Lagwine Cairn (MDF3478)
  - Figure 9.21 Cultural Heritage Viewpoint 12: Knockgray Policies (MDG25538)
  - Figure 9.22 Cultural Heritage Viewpoint 13: Craigengillan (GDL111)
  - Figure 9.23 Cultural Heritage Viewpoint 14: Little Auchrae (MDG11404)
  - Figure 9.24 Cultural Heritage Viewpoint 15: Round Craigs (MDG3944)
  - Figure 9.25 Cultural Heritage Viewpoint 16: Culmark Hill (MDG3845)
  - Figure 9.26 Cultural Heritage Viewpoint 17: Bardennoch-Garryhorn ASA
  - Figure 9.27 Cultural Heritage Viewpoint 18: Stroanfreggan ASA

[1] UNITED KINGDOM. CIfA (2019) Code of Conduct. Published December 2014. Revised October 2019.

[2] UNITED KINGDOM. CIfA (2019) Regulations for professional conduct. The Chartered Institute for Archaeologists. Published May 2019.

[3] UNITED KINGDOM. CIfA (2020) Standard and guidance for commissioning work or providing consultancy advice on archaeology and the historic environment. The Chartered Institute for Archaeologists. Published December 2014. Updated October 2020.

[4] UNITED KINGDOM. CIfA (2017) Standard and guidance for historic environment desk-based assessment. The Chartered Institute for Archaeologists. Published December 2014. Updated January 2017.

[5] UNITED KINGDOM. CIfA (2020) Standard and guidance for archaeological field evaluation. Published December 2014. Updated June 2020. Updated October 2020.

[6] UNITED KINGDOM. CIfA (2019) Code of Conduct. Published December 2014. Revised October 2019.

[7] UNITED KINGDOM. CIfA (2020) Standard and guidance for commissioning work or providing consultancy advice on archaeology and the historic environment. The Chartered Institute for Archaeologists. Published December 2014. Updated October 2020.

[8] UNITED KINGDOM. CIfA (2017) Standard and guidance for historic environment desk-based assessment. The Chartered Institute for Archaeologists. Published December 2014. Updated January 2017.

[9] UNITED KINGDOM. CIfA (2020) Standard and guidance for archaeological field evaluation. Published December 2014. Updated June 2020. Updated October 2020.

  - Figure 9.28 Cultural Heritage Viewpoint 19: Polharrow Burn ASA
  - Figure 9.29: The Proposed Development Area, heritage assets and infrastructure
- Volume 3: Technical Appendices
  - Appendix 9.1: Settings Assessment
  - Appendix 9.2: Plates
  - Appendix 9.3: Asset Gazetteer
- Volume 1: EIAR Chapter 5: Landscape and Visual Impact Assessment (LVIA)
  - Figure 5.23a-f Viewpoint 10: Cairn Avel
  - Figure 5.27a-f Viewpoint 14: Stroanfreggan Cairn

9.3 LEGISLATION, POLICY & GUIDANCE

9.3.1 The scope of the assessment has been informed by consultation responses summarised in Table 9.1 and the following legislation, polices and guidelines/ guidance:

- Ancient Monuments and Archaeological Areas Act (1979)[10];
- The Planning (Listed Buildings and Conservation Areas) (Scotland) Act (1997)[11] ;
- The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations (2017)[12] ;
- Historic Environment (Amendment) (Scotland) Act 2011[13];
- Protection of Military Remains Act 1986[14];
- Historic Environment Policy for Scotland (HEPS)[15] ;
- Scottish Planning Policy (SPP)[16];
- Planning Advice Note 2/2011 (PAN 2)[17];
- Local Development Plan 2 (Dumfries & Galloway Council 2019)[18];
- Environmental Impact Assessment Handbook v5, Historic Environmental Scotland (HES) and Scottish Natural Heritage (now NatureScot)[19]; and
- Managing Change in the Historic Environment: Setting[20].

9.4 METHOD OF ASSESSMENT

9.4.1 The assessment distinguishes between the term ‘impact’ and ‘effect’. An impact is defined as a physical change to a heritage asset or its setting, whereas an effect refers to the significance of this impact. The first stage of the assessment involves establishing the importance of the heritage asset and assessing the sensitivity of the asset to change (impact). Using the proposed design for the Proposed Development, an assessment of the impact magnitude is made and a judgement regarding the level and significance of effect is arrived at.

Criteria for Assessing Sensitivity of Heritage Assets

9.4.2 The definition of cultural significance is readily accepted by heritage professionals both in the UK and internationally and was first fully outlined in the Burra Charter, which states in article one that “cultural significance” or “cultural heritage value”[21] means aesthetic, historic, scientific, social or spiritual value for past, present or future generations[22]. This definition has since been adopted by heritage organisations around the world, including HES. HEPS notes that to have cultural significance an asset must have a particular “aesthetic, historic, scientific or social value for past, present and future generations”[23]. Heritage assets also have value in the sense that they contribute to a “...sense of place, cultural identity, social well-being, economic growth, civic participation and lifelong learning”[24]. All heritage assets have significance; however, some heritage assets are judged to be more important than others. The level of that importance is, from a cultural resource management perspective, determined by establishing the asset’s capacity to contribute to our understanding or appreciation of the past[25]. In the case of many heritage assets their importance has already been established through the designation (i.e. Scheduling, Listing and Inventory) processes applied by HES.

9.4.3 The rating of importance of heritage assets is first and foremost made in reference to their designation. For non-designated assets, importance will be assigned based on professional judgement and guided by the criteria presented in Table 9.1; which itself relates to the criteria for designations as set out in Designation Policy and Selection Guidance[26] and Scotland’s Listed Buildings[27].

Table 9.1: Criteria for Establishing Importance of Heritage Assets

Importance	Receptors
Very High	World Heritage Sites; Other designated or non-designated assets with demonstrable Outstanding Universal Value.

[10] UNITED KINGDOM. The Ancient Monuments and Archaeological Areas Act 1979: Elizabeth II. Chapter 14 (1979) London: Her Majesty’s Stationary Office.

[11] UNITED KINGDOM. Planning (Listed Buildings and Conservation Areas) (Scotland) Act 1997: Elizabeth II. Chapter 9. London: Her Majesty’s Stationary Office.

[12] UNITED KINGOM. The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017. (2017) London: Her Majesty’s Stationary Office.

[13] UNITED KINGDOM. Historic Environment (Amendment) (Scotland) Act 2011: Elizabeth II. 2011 asp 3 The Queen’s Printer for Scotland: The Stationery Office Limited.

[14] UNITED KINGDOM. Protection of Military Remains Act 1986: Elizabeth II. Chapter 35 (1986) London: Her Majesty’s Stationary Office.

[15] SCOTLAND. HES (2019) Historic Environment Policy for Scotland. Edinburgh: Historic Environment Scotland

[16] SCOTLAND. Scottish Government (2014) Scottish Planning Policy. Available from – [https://www.gov.scot/publications/scottish-planning-policy/document]

[17] SCOTLAND. Scottish Government (2011) PAN2/2011 Planning and Archaeology. Available from – [http://www.scotland.gov.uk/Resource/Doc/355385/0120020.pdf]

[18] SCOTLAND. Dumfries and Galloway Council. (2019). Local Development Plan 2

[19] SCOTLAND. SNH & HES (2018) Environmental Impact Assessment Handbook v5. Inverness; Edinburgh: Scottish Natural Heritage & Historic Environment Scotland. Available from - https://www.nature.scot/sites/default/files/2018-05/Publication%202018%20-%20Environmental%20Impact%20Assessment%20Handbook%20V5.pdf

[20] SCOTLAND. HES (2020) Managing Change in the Historic Environment: Setting. Edinburgh: Historic Environment Scotland.

[21] ICOMOS. (2013) The Burra Charter: The Australian ICOMOS Charter for Places of Cultural Significance. Australia: Australia ICOMOS Incorporated International Council on Monuments and Sites. P. 2.

[22] ICOMOS. (2013) The Burra Charter: The Australian ICOMOS Charter for Places of Cultural Significance. Australia: Australia ICOMOS Incorporated International Council on Monuments and Sites.

[23] SCOTLAND. HES (2019) Historic Environment Policy for Scotland. Edinburgh: Historic Environment Scotland. P. 5.

[24] SCOTLAND. Scottish Government (2014) Scottish Planning Policy. p. 33. Available from – [https://www.gov.scot/publications/scottish-planning-policy/document]

[25] SCOTLAND. HES (2019) Designation Policy and Selection Guidance. Edinburgh: Historic Environment Scotland.

[26] SCOTLAND. HES (2019) Designation Policy and Selection Guidance. Edinburgh: Historic Environment Scotland.

[27] SCOTLAND. HES (2019) Scotland’s Listed Buildings. Edinburgh: Historic Environment Scotland.

Importance	Receptors
High	Scheduled Monuments (as protected by the Ancient Monuments and Archaeological Areas Act 1979 (the "1979 Act")[28]; Category A Listed Buildings (as protected by the Planning (Listed Buildings and Conservation Areas) (Scotland) Act 1997) (the "1997 Act")[29]; Inventory Gardens and Designed Landscapes (as protected by the 1979 Act, as amended by the Historic Environment (Amendment) (Scotland) Act 2011)[30]; Inventory Battlefields (as protected by the 1979 Act, as amended by the 2011 Act)[31]; Outstanding examples of some period, style or type; Military aircraft crash sites (as protected by the Protection of Military Remains Act 1986)[32] Non-Designated assets considered to meet the criteria for the designations as set out above (as protected by SPP, 2020)[33].
Medium	Category B and C Listed Buildings (as protected by the 1997 Act)[34]; Conservation Areas (as protected by the 1997 Act)[35]; Major or representative examples of some period, style or type; or Non-designated assets considered to meet the criteria for the designations as set out above (as protected by SPP)[36];
Low	Locally Listed assets; Examples of any period, style or type which contribute to our understanding of the historic environment at the local level.
Negligible	Relatively numerous types of features; Findspots of artefacts that have no definite archaeological remains known in their context; The above non-designated features are protected by Paragraph 137 of SPP, 2020[37].

9.4.4 Determining cultural heritage significance can be made with reference to the intrinsic, contextual and associative characteristics of an asset as set out in HES[38] and its accompanying Designation Policy and Selection Guidance. HES Designation Policy and Selection Guidance[39] indicates that the relationship of an asset to its setting or the landscape makes up part of its contextual characteristics.

9.4.5 The Xi'an Declaration[40] set out the first internationally accepted definition of setting with regard to heritage assets and features, indicating that setting is important where it forms part of. or contributes to. the significance of a heritage asset.

9.4.6 While SPP[41] does not differentiate between the importance of the asset itself and the importance of the asset's setting, HES's Managing Change Guidance, in defining what factors need to be considered in assessing the impact of a change on the setting of a historic asset or place, states that the magnitude of the proposed change should be considered "relative to the sensitivity of the setting of an asset"[42]; thereby making clear that assets vary in their sensitivity to changes in setting and thus have a relative sensitivity.

9.4.7 The EIA Handbook suggests that cultural significance aligns with sensitivity but also states that "the relationship between value and sensitivity should be clearly articulated in the assessment"[43]. It is therefore recognised (ibid;) that the importance of an asset is not the same as its sensitivity to changes to its setting. Elements of setting may make a positive, neutral or negative contribution to the significance of an asset. Thus, in determining the nature and level of effects upon assets and their settings by the development, the contribution that setting makes to an asset's significance and thus its sensitivity to changes to setting need to be considered.

9.4.8 This approach recognises the importance of preserving the integrity of the setting of an asset in the context of the contribution that setting makes to the understanding, appreciation and experience of a given asset. It recognises that setting is a key characteristic in understanding and appreciating some, but by no means all, assets. Indeed, assets of High or Very High importance do not necessarily have high sensitivity to changes to their settings (e.g. do not necessarily have a high relative sensitivity). An asset's relative sensitivity to alterations to its setting refers to its capacity to retain its ability to contribute to our understanding and appreciation of the past in the face of changes to its setting. The ability of an asset's setting to contribute to an understanding, appreciation and experience of it and its significance also has a bearing on the sensitivity of that asset to changes to its setting. While heritage assets of High or Very High importance are likely to be sensitive to direct effects, not all will have a similar sensitivity to effects on their setting; this would be true where setting does not appreciably contribute to their significance. The HES's guidance on setting makes clear that the level of effect may relate to "the ability of the setting [of an asset] to absorb new development without eroding its key characteristics"[44]. Assets with Very High or High relative sensitivity to settings effects may be vulnerable to any changes that affect their settings, and even slight changes may erode their key characteristics or the ability of their settings to contribute to the

[28] UNITED KINGDOM. The Ancient Monuments and Archaeological Areas Act 1979: Elizabeth II. Chapter 14 (1979) London: Her Majesty's Stationary Office.

[29] UNITED KINGDOM. Planning (Listed Buildings and Conservation Areas) (Scotland) Act 1997: Elizabeth II. Chapter 9. London: Her Majesty's Stationary Office.

[30] UNITED KINGDOM. Historic Environment (Amendment) (Scotland) Act 2011: Elizabeth II. 2011 asp 3 The Queen's Printer for Scotland: The Stationery Office Limited.

[31] UNITED KINGDOM. Historic Environment (Amendment) (Scotland) Act 2011: Elizabeth II. 2011 asp 3 The Queen's Printer for Scotland: The Stationery Office Limited.

[32] UNITED KINGDOM. Protection of Military Remains Act 1986: Elizabeth II. Chapter 35 (1986) London: Her Majesty's Stationary Office.

[33] SCOTLAND. Scottish Government (2014) Scottish Planning Policy. Available from – [https://www.gov.scot/publications/scottish-planning-policy/document]

[34] UNITED KINGDOM. Planning (Listed Buildings and Conservation Areas) (Scotland) Act 1997: Elizabeth II. Chapter 9. London: Her Majesty's Stationary Office.

[35] UNITED KINGDOM. Planning (Listed Buildings and Conservation Areas) (Scotland) Act 1997: Elizabeth II. Chapter 9. London: Her Majesty's Stationary Office.

[36] SCOTLAND. Scottish Government (2014) Scottish Planning Policy. Available from – [https://www.gov.scot/publications/scottish-planning-policy/document]

[37] SCOTLAND. Scottish Government (2014) Scottish Planning Policy. Available from – [https://www.gov.scot/publications/scottish-planning-policy/pages/2/]

[38] SCOTLAND. HES (2019) Historic Environment Policy for Scotland. Edinburgh: Historic Environment Scotland.

[39] SCOTLAND. HES (2019) Designation Policy and Selection Guidance. Edinburgh: Historic Environment Scotland.

[40] ICOMOS. (2005). Xi'an Declaration on The Conservation Of The Setting of Heritage Structures, Sites And Areas. Adopted in Xi'an, China, by the 15th General Assembly of ICOMOS on 21 October 2005. China: Incorporated International Council on Monuments and Sites.

[41] SCOTLAND. Scottish Government (2014) Scottish Planning Policy. Available from – [https://www.gov.scot/publications/scottish-planning-policy/document]

[42] SCOTLAND. HES (2020) Managing Change in the Historic Environment: Setting. Edinburgh: Historic Environment Scotland. P. 11.

[43] SCOTLAND. SNH & HES (2018) Environmental Impact Assessment Handbook v5. Inverness; Edinburgh: Scottish Natural Heritage & Historic Environment Scotland. P. 184. Available from - https://www.nature.scot/sites/default/files/2018-05/Publication%202018%20-%20Environmental%20Impact%20Assessment%20Handbook%20V5.pdf

[44] SCOTLAND. HES (2020) Managing Change in the Historic Environment: Setting. Edinburgh: Historic Environment Scotland. P. 11.

understanding, appreciation and experience of them. Assets whose relative sensitivity to changes to their setting is lower may be able to accommodate greater changes to their settings without having key characteristics eroded.

9.4.9 The criteria used for establishing an asset's relative sensitivity to changes to its setting is detailed in Table 9.2. This table has been developed based on AOC's professional judgement and experience in assessing setting effects. It has been developed with reference to the policy and guidance noted above including SPP[45], HEPS[46] and its Designation Policy and Selection Guidance[47], the Xi'an Declaration[48], the EIA Handbook[49] and HES's guidance on the setting of heritage assets[50].

Table 9.2 – Criteria for Establishing Relative Sensitivity of a Heritage Asset to Changes to its Setting

Relative Sensitivity	Criteria
Very High	An asset, the setting of which, is critical to an understanding, appreciation and experience of it should be thought of as having Very High Sensitivity to changes to its setting. This is particularly relevant for assets whose settings, or elements thereof, make an essential direct contribution to their cultural significance (e.g. form part of their Contextual Characteristics.[51]
High	An asset, the setting, of which, makes a major contribution to an understanding, appreciation and experience of it should be thought of as having High Sensitivity to changes to its setting. This is particularly relevant for assets whose settings, or elements thereof, contribute directly to their cultural significance (e.g. form part of their Contextual Characteristics[52].
Medium	An asset, the setting of which makes a moderate contribution to an understanding, appreciation and experience of it, should be thought of as having Medium Sensitivity to changes to its setting. This could be an asset for which setting makes a contribution to significance but whereby its value is derived mainly from its other characteristics[53].
Low	An asset, the setting of which makes some contribution to an understanding, appreciation and experience of it, should generally be thought of as having Low Sensitivity to changes to its setting. This may be an asset whose value is predominantly derived from its other characteristics
Marginal	An asset whose setting makes minimal contribution to an understanding, appreciation and experience of it should generally be thought of as having Marginal Sensitivity to changes to its setting.

9.4.11 The determination of a heritage asset's relative sensitivity to changes to its setting is first and foremost reliant upon the determination of its setting and the key characteristics of setting which contribute to its cultural significance and an understanding and appreciation of that cultural significance. This aligns with Stage 2 of the HES guidance on setting (2020, 9)[54]. The criteria set out in Table 9.2 are intended as a guide. Assessment of individual heritage assets is informed by knowledge of the asset itself; of the asset type if applicable and by site visits to establish the current setting of the assets. This will allow for the use of professional judgement and each asset is assessed on an individual basis.

Protection of Military Remains Act 1986

9.4.12 The Protection of Military Remains Act 1986[55] has the principal concern to protect the sanctity of aircraft that are military or maritime graves. The purpose of this safeguard is not primarily archaeological, but the Ministry of Defence (MoD) liaises closely with Department for Culture, Media and Sport and HES in the process of site designation. Any aircraft lost while in military service is automatically protected under this Act and is relevant as an aircraft crash site is recorded within the Proposed Development Area.

9.4.13 There is 1 category of site designated under this act which is applicable to the Proposed Development:

Protected Places

- All aircraft, whether civilian or military are Protected Places if on military service irrespective of whether any loss of life occurred as a result of a crash or whether a crash was during wartime.

9.4.14 Protected Places, unlike sites designated as Controlled Sites under the PMRA Act 1986,[56] do not have an exclusion zone designated around them. Access is allowed on a *'look but don't touch basis'*; however, it should be noted that the MoD advises that groups wishing to undertake surveys of such remains should secure a license from the MoD on receipt of an approved WSI[57]. This precaution is taken in case such surveys unintentionally disturb the asset.

Criteria for Assessing Magnitude of Impact

9.4.15 Potential impacts relate to the possibility of disturbing, removing or destroying in situ remains and artefacts during the construction phase or the placement of new features within their setting during the operational phase. Potential impacts also relate to changes in the settings of heritage assets during the construction and operational phase of the Proposed Development.

9.4.16 The magnitude of the impacts upon heritage assets caused by the Proposed Development is rated using the classifications and criteria outlined in Table 9.3.

Table 9.3- Criteria for Classifying Magnitude of change

Magnitude of change	Criteria
High	Substantial loss of information content resulting from total or large-scale removal of deposits from an asset; Major alteration of an asset's baseline setting, which materially compromises the ability to understand, appreciate and experience the contribution that

[45] SCOTLAND. Scottish Government (2014) Scottish Planning Policy. Available from – [https://www.gov.scot/publications/scottish-planning-policy/document]

[46] SCOTLAND. HES (2019) Historic Environment Policy for Scotland. Edinburgh: Historic Environment Scotland.

[47] SCOTLAND. HES (2019) Designation Policy and Selection Guidance. Edinburgh: Historic Environment Scotland.

[48] ICOMOS. (2005). Xi'an Declaration on The Conservation Of The Setting of Heritage Structures, Sites And Areas. Adopted in Xi'an, China, by the 15th General Assembly of ICOMOS on 21 October 2005. China: Incorporated International Council on Monuments and Sites.

[49] SCOTLAND. SNH & HES (2018) Environmental Impact Assessment Handbook v5. Inverness; Edinburgh: Scottish Natural Heritage & Historic Environment Scotland. Available from - https://www.nature.scot/sites/default/files/2018-05/Publication%202018%20-%20Environmental%20Impact%20Assessment%20Handbook%20V5.pdf

[50] SCOTLAND. HES (2020) Managing Change in the Historic Environment: Setting. Edinburgh: Historic Environment Scotland.

[51] SCOTLAND. HES (2019) Designation Policy and Selection Guidance. Edinburgh: Historic Environment Scotland. P. 10.

[52] SCOTLAND. HES (2019) Designation Policy and Selection Guidance. Edinburgh: Historic Environment Scotland. P. 10.

[53] SCOTLAND. HES (2019) Designation Policy and Selection Guidance. Edinburgh: Historic Environment Scotland.

[54] SCOTLAND. HES (2020) Managing Change in the Historic Environment: Setting. Edinburgh: Historic Environment Scotland.

[55] UNITED KINGDOM. Protection of Military Remains Act 1986: Elizabeth II. Chapter 35 (1986) London: Her Majesty's Stationary Office.

[56] UNITED KINGDOM. Protection of Military Remains Act 1986: Elizabeth II. Chapter 35 (1986) London: Her Majesty's Stationary Office.

[57] SCOTLAND. Aviation Research Group Orkney & Shetland. Pers. comm. Kevin Heath. 22 February 2021

Magnitude of change	Criteria
	setting makes to the significance of the asset and erodes the key characteristics[58] of the setting.
Medium	Loss of information content resulting from material alteration of the baseline conditions by removal of part of an asset; Alteration of an asset's baseline setting that effects the ability to understand, appreciate and experience the contribution that setting makes to the significance of the asset to a degree but whereby the cultural significance of the monument in its current setting remains legible. The key characteristics of the setting[59] are not eroded.
Low	Detectable impacts leading to minor loss of information content. Slight alterations to the asset's baseline setting, which do not affect the ability to understand, appreciate or experience the contribution that setting makes to the asset's overall significance.
Negligible	Loss of a small percentage of the area of an asset's peripheral deposits; A reversible alteration to the fabric of the asset; A marginal alteration to the asset's baseline setting.
None	No effect predicted

Criteria for Assessing Significance

9.4.17 The predicted level of effect on each heritage asset is then determined by considering the asset's importance and/or relative sensitivity in conjunction with the predicted magnitude of the impact. The method of deriving the level of effect is provided in Table 9.4.

Table 9.4 - Level of Effects based on Inter-Relationship between the Sensitivity of a Heritage Asset and/or its setting and the Magnitude of Impact

Magnitude of Impact	Sensitivity				
	Negligible	Low	Medium	High	Very High
High	Minor	Moderate	Moderate	Major	Major
Medium	Negligible/Neutral	Minor	Moderate	Moderate	Major
Low	Negligible/Neutral	Negligible/Neutral	Minor	Minor	Moderate
Negligible	Negligible/Neutral	Negligible/Neutral	Negligible/Neutral	Minor	Minor

9.4.18 The level of effect is judged to be the interaction of the asset's importance and/or relative sensitivity (Tables 9.1 and/or 9.2) and the magnitude of the impact (Table 9.3). In order to provide a level of consistency, the assessment of importance and relative sensitivity, the prediction of magnitude of impact and the assessment of level of effect is guided by pre-defined criteria. However, a qualitative descriptive narrative is also provided for each asset to summarise and explain each of the professional value judgements that have been made in establishing sensitivity and magnitude of impact for each individual asset.

9.4.19 Using professional judgment and with reference to the Guidelines for Environmental Impact Assessment (as updated)[60], and the EIA Handbook[61] the assessment considers moderate and greater effects to be significant (shaded grey in Table 9.4), while minor and lesser effects are considered not significant.

Integrity of Setting

9.4.20 SPP notes that where there is potential for a proposed development to have an adverse effect on a Scheduled Monument or on the integrity of its setting permission should only be granted where there are 'exceptional circumstances'[62]. Adverse effects on integrity of setting are judged here to relate to whether a change would seriously adversely affect the asset's key attributes or elements of setting which contribute to an asset's significance to the extent that that the setting of the asset can no longer be understood or appreciated.

9.4.21 In terms of effects upon the setting of heritage assets, it is considered that only those effects identified as 'significant' in the assessment will have the potential to adversely affect integrity of setting. Where no significant effect is found it is considered that the integrity of an asset's setting will remain intact. This is because for many assets, setting may make a limited contribution to their significance and as such changes would not affect integrity of their settings. Additionally, as set out in Table 9.3, lower ratings of magnitude of change relate to changes that would not obscure or erode key characteristics of setting.

9.4.22 Where significant effects are found, a detailed assessment of adverse effects upon integrity of setting is made. Whilst non-significant effects are unlikely to affect integrity of setting, the reverse is not always true. That is, the assessment of an effect as being 'significant' does not necessarily mean that the adverse effect to the asset's setting will harm its integrity. The assessment of adverse effect upon the integrity of an asset's setting, where required, will be a qualitative one, and will largely depend upon whether the effect predicted would result in a major impediment to the ability to understand or appreciate the heritage asset and therefore reduce its cultural significance.

Criteria for Assessing Cumulative Effect

9.4.23 In terms of cultural heritage, it is necessary to consider whether the effects of the Proposed Development in conjunction with other schemes would result in an additional cumulative change upon the settings of heritage assets, beyond the levels predicted for the Proposed Development alone. The in-combination effect also needs to be considered. However, only those assets which are judged to have the potential to be subject to significant cumulative effects will be included in the detailed cumulative assessment provided. The cumulative assessment will have regard to the guidance on cumulative effects upon heritage assets as set out in Environmental Impact Assessment Handbook V5[63] and will utilise the criteria used in determining effects resulting from the Proposed Development alone as outlined in Tables 9.2-9.5. The assessment of cumulative effects will consider whether there would be an increased impact, either additive or synergistic, upon the setting of heritage assets as a result of adding the Proposed Development to a baseline, which may include operational, under construction, consented or proposed developments as agreed with DGC. In determining the degree to which a cumulative effect may occur as a result of the addition of the Proposed Development into the cumulative baseline a number of factors are taken into consideration including:

- the distance between wind farms;
- the interrelationship between their Zones of Theoretical Visibility (ZTV);

[58] SCOTLAND. HES (2020) Managing Change in the Historic Environment: Setting. Edinburgh: Historic Environment Scotland.

[59] SCOTLAND. HES (2020) Managing Change in the Historic Environment: Setting. Edinburgh: Historic Environment Scotland.

[60] IEMA, (2017). Guidelines for Environmental Impact Assessment. Published 2016. Updated 2017.

[61] SCOTLAND. SNH & HES (2018) Environmental Impact Assessment Handbook v5. Inverness; Edinburgh: Scottish Natural Heritage & Historic Environment Scotland Available at: https://www.nature.scot/sites/default/files/2018-05/Publication%202018%20-%20Environmental%20Impact%20Assessment%20Handbook%20V5.pdf

[62] SCOTLAND. Scottish Government (2014) Scottish Planning Policy. p. 35 Available from – [https://www.gov.scot/publications/scottish-planning-policy/document]

[63] SCOTLAND. SNH & HES (2018) Environmental Impact Assessment Handbook v5. Inverness; Edinburgh: Scottish Natural Heritage & Historic Environment Scotland. Available from - https://www.nature.scot/sites/default/files/2018-05/Publication%202018%20-%20Environmental%20Impact%20Assessment%20Handbook%20V5.pdf

- the overall character of the asset and its sensitivity to wind farms;
- the siting, scale and design of the wind farms themselves;
- the way in which the asset is experienced;
- the placing of the cumulative wind farm(s) in relation to both the individual proposal being assessed and the heritage asset under consideration; and
- the contribution of the cumulative baseline schemes to the significance of the effect, excluding the individual proposal being assessed, upon the setting of the heritage asset under consideration.

Criteria for assessing residual effects

9.4.24 The residual effect is what remains following the application of mitigation and management measures, and construction has been completed and is thus the final level of effect associated with the Proposed Development. The level of residual effect is defined using criteria outlined in Table 9.2 to Table 9.5. No direct mitigation is possible for setting effects (beyond embedded mitigation by design) and therefore residual effects on the setting of heritage assets would be the same as predicted for the operational phase. The predicted level of effect on each heritage asset is then determined by considering the asset's sensitivity in conjunction with the predicted magnitude of the impact.

9.5 CONSULTATION

9.5.1 Table 9.5 summarises the consultation responses received regarding Archaeology and Cultural Heritage and provides information on where and/or how they have been addressed in this assessment.

Table 9.5: Consultation Responses

Consultee	Consultation Response Date/Type	Consultation Response	Applicant Action
Historic Environment Scotland (HES)	24 July 2020/Scoping Response	HES in their scoping response of the 24 July 2020 were broadly happy with the approach to assessing impacts. HES recommended that impacts on the setting of heritage assets should be assessed using photomontage and wireframe visualisations where impacts are likely to be highest. They noted that the EIA Scoping Report did not identify any cultural heritage assessment viewpoints and they recommended further engagement with HES as the assessment progressed and more detailed ZTV information became available. HES noted the potential for cumulative impacts on the setting of heritage assets caused by the Proposed	Craigengillen Inventory Designed Landscape (GDL111) (Asset 217) has been subject to setting assessment (Section 9.7). Policy and Guidance adhered to as relevant. Detailed assessments of these assets undertaken and presented in this EIAR Chapter. Photomontages, wireframes and ZTV have been used to inform the assessment of impacts upon the setting of heritage assets. Cumulative impacts have been assessed as part of this EIAR Chapter in Section 9.8.
		Development in combination with other existing, proposed and consented wind farms in the surrounding area and recommended that cumulative impacts should be assessed and examined through the use of cumulative visualisations. They recommended that setting impact on Craigengillen Inventory Designed Landscape (GDL111) (Asset 217) which is located northwest beyond the 10 km Study Area be given consideration.	
Dumfries and Galloway Council Archaeology Service (DGAS)	27 April 2020/Scoping Response	DGAS provided a scoping response on the 27 April 2020 DGAS advised that indirect setting assessment on the following assets must be included in any assessment: • Scheduled Monuments at Woodhead Mine (Asset 19, List No. SM5184), Holm of Daltallochan standing stone and stone circle (Asset 25, List No. SM1029), Cairn Avel (Asset 24, List No. SM1006), Stroanfreggan Craig, fort (Asset 30, List No. SM1095), Stroanfreggan, cairn (Asset 27, List No. SM1043), Dundeugh Castle (Asset 32, List No. SM2476) and Craigengillan, cairn (Asset 31, List No. SM2238). • Non-designated monuments of national significance at Little Auchrae (Asset 218, MDG11404), Round Craigs (Asset 219, MDG3944) and Culmark Hill (Asset 220, MDG3845). • Archaeologically Sensitive Area (DGC	Assessment of the potential form impacts upon the setting of these assets has been included in the EIAR. See Section 9.7.

Consultee	Consultation Response Date/Type	Consultation Response	Applicant Action
		Policy HE4) at Bardennoch-Garryhorn (Asset 221), Stroanfreggan (Asset 222) and Polharrow Burn (Asset 223). • Non-Inventory designed landscape at Knockgray Policies (89, MDG25538)	
HES	19 August 2021/Direct Consultation by AOC Archaeology Group	In response to AOC Archaeology Group's post scoping consultation and proposed visualisations, HES, in their response of 19 August 2021 recommended a photomontage as well as a wireline for Earlston Castle Asset 23, List No. SM1118 (Section 9.7, Figure 008.tif). HES were content to include a visualisation from the (GDL111) (Asset 217) to be subject to setting assessment.	Craigengillen Inventory Designed Landscape (Asset 217, GDL111) to be subject to setting assessment (Section 9.7,Figure 9.22).
DGAS	23 August 2021/Direct Consultation by AOC Archaeology Group	In response to AOC Archaeology Group's post scoping consultation DGAS, in their scoping response of 23 August 2021, advised that the indirect setting assessment should take into consideration the following: • As there are current forestry proposals to open up views from the Round Craigs (Asset 219) to the east and south, returning something of its landscape setting and prominence, it is important in considering the setting of Craigengillan to consider views into it, from Round Craigs and Stroanfreggan Fort (Asset 27, List No. SM1043) in particular, rather than just views out from the asset. • An additional wireline was requested from Culmark Hill (Asset 220,	Detailed assessments of these assets undertaken and presented in this EIAR Chapter in Section 9.7 Wireline Figure 017.tif has been produced and Asset 219 has been subjected to setting assessment in Section 9.7. • Wireline Figure 018.tif has been produced

Consultee	Consultation Response Date/Type	Consultation Response	Applicant Action
		MDG3845) which lies close to the route of the Southern Upland Way and is part of the wider prehistoric landscape in this upland zone overlooking the Water of Ken. It is a non-designated HER asset of National Significance.	and Asset 219 has been subjected to setting in Section 9.7
Carsphairn Heritage Initiative	2 August 2021/Direct Consultation by AOC Archaeology Group and Vattenfall	Carsphairn Heritage Initiative recommended further research into the Gaelic placenames within the Proposed Development Area and the possibility of a hiking trail linking the Proposed Development Area to other hiking trails. Locations on this trail could have information boards with QR Codes for visitors to learn further information regarding specific areas and heritage assets within the Proposed Development Area. Archaeological survey and investigation projects involving the local community were also discussed including a survey on Asset 17, the Blenheim bomber crash site.	AOC Archaeology Group to recommend further mitigation proposed by Carsphairn Heritage Initiative.(Section 9.10.3)

9.6 BASELINE

Method of Baseline Characterisation

Extent of the Study Area

9.6.1 The aim of this assessment is to identify the archaeological and cultural heritage significance of the Proposed Development and to identify the likely significant direct and setting effects which may result as a consequence of the Proposed Development. Four study areas were identified for this assessment:

- A core study area (the Proposed Development Area) which includes all land within the Proposed Development Area which is subject to assessment for potential direct effects. This study area was subject to identification of known heritage assets, map regression, review of aerial photographs, review of Scottish remote sensing data and walkover survey which were used to identify cultural heritage assets which may be directly affected by the Proposed Development;
- A 1 km study area (the 1 km Study Area) for the identification of all known heritage assets and known previous archaeological interventions in order to help predict whether any similar hitherto unknown archaeological remains are likely to survive within the Proposed Development Area and thus be impacted by the Proposed Development;

- A 5 km study area (the 5 km Study Area) for the assessment of potential effects on the setting of all designated heritage assets including Scheduled Monuments; all Listed Buildings; Inventoried Gardens and Designed Landscapes; Inventoried Battlefields and Conservation Areas and non-designated nationally important assets as identified by Dumfries and Galloway HER. This study area is covered by the Zone of Theoretical Visibility (ZTV); and
- A 10 km study area (the 10 km Study Area) for the assessment of potential effects on the setting of nationally important designated heritage assets including Scheduled Monuments; Category A Listed Buildings; Inventoried Gardens and Designed Landscapes and Inventoried Battlefields. The 10 km Study Area also identifies Dumfries and Galloway HER assets that are not statutorily designated but which are defined as being of 'National Significance' by the Archaeology Service.

Desk Study

9.6.2 The following sources were consulted for the collation of data:

- Dumfries and Galloway HER: for a digital database extract in GIS for all assets within 10 km of the Proposed Development Area;
- The National Record for the Historic Environment (NRHE) as held by HES;
- Spatial data and descriptive information for designated assets held on Historic Environment Scotland Data website;
- Ordnance Survey maps (principally First and Second Edition), and other published historic maps held in the Map Library of the National Library of Scotland;
- Online aerial satellite imagery, Google Earth, bing, Environmental Systems Research Institute (ESRI) aerial mapping;
- Scottish Remote Sensing Portal for Light Detection And Ranging (LiDAR) data;
- Vertical and oblique aerial photographs held by the National Collection of Aerial Photographs (NCAP), as held by HES;
- Published bibliographic sources, including historical descriptions of the area (Statistical Accounts, Parish Records);
- The Scottish Palaeoecological Database; and
- The Historic Land-use Assessment (HLA) Data (HLAmap) for Scotland.

Proposed Development Area

9.6.3 Desk-based assessment, analysis of publicly available LiDAR data and an archaeological walkover survey of the Proposed Development Area has identified 89 cultural heritage assets that lie within the Proposed Development Area (Figure 9.1).

9.6.4 There is one designated asset within the Proposed Development Area, the crash site of a Blenheim Bomber Mk IV aircraft which crashed on 8 November 1939.

Wider Survey Area

1 km Study Area

9.6.5 Within the 1 km Study Area, there is one Scheduled Monument, one Listed Building of Category B status, one Listed Building of Category C status and one Landscape Park designated as being of Regional Significance in the HER.

5 km Study Area

9.6.6 Within the 5 km Study Area, there are an additional nine Scheduled Monuments, six Listed Buildings of Category B status, four Listed Buildings of Category C status, five assets deemed to be of 'National Significance' in the HER and two Archaeologically Sensitive Areas (ASAs).

10 km Study Area

9.6.7 Within the 10 km Study Area, there are an additional six Scheduled Monuments, one Listed Building of Category A status and one ASA.

Site Visit to Proposed Development Area

9.6.8 An archaeological walkover survey of the Proposed Development Area was undertaken from Monday 26 October 2020 to Thursday 29 October 2020 with the aim of identifying any previously unknown remains. The weather varied from clear to rainy with the rain inhibiting long-distance views across the landscape within the Proposed Development Area. In such conditions the walkover survey focussed on assessing the landscape around the proposed turbine positions, and views across the Proposed Development Area were acquired on days when there was better visibility. All known and accessible heritage assets were assessed in the field to establish their survival, extent, significance and relationship to other assets. Any conditions affecting the visibility during the survey were also recorded. All heritage assets encountered were recorded and photographed. The location of features noted in the field was recorded on a US Global Positioning System (GPS) Navstar enabled iPad using ESRI's ArcGIS Collector software. All features were recorded directly through ArcGIS Collector in full British National Grid coordinates.

9.6.9 The majority of the Proposed Development Area consists of rough pasture grazing in the valleys between the prominent hills that dominate the northern portion of the Proposed Development Area and on the lower lying slopes (Plate 1). Semi-isolated patches of improved pasture are situated within the southern portion of the Proposed Development Area, closer to the farms and infrastructure of Knockgray, Marbrack and Furmiston (Plate 2). Areas of heathland with isolated patches of woodland comprised the remainder of the Proposed Development Area, particularly in the eastern portion and along the Marbrack Burn. The ground was noticeably boggy and the length of the grasses was tall. A regular spacing of cut drainage ditches were observed leading down from the middle slopes of the hills in the northern portion of the Proposed Development Area (Plate 3). These ditches and the occasional wet and boggy ground made the terrain difficult to traverse in some portions of the Proposed Development Area, particularly the northern portion.

9.6.10 Since AOC Archaeology's archaeological walkover survey of the Proposed Development and setting assessment surveys of heritage assets areas of the Proposed Development have been subject to tree plantation. As of October 2021 the proposed Marbrack plantation (Figure 12.2) was fenced, cultivated and planted. The proposed plantation at Furmiston was at the point of fencing and cultivation and target date of planting from April 2022.

9.6.11 These proposed plantations will be cultivated by producing made mounds or by shallow ploughing. Cross drains will be placed at approximately 50 metres with drops of 3 degrees to catch water; these cross drains will lead towards the watercourses.

9.6.12 Dry stone wall field boundaries separate the land ownership between the farms of Knockgray, Marbrack and Furmiston in the southern portion of the Proposed Development Area; these walls tend to follow the burns that divide the Proposed Development Area (Plate 4).

9.6.13 Within the western portion of the Proposed Development Area an existing trackway (Plate 5) leads from north of the HER Asset of Regional Significance at Knockgray Policies Landscape Park (Asset 89, HER No. MDG25538); this trackway extends halfway into the Proposed Development Area. There are no major trackways in the eastern portion of the Proposed Development Area and no trackway extends into the northern portion of the Proposed Development Area.

9.6.14 Few finds or features of an archaeological nature were recorded within the Proposed Development Area during the walkover survey. The majority of the assets recorded during the walkover survey of the Proposed Development Area were located within areas of pastureland consisting of lower lying grasses, between the Marbrack Burn and the Polshagg Burn. Most of these assets have been assessed as possible clearance cairns and it was noticeable that there were patches of exposed rock along the lower slopes of the hills in this area. These assets are likely to be impacted by the proposed plantation within these areas.

9.6.15 Two possible prehistoric burial cists, Assets 169 and 170 were recorded in this area. Asset 169 (Plate 6) could be identified as a sub-rectangular feature with rounded edges measuring approximately 1.5 m by 1.5 m while Asset 170 (Plate 8) situated 8.94 m to the southwest of Asset 169 was approximately 1.5 m in size and partially hidden by turf.

9.6.16 Isolated from this group, sits Asset 165; a more ambiguous asset which could potentially be a prehistoric burial cairn (Plate 9) rather than a field clearance cairn. This asset was located 529 m south of an isolated upright stone at Asset 166 (Plate 10). It is not known whether this stone, standing partially upright to a height of approximately 0.5 m high dates to the prehistoric period or is simply a marker stone that may have been set up in the post-medieval period. This asset is notable within the Proposed Development Area due to the relative lack of archaeological finds or features; in this regard an upright stone placed by anthropogenic action, whatever period it may have been deposited, could be regarded as a notable find. Such a stone could suggest some prehistoric activity within the landscape occupied by the Proposed Development Area. If placed during subsequent periods as a land marker it would still be relatively notable due to the sparsity of finds or features within this portion of the Proposed Development Area. However, it is also possible that this stone, although relatively isolated from outcrops of stone, has been deposited at its current location through natural processes and merely looks as if it may be a standing stone purposely set by human activity.

9.6.17 One potential prehistoric hut circle was recorded at Asset 164 (Plate 7) on the lower southwest facing slopes of Furmiston Craig and consisted of a rim of stones measuring approximately 3 m by 3 m.

Limitations of Scope

9.6.18 This chapter is based upon data obtained from publicly accessible archives as described in the Data Sources in Paragraph 9.6.2 above. NRHE data and HES Designation data was downloaded from HES' Pastmap portal (https://pastmap.org.uk/) in September 2020 and updated in June 2021 and this data is current to the latter date. HER data was received in October 2020 and is current to this date.

9.6.19 Due to the Covid-19 pandemic it was not possible to view hard copies of historic aerial photographs at John Sinclair House. As such only the online images held by HES were examined.

9.6.20 Given the nature of the terrain, consisting of rough pasture and moorland and not arable farmland, there are limitations to the review of aerial photography. These limitations were mitigated through examination of online modern APs and satellite imagery and examination of the LiDAR data for the site

Designations

9.6.21 There is one aircraft crash site designated as a Protected Place within the Proposed Development Area. There are no World Heritage Sites within the 10 km Study Area. There are 16 Scheduled Monuments, one Listed Building of Category A status, seven Listed Buildings of Category B status, five Listed Buildings of Category C status, one Landscape Park designated as being of Regional Significance by the Dumfries and Galloway HER and four non-designated asset designated as being of National Significance by the Dumfries and Galloway HER within the prescribed study areas for the assets as noted above in Paragraph 9.6.1. One asset, Scottish Dark Skies Observatory within the nationally designated Garden and Designed Landscape at Craigengillan (Asset 217, List No. GDL00111) is outwith the 10 km Study Area and has been included within this assessment following consultation with HES, although it has since been destroyed by a fire following assessment.

Archaeological and Historical Background

Prehistoric and Roman (8000 BC-AD410)

9.6.22 A number of assets that potentially date to the prehistoric period have been recorded within the Proposed Development Area. The majority of these assets are within the southern portion of the Proposed Development Area; a landscape of lower lying hills and valleys of rough grazing in contrast to the steeper topography in the northern portion of the Proposed Development Area. These assets are also closer to any transportation routes offered by the Water of Deugh, either through water craft or terrestrial trackways and routes that would have utilised the easier, lower lying ground closer to the river.

9.6.23 Assets 164, 179, 195 and 198 have been identified as possible prehistoric hut circles. Asset 164 was recorded during AOC Archaeology Group's walkover survey of the Proposed Development Area and consists of a rim of stones measuring roughly 3 m by 3 m. Assets 179, 195 and 198 were recorded during LiDAR analysis undertaken by AOC Archaeology Group; however the confidence of their assessment as hut circles has been rated as **Low**.

9.6.24 LiDAR analysis also suggested a sub-oval mound, possibly a cairn at Asset 194. Measuring 5 m by 4 m, the LiDAR analysis confidence that this asset is a cairn was assessed as **Low**.

9.6.25 A number of assets within the Proposed Development Area have been recorded as field clearance cairns. Due to the purpose behind their creation, clearance cairns are difficult to date; they tend to be simple mounds of stones created when the land is cleared and therefore it is unknown whether any of these date to the prehistoric or Roman periods. Without intrusive investigations they are not distinctive enough to date and such features tend not to have artefactual evidence contained within them; this would limit any techniques for dating to environmental sampling. It should also be noted that environmental sampling may not recover sufficient material from these types of assets to date them.

9.6.26 No known assets dating to the Roman period are located within the Proposed Development Area.

9.6.27 No known assets that can be definitely dated to the Roman period have been identified within the 1km Study Area and no designated assets of this date have been identified within the 5 km or 10 km Study Areas.

9.6.28 Although a few assets that could potentially date to the prehistoric period have been recorded within the NRHE, HER and during AOC Archaeology Group's walkover survey, in AOC Archaeology Group's professional opinion, and given evidence gathered, it is considered that there would be a **Low** potential for finds or features dating to the prehistoric period to be present within the Proposed Development Area.

9.6.29 Due to the lack of finds or features within the Study Areas that have been assessed as belonging to the Roman period, in AOC Archaeology Group's professional opinion, and given evidence gathered, it is considered that there would be a **Low** potential for finds or features dating to the Roman period to be present within the Proposed Development Area.

Early Historic and Medieval (AD 410-1600)

9.6.30 The majority of assets recorded within the Proposed Development Area probably date to the early historic or medieval periods. Such assets consist of farmsteads, enclosures, fields systems, sheep folds and clearance cairns. It is notable that the majority of these assets are located within the southern portion of the Proposed Development Area; which comprises a landscape of lower lying hills and valleys of rough grazing in contrast to the steeper topography in the northern portion of the Proposed Development Area.

9.6.31 A number of field clearance cairns previously discussed could date to either the early historic or medieval periods. However, as previously discussed, these assets are difficult to date with any certainty.

9.6.32 Within the Proposed Development Area and in the immediate area surrounding it, there is a low density of finds or features of any period and there are relatively few finds or features that can be positively identified with the early historic and medieval period. Therefore, in AOC Archaeology Group's professional opinion, and given evidence

gathered, it is considered that there would be a **Low** potential for finds or features dating to the early historic or medieval periods to be present within the Proposed Development Area.

Post-medieval (AD 1600-1900)

9.6.33 Early pre-Ordnance Survey maps of the Proposed Development Area such as Bleau's map of 1654[64] (Figure 9.5) tend to be schematic and lack detail. Marbrack, labelled as *'Morbrack*' is depicted, and a patch of woodland labelled as *'Banck',* along with a site depicted at *'Knokracks',* may be associated with Asset 89, Knockgray Policies, a Landscape Park deemed to be of Regional Significance in the Dumfries and Galloway HER. No settlement is depicted in the location of Carsphairn on Blaeu's map.

9.6.34 Roy's map of 1752-55[65] (Figure 9.6) is the first map to show the area around the Proposed Development Area in detail. Carsphairn is depicted (labelled as *'Carsfernkirk'*) to the west of the Proposed Development Area. Knockgray is depicted, as are the farms of Marbrack (labelled *'Mursbrack'*) and Furmiston (labelled as *'formiston'*). The rough landscape within the Proposed Development Area is depicted with hills, valleys and burns equating to the modern landscape.

9.6.35 The Ordnance Survey map of 1853[66] (Figure 9.7) is the first map to show all details concerning the Proposed Development Area and labels Quantans Hill. The Proposed Development Area is shown as relatively empty with the occasional sheep ree and field enclosure depicted. The landscape is shown as open moorland and rough pasture with a few areas of forestland bordering the Proposed Development Area. The majority of the features depicted are land boundaries with the occasional enclosure situated within the southern portion of the Proposed Development Area, nearer the farms of Knockgray, Marbrack and Furmiston.

9.6.36 The Ordnance Survey map of 1895[67] (Figure 9.8) does not show any appreciable differences from the Ordnance Survey map of 1853[68] (Figure 9.7). Asset 1, Cemetery Wood, Knockgray was chosen as a burial ground by Captain Clark Kennedy of Knockgray, prior to his death in 1894. It does not feature on this map. However, the Ordnance Survey map of 1895 was surveyed in 1894 and published in 1895 and this could account for its lack of depiction.

9.6.37 Overall, there is a distinct lack of assets recorded in the NRHE, HER, historic mapping and during AOC Archaeology Group's walkover survey of the Proposed Development Area that date to the post-medieval period Therefore, in AOC Archaeology Group's professional opinion, and given evidence gathered, it is considered that there would be a **Low** potential for finds or features dating to the post-medieval period to be present within the Proposed Development Area.

Modern (AD post 1900)

9.6.38 There are two assets that date to the modern period within the Proposed Development Area; Asset 1, Cemetery Wood, Knockgray and Asset 17, the crash site of a Bristol Blenheim Mk IV bomber which dates to 8 November 1939.

9.6.39 Asset 1, Cemetery Wood, Knockgray is clearly depicted on the Ordnance Survey mapping of 1909-10[69] (Figure 9.9).

9.6.40 Asset 17 is the crash site of a Bristol Blenheim Mk IV bomber which crashed on 8 November 1939.

9.6.41 The Bristol Blenheim light bomber (Reg. No. P4848) crashed on the 8 November 1939 whilst in service with the Royal Air Force (RAF) killing its only occupant, the pilot, Flight Lt. Kenneth Eyres. The wreckage lies within the Proposed Development Area on the lower northern slopes of Beninner at a height of around 44 m AOD (Asset 17). P4848 appears to have had an unusual service history as it was attached to the Special Duties Flight, a highly confidential unit attached to the Air Ministry Research Establishment (AMRE) that was responsible for testing radio, radar and other emerging military technology. Five aircraft, four Blenheims and a Fairey Battle, from the flight took off from RAF Perth on the 8 November 1939 en route to RAF St. Athan in Glamorganshire. Only three of the aircraft were to reach Wales, poor weather forced the Battle to land at Blackpool whilst the final Blenheim (P4848) could not be located at any airfield and was consequently reported overdue.

9.6.42 It was to take the RAF nine days to locate P4848, which was eventually spotted on the slopes of Beninner on the 17 November 1939. It is noticeable that Asset 17 is situated on relatively flat ground between the hill of Benninner and Green Hill rather than close up against one of the hills. How Flight Lt. Kenneth Eyres came to crash at the location of Asset 17 is not known, but the position on this flatter ground suggests that the crash did not occur as a result of hitting the higher upland terrain of either hill. Instead it is possible that Eyres had problems with either his engines or fuel, in addition to any navigational issues, and may have been attempting an emergency crash landing between the two hills. Unfortunately, if this is the case, it did not prove to be a survivable crash landing.

9.6.43 The wreckage was guarded by personnel from RAF West Freugh who may have been responsible for the burial of Eyres body, as the Commonwealth War Graves Commission record his final resting place as The Glebe Cemetery in Stranraer, which is the nearest town to West Freugh. The principal purpose of the guard however appears to have been safeguarding the *'special installation'* that was attached to the aircraft whilst they awaited the arrival of specialist personnel from the ARME who were to recover it. The precise nature of the *'special installation'* is unknown although it may have been a Mk. II Airborne Interception Radar that the Special Duties Flight first fitted to their Blenheims in November 1939. Intended to allow aircraft to locate and target German bombers, the Mk. II does not appear to have been a particularly successful radar, due to its ineffective minimum range and by the time it entered service in May 1940, the Mk. III had already been fitted to the experimental Blenheims. The Mk. III entered service with operational Blenheim squadrons in July 1940 whilst testing of the Mk. IV commenced in July 1940. The progress achieved by the testing teams at Perth, St. Athan and University College, Dundee was immense, the Mk. II radar was found to have a minimum range of 1000 – 3,500 feet (305 – 1,065 m) whilst by the time the Mk. IV was tested a mere seven months later this had been reduced to 500 feet (152 m). The effectiveness of the Mk. IV when fitted to Bristol Beaufighter night fighters was demonstrated when they were thrown into action over London during the winter of 1940 to 1941 and the spring of 1941. The first 'kill' with a Mk. IV occurred on the night of the 15/16 November 1940 when a Beaufighter from No. 604 Squadron shot down a Junkers JU88-5 over Chichester almost a year to the day after the wreckage containing Kenneth Eyres was spotted on a remote hillside.

9.6.44 Overall, other than Asset 17, there is a distinct lack of assets recorded in the NRHE, HER, historic mapping and during AOC Archaeology Group's walkover survey of the Proposed Development Area that date to the modern period Therefore, in AOC Archaeology's professional opinion, and given evidence gathered, it is considered that

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[64] UNITED KINGDOM. National Library of Scotland. Blaeu, J. (1654) Gallovidiae pars media quae Deam et Cream fluvios interjacet, [vulgo], The Middle part of Galloway, which lyeth betweene the rivers Dee and Cree.

[65] UNITED KINGDOM. British Library. Roy, W. (1747-55) Military Survey of Scotland.

[66] UNITED KINGDOM. Ordnance Survey (1853) Kirkcudbrightshire, Sheet 5 (includes: Carsphairn). Surveyed: 1850-51. Published: 1853.

UNITED KINGDOM. Ordnance Survey (1853) Kirkcudbrightshire, Sheet 9 (includes: Carsphairn; Dalry; Kells). Surveyed: 1849-50. Published: 1853.

[67] UNITED KINGDOM. Ordnance Survey (1895) Kirkcudbrightshire VII.SE. Surveyed: 1894. Published: 1895.

UNITED KINGDOM. Ordnance Survey (1895) Kirkcudbrightshire VII.SE. Surveyed: 1894. Published: 1895.

[68] UNITED KINGDOM. Ordnance Survey (1853) Kirkcudbrightshire, Sheet 5 (includes: Carsphairn). Surveyed: 1850-51. Published: 1853.

UNITED KINGDOM. Ordnance Survey (1853) Kirkcudbrightshire, Sheet 9 (includes: Carsphairn; Dalry; Kells). Surveyed: 1849-50. Published: 1853.

[69] UNITED KINGDOM. Ordnance Survey (1909) Kirkcudbrightshire IW.SW (includes: Carsphairn). Revised: 1907. Published: 1909.

UNITED KINGDOM. Ordnance Survey (1909) Kirkcudbrightshire VIII.NW (includes: Carsphairn). Revised: 1907. Published: 1909.

UNITED KINGDOM. Ordnance Survey (1909) Kirkcudbrightshire VIII.NE (includes: Carsphairn). Revised: 1907. Published: 1910.

UNITED KINGDOM. Ordnance Survey (1910) Kirkcudbrightshire VIII.SW (includes: Carsphairn). Revised: 1907. Published: 1910.

there would be a **Low** potential for finds or features dating to the post-medieval period to be present within the Proposed Development Area.

Aerial and satellite imagery

9.6.45 A review of vertical aerial photographs held by NCAP, as well as available oblique photographs, satellite imagery (Google Earth, ESRI mapping, Getmapping aerial data, and Scottish remote sensing LiDAR data) was undertaken to inform this assessment. Four vertical aerial photographs from Sortie ASS/62388 were available on NCAP online (Available at: https://ncap.org.uk/, frames 0168 to 0170) at a scale of 1:24,000. Due to the Covid-19 pandemic it was not possible to view hard copies of historic aerial photographs at John Sinclair House. As such only the online images held by HES were examined. The imagery showed an upland landscape with few or little changes from the landscape visible in modern Google Earth photography and conformed to the landscape viewed and assessed during the walkover survey undertaken by AOC Archaeology Group from Monday 26 October 2020 to Thursday 29 October 2020. The available images were also at a scale of 1:24000. Although they were clear, this limited the amount of detail that was identifiable to the assessor.

LiDAR Analysis

9.6.46 AOC Archaeology undertook analysis of publicly available LiDAR datasets to identify points of possible heritage assets within the Proposed Development Area. The data is derived from:

- Scottish Remote Sensing Portal for LiDAR data.
  - Publicly available LiDAR datasets; https://remotesensingdata.gov.scot/data#/map

9.6.47 The analysis was undertaken in Relief Visualization Toolbox Version 1.3 using Hill Shading and Local Relief Model by an experienced assessor in LiDAR analysis. Features observed in the processed LiDAR data were digitised. An assessment of what the features could be was undertaken and a confidence rating was assigned. The LiDAR analysis was undertaken alongside the existing datasets listed above in the Desk Study Section 9.6.2; this prevented unnecessary duplication of heritage assets already listed in AOC's gazetteer of Heritage Assets and also allowed additional analysis to be undertaken of a few existing assets where the LiDAR data provided additional information.

9.6.48 Possible features observed include cairns, enclosures, peat cuttings and hut circles. The majority of these assets had been previously recorded in the NRHE and HER; the LiDAR analysis provided an opportunity to confirm the presence and extent of these assets and provide a more accurate location where appropriate. None of these potential assets are located in close proximity to the proposed turbines.

Archaeological and cultural heritage importance

9.6.49 Known heritage assets within the Proposed Development Area have been carried forward for a detailed assessment with regard to consideration of direct impacts upon known heritage assets within the Proposed Development Area. Given the preliminary findings outlined above and in consultation with HES and Dumfries and Galloway Archaeology Service the following assets have been carried forward for detailed setting assessment:

- Scheduled Monument at Woodhead lead mines and smelter, Carsphairn (Asset 18, List No. SM5391);
- Scheduled monument at Woodhead Mine (Asset 19, List No. SM5184);
- Scheduled Monument at Earlston Castle (Asset 23, List No. SM1118);
- Scheduled monument at Cairn Avel (Asset 24, List No. SM1006);
- Scheduled Monument of Holm of Daltallochan, Stone Circle and Standing Stone (Asset 25, List No. SM1029);
- Scheduled Monument of Holm of Daltallochan Cross Slab (Asset 26, List No. SM1106);
- Scheduled Monument at Stroanfreggan Bridge, cairn (Asset 27, List No. SM1043);
- Scheduled monument at Stroanfreggan Cairn Fort (Asset 30, List No. SM1095);
- Scheduled Monument at Craigengillan Cairn (Asset 31, List No. SM2238);
- Scheduled Monument at Dundeugh Castle (Asset 32, List No. SM2476);
- HER Asset of National Significance at Lagwine Cairn (Asset 79, HER No. MDG25538);
- HER Asset of Regional Significance at Knockgray Policies Landscape Park (Asset 89, HER No. MDG25538):
- Inventory Garden and Designed Landscape at Craigengillan, viewpoint from Scottish Dark Skies Observatory (Asset 217, List No. GDL00111);
- HER Asset of National Significance at Little Auchrae, Farmstead (Asset 218, HER No. MDG11404);
- HER Asset of National Significance at Round Craigs, landscape containing cairns, clearance cairns, cultivation remains and burnt mounds. (Asset 219, HER No. MDG3944);
- HER Asset of National Significance at Culmark Hill Cairn (Asset 220, HER No. MDG3845);
- Bardennoch-Garryhorn Archaeologically Sensitive Area (Asset 221);
- Stroanfreggan Archaeologically Sensitive Area (Asset 222); and
- Polharrow Burn Archaeologically Sensitive Area (Asset 223).

9.6.50 The importance of these assets is detailed in Section 9.7 below.

9.7 POTENTIAL EFFECTS

Construction Effects

9.7.1 Construction effects on cultural heritage receptors, as discussed here, have been limited to direct impacts on heritage features and deposits. Whilst there is some limited potential for impacts upon the setting of designated heritage assets to occur during the construction phase, any such effects would be temporary and it is considered that setting effects resulting from construction would not exceed the predicted operational effects upon the setting of heritage assets. As such, with aim of achieving proportionality, the potential for setting effects are considered under operational effects.

9.7.2 A total of 89 heritage assets have been identified within the Proposed Development Area. As previously discussed LiDAR analysis undertaken by AOC Archaeology Group has revealed numerous assets which form part of assets previously recorded in the NRHE and HER. The Proposed Development has been designed to avoid direct impacts on known heritage features where possible. Table 9.5 below provides a list of assets which may be subject to direct effects. Where LiDAR analysis has identified specific assets within a group of assets already recorded within the NRHE and HER the NRHE/HER asset will be listed in the table. The sensitivity of the assets has been classified according to the method shown in Table 9.2 and is summarised below in Table 9.5.

9.7.3 Asset 17, the Protected Place of an Aircraft Crash Site, designated as such under the PMRA Act 1986[70], is situated 1.73 km to the north of the nearest element of the Proposed Development and therefore will not be subject to any direct effects.

9.7.4 Table 9.6 below provides a list of assets which may be subject to direct effects and summarises the expected magnitude of impact and level of effect. Assets within the Proposed Development Area not included within Table 9.6 are not expected to subject to any impacts or effect.

[70] UNITED KINGDOM. Protection of Military Remains Act 1986: Elizabeth II. Chapter 35 (1986) London: Her Majesty's Stationary Office.

Table 9.6 – Summary of Direct Effects

Receptor	Sensitivity	Magnitude of Impact	Level of Effect
3, Big Loskie Field System, Sheep Fold	Low	Low	Negligible
4, Marbrack Burn, Enclosure	Low	Low	Negligible
5/182, Marbrack Burn, Enclosure	Low	High	Minor
180, Structure	Negligible	High	Minor
181, Enclosure	Negligible	High	Minor

9.7.5 A new section of access track would pass within the NRHE Known Site Extent of Asset 3, Big Loskie Field System and Sheep Fold. Further assets associated with Asset 3 include Assets 116 to 117, 129, 131, 162, 192 and 193, of which Assets 117 and 131, sheep ree and possible buildings are the closest to the line of the proposed access track. The individual elements represented by Asset 3 are not interlinked. The assets represent medieval or post-medieval remains of a type common throughout Scotland and Dumfries and Galloway. They are considered to contribute to our understanding of the historic environment at the local level and are considered to be of Low importance. Direct impacts on any of the assets could result in the loss of a small percentage of the asset's peripheral deposits. Therefore, in AOC Archaeology Group's professional opinion, and given evidence gathered, it is considered that there will be a **Low** magnitude of impact by the Proposed Development on Asset 3, the resulting effect on Asset 3 would be **Negligible** and not significant.

9.7.6 A new section of access track would pass within the NRHE Known Site Extent of Asset 4, Marbrack Burn, Enclosure. The enclosure is undated in the HER but was identified on the First Edition Ordnance Survey Mapping as two enclosures, along with a sheep fold and a short length of wall annotated 'Old Fences'. The assets represent incomplete medieval or post-medieval remains of a type common throughout Scotland and Dumfries and Galloway. They are considered to contribute to our understanding of the historic environment at the local level and are considered to be of Low importance. Direct impacts on any of this asset could result in the loss of a small percentage of the asset's peripheral deposits. Therefore, in AOC Archaeology Group's professional opinion, and given the evidence gathered, it is considered that there will be a **Low** magnitude of impact by the Proposed Development on Asset 3, the resulting effect on Asset 3 would be **Negligible** and not significant.

9.7.7 A new section of access track would pass within the NRHE Known Site Extent of Asset 5, Marbrack Burn, Enclosure. Further assets associated with Asset 5 include Asset 181, a possible further enclosure identified via LiDAR analysis. The asset includes an enclosure, probably a field attached to a sheep fold and annotated 'Old Fences' on the First Edition Ordnance Survey map. The asset represents incomplete medieval or post-medieval remains of a type common throughout Scotland and Dumfries and Galloway. They are considered to contribute to our understanding of the historic environment at the local level and are considered to be of Low importance Direct impacts on any of these assets could result in the loss of a small percentage of the asset's peripheral deposits. Therefore, in AOC Archaeology Group's professional opinion, and given evidence gathered, it is considered that there will be a **Low** magnitude of impact by the Proposed Development on Asset 5, the resulting effect on Asset 5 would be **Negligible** and not significant

9.7.8 The Proposed Substation, Operations Centre and Battery Storage (Figure 9.29) would have a high impact on Asset 180, a non-designated structure recorded in the NRHE, (Asset 5) and subject to Lidar analysis by AOC Archaeology at Asset 182 and Asset 181, a field enclosure recorded in LiDAR analysis by AOC Archaeology. The construction of the Proposed Substation, Operations Centre and Battery Storage would result in their complete or partial removal. These assets are depicted on the Ordnance Survey map of 1853[71] (Figure 9.7) and are therefore likely to date to the post-medieval period. Both also appear to be of agricultural origin; Asset 180 a field enclosure and Asset 181 a sheep ree. Given that that late post-medieval livestock management features are commonly found across upland Scotland, indeed across all those parts of the country that have historically been set to pasture, the potential for these individual assets to specifically contribute to our understanding of the wider historic environment is limited and for this reason they are considered to be of Negligible importance. Consequently, although the Proposed Development would result in their large-scale removal, which would constitute a **High** magnitude of impact, the overall level of this effect would be **Minor** and not significant.

9.7.9 The footprint of the Proposed Substation, Operations Centre and Battery Storage is in close proximity to Asset 55 an area of clearance cairns, 30 m to the north and Asset 179, a possible prehistoric hut circle situated 11 m to the north. The Proposed Substation, Operations Centre and Battery Storage has the potential to clip and impact any unknown areas of these two assets that may lie within its footprint. However, due to the relative distance of these two assets from the footprint of the Proposed Substation, Operations Centre and Battery Storage in AOC Archaeology Group's profession opinion it is considered that there will be a **Low** magnitude of impact by the Proposed Development on Asset 3, the resulting effect on Assets 55 and 179 would be **Negligible** and not significant.

9.7.10 Given the known heritage assets within and surrounding the Proposed Development Area, there is some, albeit Low potential, for hitherto unknown archaeological remains to survive within the Proposed Development Area. By their very nature any such remains are unknown and the importance and sensitivity of such assets could range from Negligible to High. Such assets would also be impacted upon by the proposed plantations that are in the process of undergoing cultivation within the areas of Marbrack and Furmiston (Figure 12.2). Any areas of planting are likely to significantly impact any surviving archaeological remains within these areas, their level of relative sensitivity and the level of direct and indirect effects as a result of the Proposed Development. If located within the footprint of the Proposed Development, the magnitude of impact upon any such remains could also be High. Mitigation to allow for avoidance or minimisation of any such direct effects is set out in Section 9.10.

Operational Effects

9.7.11 Direct effects upon any known or previously unknown archaeological remains which may be present within the Proposed Development Area would cease with the completion of the groundworks stage of construction and consequently no direct effects are predicted during the operational phase of the Proposed Development.

9.7.12 Operational phase effects include impacts upon the settings of assets such as Listed Buildings, Scheduled Monuments, Conservation Areas and Inventory Gardens and Designed Landscapes.

9.7.13 There is one aircraft crash site designated as a Protected Place within the Proposed Development Area. There are no World Heritage Sites within the 10 km Study Area. In addition, there are 16 Scheduled Monuments, one Listed Building of Category A status, seven Listed Buildings of Category B status, five Listed Buildings of Category C status, one Landscape Park designated as being of Regional Significance by the Dumfries and Galloway HER and one non-designated asset designated as being of National Significance by the Dumfries and Galloway HER within the relevant Study Areas. One asset, Scottish Dark Skies Observatory within the nationally designated Garden and Designed Landscape at Craigengillan (Asset 217, List No. GDL00111) is outwith the 10 km Study Area and has been included within this assessment following consultation with HES.

9.7.14 All nationally important designated assets located within the ZTV have been subject to detailed setting assessment. Additionally, all designated assets within the 10 km Study Area were reviewed against the information known about their contextual characteristic (see Appendix 9.1) and against mapping information to identify any assets where views of the Proposed Development in views towards the asset may significantly impact on their settings.

[71] UNITED KINGDOM. Ordnance Survey (1853) Kirkcudbrightshire, Sheet 5 (includes: Carsphairn). Surveyed: 1850-51. Published: 1853.

UNITED KINGDOM. Ordnance Survey (1895) Kirkcudbrightshire VII.SE. Surveyed: 1894. Published: 1895.

9.7.15 Asset 17, the crash site of a Bristol Blenheim Mk IV bomber which dates to 8 November 1939 is situated 1.73 km north of the nearest turbine. As a Protected Area under the PMRA Act 1986[72] and in AOC Archaeology's professional opinion the relative sensitivity of Asset 17 is considered to be High. However, the Proposed Development does not impinge upon the primary setting of Asset 17, its crash site location in the valley between the hill of Beninner and Green Hill. An Observer would still be able to appreciate and understand this setting and the possible events that led to the crash; the nearest turbine, would be situated south at a considerable distance away from this visual axis. In AOC Archaeology's professional opinion and evidence gathered it is considered that there would be a **Minor** magnitude of impact, the resulting effect on Asset 17 would be **Negligible** and not significant.

9.7.16 The Scheduled Monument at Woodhead Mine (Asset 19, List No. SM5184) is situated 4.25 km west of the nearest proposed turbine. Woodhead lead mines setting is associated with the location of the ore in the landscape northwest of Carsphairn. The track that leads to Asset 19 would have been used for the shipment of supplies and personnel to the mines; personnel and processed ores would have used the track to egress Asset 19 and access the road network near the settlement of Carsphairn. The presence of workers' houses on Asset 19 means that the mine is a fairly self-contained industrial complex although it is likely that there was some association with the nearby settlement of Carsphairn. As an industrial complex located primarily for the purpose of the extraction and processing of lead ore in its geographical location Asset 19, in AOC Archaeology's professional opinion, has a relative sensitivity of Medium. The Proposed Development would be located to the east of the mines, beyond their working boundary and the settlements they were associated with. The wireline (Figure 9.14) shows that 14 turbines would be visible, 11 to hub height. Whilst the turbines would be visible, they would be located well beyond the elements of setting which contribute to an understanding, appreciation and experience of the asset and they would not materially affect the ability of the asset's setting to contribute to its significance. In AOC Archaeology's professional opinion and evidence gathered it is considered that there would be a **Low** magnitude of impact, the resulting effect on Asset 15 would be **Minor** and not significant.

9.7.17 The Scheduled Monument at Earlston Castle (Asset 23, List No. SM1118) (Plate 8) is situated 8.96 km south of the nearest proposed turbine. Earlston Castle is a late 16th or early 17th century laird's house in a L-shaped plan. It is surrounded by a small estate featuring a mix of mature deciduous and evergreen trees. These belts of trees predominantly screen Asset 23 from the north to south B7000 to the east of Asset 23. Earlston Castle has clearer views northwest and west across Earlstoun Loch. In AOC Archaeology's professional opinion due to Asset 23's condition and prominent geographical location overlooking Earlstoun Loch it is considered to have a relative sensitivity of High. The Proposed Development would be visible to the northwest of Asset 23. The wireline (Figure 9.15shows that 9 turbines would be visible, 7 to hub height. Whilst the turbines would be visible, they would be located well beyond the elements of setting which contribute to an understanding, appreciation and experience of the asset and they would not materially affect the ability of the asset's setting to contribute to its significance. However, Asset 23's primary setting is with Earlstoun Loch and this relationship would not be affected by the Proposed Development; the photomontages in Figures 10a to f and Plate 8 clearly show and confirm this primary setting. Given this, and the distance to the Proposed Development, it is considered that whilst the Proposed Development would potentially be visible from the castle, it would not affect the ability to understand, appreciate and experience the contribution that setting makes to the asset's overall significance. In AOC Archaeology Group's professional opinion, and given evidence gathered, it is considered that there would be a **Low** magnitude of impact, the resulting effect on Asset 23 would be **Minor** and not significant.

9.7.18 The Scheduled Monument at Cairn Avel (Asset 24, List No. SM1006) is situated 2.69 km to the southwest of the nearest proposed turbine (Plate 11). Cairn Avel's primary setting overlooks the lower lying valley of the Water of Deugh to the north. The western portion of the monument has been heavily robbed of material which has presumably been used in the nearby drystone walls; however the boundary of the cairn remains clear. The north facing slopes of the ridge of hills associated with Bardennoch Hill backcloths Cairn Avel to the south along with the route of the old pack road. It is not known if the old park road existed in some form in prehistoric times. As a substantially intact prehistoric tomb with a landscape setting overlooking views to its north in AOC Archaeology's professional opinion Asset 24 is considered to have a relative sensitivity of High. The wireline (Figure5.23e) shows that 14 turbines would be visible, 12 to hub height. The Proposed Development is located to the east on hills to the east of Asset 24's primary setting overlooking the landscape to the north of Asset 24 (Figure 5,23d). Therefore, whilst the turbines would be visible, they would be located well beyond the elements of Asset 24's setting which contribute to an understanding, appreciation and experience of the asset and they would not materially affect the ability of the asset's setting to contribute to its significance. In AOC Archaeology's professional opinion and evidence gathered it is considered that there would be a **Low** magnitude of impact, the resulting effect on Asset 24 would be **Minor** and not significant.

9.7.19 The Scheduled Monument of Holm of Daltallochan, Stone Circle and Standing Stone (Asset 25, List No. SM1029) (Plate 10) is situated 2.39 km to the west of the nearest proposed turbine. The setting of the Holm of Daltallochan is within the low-lying agricultural lands to the northwest of Carsphairn and can best be appreciated within these low lying lands to the west of the Proposed Development. The landscape within which Asset 25 is situated extends away from the Proposed Development. As a substantial stone circle and standing stone with a landscape setting overlooking views to its north in AOC Archaeology's professional opinion Asset 25 is considered to have a relative sensitivity of High. The wireline (Figure 9.11e) shows that 5 turbines would be visible, 1 to hub height. These would be visible beyond the treeline whilst looking east at the Stone Circle (Figure 9.11a). However, whilst the turbines would be visible, they would be located to the east of Asset 25's primary setting well beyond the elements of setting which contribute to an understanding, appreciation and experience of the asset and they would not materially affect the ability of the asset's setting to contribute to its significance. The turbines, located away from this primary landscape setting would not reduce the ability of setting to contribute to an understanding of the overall significance of the assets. In AOC Archaeology Group's professional opinion, and given evidence gathered, the magnitude of impact is judged to be **Low** and the level of effect on Asset 25 would be **Minor** and not significant.

9.7.20 The Scheduled Monument of Holm of Daltallochan Cross Slab (Asset 26, List No. SM1106) is situated 2.13 km to the west of the nearest proposed turbine. Tradition states that this cross slab was found at the location of Asset 25, the Scheduled Monument of Holm of Daltallochan, stone circle & standing stone (Asset 25, List No. SM1029), 105 m to the northwest of Asset 26. However, historical records give its location as within the gardens of the Holm of Daltallochan Farmhouse. Its setting is within the river valley to the north of Carsphairn and the track leading northeast to southwest from the A713. As historical records indicate that Asset 26 has been removed from its original setting in AOC Archaeology's professional opinion it is considered to have a relative sensitivity of Negligible. The Proposed Development is located well beyond this setting and does not interrupt any key views or associations. Furthermore, the wireline (Figure 9.16) indicates that the majority of the proposed development would not be visible from the asset due to intervening topography; only one hub and the extreme tips of a further two of the proposed turbines would be visible. In AOC Archaeology Group's professional opinion, and given the evidence gathered, the magnitude of impact is judged to be **Negligible** and the level of effect on Asset 26 would be **Negligible** and not significant.

9.7.21 The Scheduled Monument at Stroanfreggan Bridge cairn (Asset 27, List No. SM1043) (Plate 13) is situated 3.76 km to the southeast of the nearest proposed turbine. Stroanfreggan Bridge cairn's setting is within the valley and landscape to the southeast of the Proposed Development. Asset 27 is a large circular cairn situated on low-lying ground. Elements of the cairn have been robbed for quarry material and a cist was found 25 feet or 7.62 m from the eastern arc of its perimeter in 1910. A plano-convex flint knife, four small chippings of flint and bone fragments mixed with charcoal along with clay fluting and a fragment of thin bronze were also found in 1910. These finds suggest that, despite the robbing of portions of Asset 27 it remains a substantial burial cairn probably dating to the Bronze Age. As a substantially intact prehistoric tomb with a landscape setting overlooking views to its north in AOC Archaeology's professional opinion Asset 27 is considered to have a relative sensitivity of High. The wireline

[72] UNITED KINGDOM. Protection of Military Remains Act 1986: Elizabeth II. Chapter 35 (1986) London: Her Majesty's Stationary Office.

(Figure 5.27e) shows that 8 turbines would be visible,3 to hub height. A view to the valley between the hills on the Proposed Development Area may also be another setting aspect. However, this sightline, as confirmed by the wireline (Figure 5.27e) is away from the location of the proposed turbines on the Proposed Development. In AOC Archaeology's professional opinion and evidence gathered it is considered that there would be a **Low** magnitude of impact, the resulting effect on Asset 27 would be **Minor** and not significant.

9.7.22 The Scheduled Monument at Stroanfreggan Craig, fort (Asset 30, List No. SM1095) (Plate 14) is situated 3.07 km to the southeast of the nearest proposed turbine. Stroanfreggan Craig, fort is associated with high upland grazing on shoulders of land in its immediate vicinity. There are good commanding views to the south in the direction of Asset 27 Scheduled Monument at Stroanfreggan cairn (Asset 27, List No. SM1043). There are also commanding views along the north to south river valley to the west and to the south (Figure 9.12d) which Asset 30 overlooks. The main candidate for the entrance to the fort is from the south. The fort was likely sited to command the views over the confluence of two east to west burns with the Water of Ken which it overlooks, providing a strategic location in the local landscape. In AOC Archaeology's professional opinion Asset 30 with its commanding view over this river valley is considered to have a relative sensitivity of High. The wireline (Figure9.12e)shows that 9 turbines would be visible, 5 to hub height beyond the confluence of the two burns and the Water of Ken that Asset 30 overlooks. These principal settings relationships are not in the direction of the Proposed Development and the relationships would not be disrupted. Whilst the turbines would be visible, they would be located well beyond the elements of setting which contribute to an understanding, appreciation and experience of the asset and they would not materially affect the ability of the asset's setting to contribute to its significance. In AOC Archaeology Group's professional opinion, and given evidence gathered, it is considered that there would be a **Low** magnitude of impact, the resulting effect on Asset 30 would be **Minor** and not significant.

9.7.23 The Scheduled Monument at Craigengillan, cairn (Asset 31, List No. SM2238) is situated 1.66 km to the east of the nearest proposed turbine. Craigengillan, cairn is within and surrounded by forestry which has slightly mutilated its periphery according to the NRHE. It sits on a slight slope overlooking the north to south Water of Ken river valley and away from the Proposed Development. As a substantially intact prehistoric cairn in AOC Archaeology's professional opinion Asset 31 is considered to have a relative sensitivity of High. DGAS in their consultation response of 23 August 2021 have indicated that there are plans to crop the forestry on and around Asset 31 to open up the setting of the cairn. The wireline (Figure 9.17) clearly illustrates visually what elements of the Proposed Development could be directly visible from Asset 31 following the removal of the surrounding forestry; it shows that 14 turbines would be visible, 12 to hub height to the west. In AOC Archaeology's professional opinion Asset 31's setting is away from the Proposed Development as it overlooks the north to south Water of Ken and the landscape and historic assets on the slopes which are situated on the east side of this valley. The view from the HER Asset of National Significance at Round Craigs, landscape containing cairns, clearance cairns, cultivation remains and burnt mounds (Asset 219, HER No. MDG3944) (Figure 9.24) shows that this relationship of the assets along the valley of the north to south Water of Ken, with 14 turbines visible to hub height is not impinged by the Proposed Development which is further to the west beyond the setting of the valley. In AOC Archaeology's professional opinion and evidence gathered it is considered that there would be a **Low** magnitude of impact, the resulting effect on Asset 31 would be **Minor** and not significant.

9.7.24 The Scheduled Monument at Dundeugh Castle (Asset 32, List No. SM2476) is situated 4.92 km to the south of the nearest proposed turbine. Dundeugh Castle is an overgrown mound with a section of L shaped wall still upstanding surrounded by modern forestry. It is close to the current Water of Deugh on relatively lower lying ground within the valley. Prior to the plantation of the modern forestry and the reservoirs of Kendoon Power Station (Asset 44, Listed Building Category B, List No. LB51694) Dundeugh Castle would have occupied a commanding position over the north to south aligned Water of Deugh river valley. This river would have been wider, deeper and probably faster flowing; the current crossing point now occupied by a low-lying modern concrete bridge. Due to the degraded nature of Dundeugh Castle, consisting of an overgrown mound and a section of an L-shaped wall surviving to roughly head height in AOC Archaeology's professional opinion it is considered to have a relative sensitivity of Negligible. The wireline (Figure 9.18) shows that 7 turbines would be visible to hub height; these turbines would be visible at some distance to the north and away from Asset 32's strategic position overlooking the north to south aligned Water of Deugh valley. In AOC Archaeology's professional opinion and evidence gathered it is considered that there would be a **Negligible** magnitude of impact, the resulting effect on Asset 32 would be **Negligible** and not significant.

9.7.25 The HER Asset of National Significance at Lagwine Cairn (Asset 79, HER No. MDG25538) is situated on a southwest facing slope overlooking the valley of the Water of Deugh. Lagwine Cairn is believed to have been partially robbed to construct a nearby sheepfold although the central core is thought to be intact and would allow an observer to appreciate and understand this asset as a prehistoric burial cairn within the landscape of the valley of the Water of Deugh. As the central core of Asset 79 is believed to be intact in AOC Archaeology's professional opinion Asset 27 is considered to have a relative sensitivity of High overlooking the valley of the water of Deugh to the southwest and away from the Proposed Development. ZTV analysis suggests that one turbine may be visible from this asset at a distance of 1.78 km although wireline analysis (Figure 9.20) indicates no visibility of any turbines of the Proposed Development from Asset 79. Therefore, in AOC Archaeology Group's professional opinion, and given evidence gathered, it is considered that there would be at most a **Negligible** magnitude of impact, the resulting effect on Asset 79 would be **Minor** and not significant.

9.7.26 The HER Asset of Regional Significance at Knockgray Policies Landscape Park (Asset 89, HER No. MDG25538) is situated 1.02 km from the nearest proposed turbine and borders the southern boundary of the Proposed Development Area. Plantation of trees occupy the centre of Asset 89 with a broader band facing on to the northwest to southeast aligned B729. A further band of trees leads from the core of Asset 89 to the undesignated access road that leads from the B729; this roads links Asset 89 and Marbrack Farm to the road network. The elements of Knockgray Policies setting which contribute most to an understanding and appreciation of it are orientated towards and along the northwest to southeast Water of Deugh and its associated valley. Visually it can be best appreciated from across the valley to the southwest. In AOC Archaeology's opinion this is the primary visual setting of Asset 89 where an observer can appreciate and understand Asset 89; there is a high likelihood that this visual setting from across the valley was intended. Therefore, in AOC Archaeology's professional opinion Asset 89 is considered to have a relative sensitivity of High. The wireline (Figure 9.21) shows that 12 turbines would be visible to hub height. Views of the asset from across the valley to the southwest would be backclothed by the Proposed Development, therefore, they do not impinge this view of Asset 89. In AOC Archaeology's professional opinion and evidence gathered it is considered that there will be a **Low** magnitude of impact, the resulting effect on Asset 89 would be **Minor** and not significant.

9.7.27 The nationally designated Garden and Designed Landscape at Craigengillan Asset 217, List No. GDL00111) is situated outwith the 10 km Study Area. The ZTV indicates that up to 11 turbines could be visible from this asset. The wireline (Figure 9.22) indicates that a maximum of up to 12 turbines could be visible from the northwest portion of the Inventory Garden and Designed Landscape at Craigengillan. Two of these turbines could be visible to hub hight with up to 10 further turbines could be visible as turbine tips. The Proposed Development would not be visible from the core of Asset 217 which encompasses a Category A Listed mansion and associated gardens. The Proposed Development would primarily be visible from the outlying areas of the GDL which consists primarily of the estate of Craigengillan consisting of fields with the occasional wooded area. In AOC Archaeology's professional opinion and evidence gathered it is considered that the magnitude of impact on would be **Low**, the resulting effect Asset 217 would be **Minor** and not significant.

9.7.28 The HER Asset of National Significance at Little Auchrae, Farmstead (Asset 218, HER No. MDG11404) is situated 2.72 km to the east of the nearest proposed turbine. The remains of the Little Auchrae farmstead are comprised of two unroofed buildings with four enclosures and large field systems clustered around the buildings. The setting of this asset is within this agricultural landscape within good pastureland predominantly on north to northwest facing slopes overlooking the north to south aligned Water of Ken. The key elements that would allow an observer to understand and appreciate this asset is the agricultural landscape situated around Asset 218. In AOC Archaeology's professional opinion Asset 218 has a relative sensitivity of Medium. The wireline (Figure 9.23) shows that 14 turbines would be visible, 12 to hub height. However, the Proposed Development is situated to the

west of Asset 218. The Proposed Development does not affect the ability of an observer to appreciate this asset within its agricultural setting. Therefore, in AOC Archaeology's professional opinion and evidence gathered it is considered that the magnitude of impact would be **Low**, the resulting effect on Asset 218 would be **Minor** and not significant.

9.7.29 The HER Asset of National Significance at Round Craigs, landscape containing cairns, clearance cairns, cultivation remains and burnt mounds (Asset 219, HER No. MDG3944) is situated 3.73 km east of the nearest proposed turbine. This is an asset comprising of several multi period features within a specific upland landscape. These features range from probable prehistoric burial cairns to clearance cairns, some of which have been assessed as dating to the post-medieval period. Asset 219 is situated on an upland agricultural landscape overlooking the north to south Water of Ken to the west. In AOC Archaeology's opinion the setting of this Asset has a relatively sensitivity of High. The wireline (Figure 9.23) shows 14 turbines visible to hub height. However, Asset 219's setting is within the landscape overlooking the north to south Water of Ken. This includes assets on the west side of this valley such as the Scheduled Monument at Craigengillan, cairn (Asset 31, List No. SM2238). As the Proposed Development is situated to the west of the valley of the Water of Deugh it does not impinge upon this setting and this relationship with Asset 31. Therefore, in AOC Archaeology's professional opinion, and given evidence gathered it is considered that the magnitude of impact would be **Low**, the resulting effect on Asset 219 would be **Minor** and not significant.

9.7.30 The HER Asset of National Significance at Culmark Hill (Asset 220, HER No. MDG3845) is a cairn of uncertain date situated 4.55 km southeast of the nearest turbine. The turf covered remains of the cairn are recorded as being heavily robbed in the centre but with a clear shape and edges. In AOC Archaeology's opinion this partially intact prehistoric cairn has a relative sensitivity of High. The wireline (Figure 9.25) shows 14 turbines visible, 9 to hub height. Asset 220 sits on a prominent east to west ridge with a view to the Water of Ken, which is aligned northeast to southwest. The Proposed Development; would be visible in the west of this primary setting but does not impinge upon it. Therefore, in AOC Archaeology's professional opinion, and given evidence gathered, it is considered that the magnitude of impact on this would be **Low**, the resulting effect on Asset 220 would be **Minor** and not significant.

9.7.31 Bardennoch-Garryhorn Archaeologically Sensitive Area (Asset 221) contains multi-period archaeological remains within its boundary and is situated 1.63 km southwest of the nearest proposed turbine at its closest point. The assets within its boundary include the Scheduled Monument at Woodhead Mine (Asset 19, List No. SM5184), the Scheduled Monument of Holm of Daltallochan, Stone Circle and Standing Stone (Asset 25, List No. SM1029); and the Scheduled Monument of Holm of Daltallochan Cross Slab (Asset 26, List No. SM1106). Asset 221 is focussed on the northwest to southeast ridgeline and slopes made by Bardennoch Hill and Braidenoch Hill. This ridge of hills overlooks the Water of Deugh. Within this view the Water of Deugh is visible to the right down low-lying slopes on a southeast to northwest alignment. This alignment changes in the centre of the view to a slightly sinuous east to west alignment near Carsphairn. The southwest facing ridgeline overlooks the northwest to southeast aligned Polmaddy Burn which is currently not visible from Asset 221 due to modern forestry plantations. In AOC Archaeology's opinion Asset 221 has a relative sensitivity of High. The wireline (Figure 9.26) shows 14 turbines visible, 12 to hub height. The Proposed Development will not interrupt views between the key monuments within the Asset 221 or the relationships between the monuments and the ridge and valley system. Therefore, in AOC Archaeology's professional opinion and evidence gathered it is considered that the magnitude of impact would be **Low**, the resulting effect on Asset 221 would be **Minor** and not significant.

9.7.32 Stroanfreggan Archaeologically Sensitive Area (Asset 222) contains multi-period archaeological remains within its boundary and is situated 2.27 km east of the nearest proposed turbine. The assets within its boundary include the Scheduled Monument at Stroanfreggan, cairn (Asset 27, List No. SM1043), the Scheduled Monument at Stroanfreggan Craig, fort (Asset 30, List No. SM1095) and the HER Asset of National Significance at Round Craigs, landscape containing cairns, clearance cairns, cultivation remains and burnt mounds (Asset 219, HER No. MDG3944). Asset 221 encompasses a landscape overlooking the north to south Water of Ken to the west and the Stroanfreggan Burn to the south. In AOC Archaeology's opinion Asset 222 has a relative sensitivity of High. The wireline (Figure 9.27) shows 6 turbines visible, 3 to hub height. Although The Proposed Development would be visible to the west it would not affect the ability to understand and appreciate the landscape and the relationships between the individual assets within the ASA. Therefore, in AOC Archaeology's professional opinion, and given evidence gathered, it is considered that the magnitude of impact would be **Low**, the resulting effect on Asset 222 would be **Minor** and not significant.

9.7.33 Polharrow Burn Archaeologically Sensitive Area (Asset 223) contains multi-period archaeological remains and is situated 5.96 km south of the nearest proposed turbine. The features within the boundary of Asset 223 include a prehistoric cairn, the remains of clearance cairns, isolated enclosures and deserted farmsteads with extensive field systems. Other traces of upland agricultural practices and traces of minor industrial activity have been recorded within this area. ZTV analysis shows the Proposed Development would be visible from the northern portion of Asset 223 and part of the eastern area. The setting of this asset is within this agricultural and settlement landscape. There is good pastureland predominantly on south to southwest facing slopes overlooking the Polharrow Burn to the south. A substantial ridge line situated at the north of the Asset 223 blocks most views to the east of Asset 223 towards the water of Ken and towards the Proposed Development. In AOC Archaeology's opinion Asset 223 has a relative sensitivity of High. The wireline (Figure 9.28) shows 14 turbines visible to hub height. The ability to appreciate this asset within its agricultural setting overlooking the Polharrow Burn to the south and southwest and the substantial ridgeline to the north will limit intervisibility with the Proposed Development. Therefore, in AOC Archaeology's professional opinion and evidence gathered it is considered that the magnitude of impact would be **Low**, the resulting effect on Asset 223 would be **Minor** and not significant.

Decommissioning

9.7.34 It is anticipated that direct impacts during the decommissioning phase would be limited and would only occur if new ground works are required beyond the areas disturbed during the original construction works. All operational effects upon the settings of designated assets would be reversed with the removal of the turbines following decommissioning leading to a neutral residual impact.

9.7.35 Detailed assessment of impacts on cultural heritage assets arising from the decommissioning phase have been scoped out of this assessment. A detailed assessment of the cultural heritage impacts of decommissioning the Proposed Development has not been undertaken as part of the EIA because: (i) the future baseline conditions (environmental and other developments) cannot be predicted accurately at this stage; (ii) the detailed proposals for decommissioning are not known at this stage, and (iii) the best practice decommissioning guidance methods will likely change during the lifetime of the Proposed Development.

9.8 CUMULATIVE EFFECTS

Cumulative Methodology

9.8.1 The assessment of cumulative effects within this EIAR chapter is based upon a list of operational or consented developments along with developments where planning permission has been applied for. While all have been considered, only those which contribute to, or have the possibility to contribute to, cumulative effects on specific heritage assets are discussed in detail in the text. Additionally, given the emphasis NatureScot place on significant effects, cumulative effects have only been considered in detail for those assets where the effect on setting from the Proposed Development, alone, has been judged to be minor or greater. The setting of assets which would have a magnitude of impact of negligible or less are judged to be unlikely to reach the threshold of significance as defined in Table 9.4.

9.8.2 As set out above, cumulative effects relating to cultural heritage are for the most part limited to effects upon the settings of heritage assets. While there can, in some rare cases, be cumulative direct effects, none are anticipated to result from the construction, operation or decommissioning of the Proposed Development. As such this assessment will consider the potential for cumulative effects upon the setting of heritage assets which have the potential to occur during the operational phase.

9.8.3 With regard to potential cumulative effects on cultural heritage assets, the assessment considers operational, consented and within-planning developments at distances up to 10 km from the Proposed Development. The location of cumulative developments is shown on Figures 5.9 and 5.10.These include: the operational/under construction wind farms and turbines of Afton, , South Kyle, , Wether Hill, Windy Rig, , Windy Standard I and Windy Standard II; the consented wind farms of Benbrack, Cornharrow, Divot Hill, Enoch Hill, Glenshimmeroch, Lorg, Margree, Pencloe, Sanquhar 'Six', Torrs Hill, Troston Loch and Windy Standard III; the scoping wind farms of Appin, Manquhill, South Kyle II, Windy Standard I Repower as well as the proposed wind farms at Euchanhead, Sanquhar II and Shepherd's Rig for which planning applications have now been received.

9.8.4 Cumulative impacts have been considered for those assets where the impact upon setting from the Proposed Development alone has been judged to be of minor level or greater and/or for assets which have been identified by consultees as requiring further assessment. This is because it is judged to be unlikely that cumulative impacts upon the setting of those monuments which would be subject to impacts of less than minor significance (based on the Proposed Development itself) are unlikely to reach the EIA Regulation significance threshold. Within this chapter any assets highlighted by consultees judged to have a minor or greater level of impact by the Proposed Development will be considered for cumulative effects:

- Scheduled Monument at Woodhead lead mines and smelter, Carsphairn (Asset 18, List No. SM5391);
- Scheduled monument at Cairn Avel (Asset 24, List No. SM1006);
- Scheduled Monument of Holm of Daltallochan, Stone Circle and Standing Stone (Asset 25, List No. SM1029);
- Scheduled Monument at Stroanfreggan Cairn Fort (Asset 30, List No. SM1095);
- Scheduled Monument at Craigengillan Cairn (Asset 31, List No. SM2238);
- HER Asset of National Significance at Lagwine Cairn (Asset 79, HER No. MDG25538);
- HER Asset of Regional Significance at Knockgray Policies Landscape Park (Asset 89, HER No. MDG25538):
- HER Asset of National Significance at Little Auchrae, Farmstead (Asset 218, HER No. MDG11404);
- HER Asset of National Significance at Round Craigs, landscape containing cairns, clearance cairns, cultivation remains and burnt mounds. (Asset 219, HER No. MDG3944);
- HER Asset of National Significance at Culmark Hill Cairn (Asset 220, HER No. MDG3845);
- Bardennoch-Garryhorn Archaeologically Sensitive Area (Asset 221);
- Stroanfreggan Archaeologically Sensitive Area (Asset 222); and
- Polharrow Burn Archaeologically Sensitive Area (Asset 223).

9.8.5 As viewed from the Scheduled Monument at Woodhead Mine (Asset 19, List No. SM5184) (Figure 9.14) indicates that cumulative turbines would be visible behind and to the right of the Proposed Development at a considerable distance and would not impinge upon Asset 19's setting, relating as it does to the lead ore deposits in the landscape and the settlement and transportation infrastructure of Carsphairn. Therefore, In AOC Archaeology's professional opinion, and given evidence gathered, it is considered that there would be a **Low** magnitude of impact. Noting the asset's previously indicated Medium relative sensitivity, the resulting cumulative effect on Asset 19 would be **Minor** and not significant.

9.8.6 As viewed from the Scheduled Monument at Earlston Castle (Asset 23, List No. SM1118) wireline (Figure 9.15) the Proposed Development would be visible to the left and ahead of cumulative turbines slightly filling out the horizon to the north of Asset 23. However, as Asset 23's primary setting remains with Earlstoun Loch this will not be significantly affected by cumulative wind turbines. Therefore, in AOC Archaeology Group's professional opinion, and given evidence gathered, it is considered that there would be a **Low** magnitude of impact. Noting the asset's previously indicated High relative sensitivity, the resulting cumulative effect on Asset 23 would be **Minor** and not significant.

9.8.7 As viewed from the Scheduled Monument at Cairn Avel (Asset 24, List No. SM1006) (Figure 5.23e) cumulative wind farms will be visible to the right and behind the Proposed Development and would not impinge upon the key setting relationship of Asset 24 with the valley of the Water of Deugh to its north. Therefore, in AOC Archaeology Group's professional opinion, and given evidence gathered. it is considered that there would be a **Low** magnitude of impact. Noting the asset's previously indicated High relative sensitivity, the resulting cumulative effect on Asset 24 would be **Minor** and not significant.

9.8.8 As viewed from the Scheduled Monument of Holm of Daltallochan, Stone Circle and Standing Stone (Asset 25, List No. SM1029) (Figure 9.11a) cumulative turbines would be visible at a considerable distance to the right of the Proposed Development and would not impinge upon the setting of this asset within the low-lying agricultural lands to the northwest of Carsphairn. Therefore, in AOC Archaeology's professional opinion, and given evidence gathered, the magnitude of impact is judged to be **Low.** Noting the asset's previously indicated High relative sensitivity, the level of cumulative effect on Asset 25 would be **Minor** and not significant.

9.8.9 As viewed from the Scheduled Monument at Stroanfreggan Bridge cairn (Asset 27, List No. SM1043) (Figure 5.27a) the Proposed Development would be visible behind the Shepherd's Rig wind farm which is currently undergoing construction. However, Asset 27's key setting relationships are within the valley and landscape to the southeast of the Proposed Development and the addition of the Proposed Development behind Shepherd's Rig would not result in material changes to views in this direction. In AOC Archaeology Group's professional opinion, and given evidence gathered, it is considered that there would be a **Low** magnitude of impact. Noting the asset's previously indicated High relative sensitivity, the resulting cumulative effect on Asset 27 would be **Minor** and not significant.

9.8.10 As viewed from The Scheduled Monument at Stroanfreggan Craig, fort (Asset 30, List No. SM1095) (Figure 9.12a) the Proposed Development would be visible behind the Shepherd's Rig wind farm. However, as Asset 30's setting remains within the valley and landscape to the southeast of the Proposed Development and the addition of the Proposed Development behind Shepherd's Rig would not result in material changes to views in this direction. In AOC Archaeology's professional opinion, and given evidence gathered, it is considered that there would be a **Low** magnitude of impact. Noting the asset's previously indicated High relative sensitivity, the resulting cumulative effect on Asset 30 would be **Minor** and not significant.

9.8.11 As viewed from the Scheduled Monument at Craigengillan cairn (Asset 31, List No. SM2238) the Proposed Development will be clearly visible behind the Shepherd's Rig wind farm. However, Asset 31's primary setting is overlooking the north to south Water of Ken river valley and away from the Proposed Development. Wireline (Figure 9.17) and (Figure 9.24) showing the view from the HER Asset of National Significance at Round Craigs, landscape containing cairns, clearance cairns, cultivation remains and burnt mounds (Asset 219, HER No. MDG3944) towards the Proposed Development show that Asset 31's relationship with the north to South Water of Ken river valley is not impinged by the Proposed Development. In AOC Archaeology's professional opinion and evidence gathered it is considered that there would be a **Low** magnitude of impact. Noting the asset's previously indicated High relative sensitivity, the resulting cumulative effect on Asset 31 would be **Minor** and not significant.

9.8.12 As viewed from the HER Asset of National Significance at Lagwine Cairn (Asset 79, HER No. MDG25538) wireline analysis (Figure 9.20) suggests that no cumulative turbine will be visible from Asset 79. Therefore, in AOC Archaeology's professional opinion and evidence gathered it is considered that there will be a **Negligible** magnitude of impact. Noting the asset's previously indicated High relative sensitivity, the resulting cumulative effect on Asset 79 would be **Minor** and not significant.

9.8.13 As viewed from the HER Asset of Regional Significance at Knockgray Policies Landscape Park (Asset 89, HER No. MDG25538) (Figure 9.21) turbines from Shepherd's Rig wind farm would be visible behind the Proposed Development. Given the asset's current setting it is not judged that the addition of the Proposed Development to the Shepherd's Rig wind farm would result in any greater impact than has been predicted for the Proposed Development on its own. Therefore, In AOC Archaeology Group's professional opinion, and given evidence

gathered, it is considered that there will be a **Low** magnitude of impact. Noting the asset's previously indicated High relative sensitivity, the resulting cumulative effect on Asset 89 would be **Minor** and not significant.

9.8.14 As viewed from The HER Asset of National Significance at Little Auchrae, Farmstead (Asset 218, HER No. MDG11404) (Figure 9.22) the Proposed Development will fill out the skyline behind the Shepherd's Rig wind farm. However, this will not affect the ability to appreciate this asset within its agricultural setting. Therefore, in AOC Archaeology Group's professional opinion, and given evidence gathered, it is considered that the magnitude of impact would be **Low**. Noting the asset's previously indicated Medium relative sensitivity, the resulting cumulative effect on Asset 218 would be **Minor** and not significant.

9.8.15 As viewed from the HER Asset of National Significance at Round Craigs, landscape containing cairns, clearance cairns, cultivation remains and burnt mounds (Asset 219, HER No. MDG3944) (Figure 9.23) the Proposed Development will fill out the skyline behind the Shepherd's Rig wind farm and beyond the Scheduled Monument at Craigengillan, cairn (Asset 31, List No. SM2238) on the west side of the valley. As previously stated in AOC Archaeology's professional opinion and evidence gathered Asset 219 has a visual relationship with this asset. However, although the turbines of the Proposed Development and Shepherd's Rig wind farm would backcloth Asset 31 as viewed from Asset 219 no turbines would be intersect this visual setting. It is AOC Archaeology's professional opinion and evidence gathered that the magnitude of impact would be **Low**, the resulting cumulative effect on Asset 219 would be **Minor** and not significant.

9.8.16 As viewed from the HER Asset of National Significance at Culmark Hill (Asset 220, HER No. MDG3845) (Figure 9.24) the Proposed Development would be visible to the west of the cumulative wind farms. However, this cumulative effect remains to the west of the primary setting of Asset 220 and does not impinge upon it. Therefore, in AOC Archaeology Group's professional opinion, and given evidence gathered, it is considered that the magnitude of impact on the setting of this asset would be **Low**. Noting the asset's previously indicated High relative sensitivity, the asset's previously indicated High relative sensitivity, the resulting cumulative effect on Asset 220 would be **Minor** and not significant.

9.8.17 As viewed from Bardennoch-Garryhorn Archaeologically Sensitive Area (Asset 221) (Figure 9.25) the Proposed Development would be in front of cumulative turbines, principally the Shepherd's Rig wind farm. However, Asset 221 is focussed on the northwest to southeast ridgeline and slopes made by Bardennoch Hill and Braidenoch Hill overlooking Water of Deugh to the northeast and further to the north near Carsphairn and the northwest to southeast aligned Polmaddy Burn to the southwest. Therefore, in AOC Archaeology Group's professional opinion, and given evidence gathered, it is considered that the magnitude of impact would be **Low**. Noting the asset's previously indicated High relative sensitivity, the resulting cumulative effect on Asset 221 would be **Minor** and not significant.

9.8.18 As viewed from Stroanfreggan Archaeologically Sensitive Area (Asset 222) (Figure 9.26) part of the Proposed Development would be visible in addition to the cumulative wind farms, amounting to three turbine hubs and two turbine tips. However this cumulative effect it would not affect the ability to understand and appreciate the landscape. Therefore, in AOC Archaeology Group's professional opinion, and given evidence gathered, it is considered that the magnitude of impact would be **Low**. Noting the asset's previously indicated High relative sensitivity, the resulting cumulative effect on Asset 222 would be **Minor** and not significant.

9.8.19 As viewed from Polharrow Burn Archaeologically Sensitive Area (Asset 223) (Figure 9.27) the Proposed Development will fill out the skyline between cumulative wind farms, albeit at an appreciable distance away from Asset 223. Furthermore as the setting of this asset is within this agricultural and settlement landscape within good pastureland predominantly on north to northwest facing slopes overlooking Polharrow Burn to the south and southwest and the ability to appreciate this asset within its agricultural setting would not be affected by this cumulative effect Therefore, in AOC Archaeology Group's professional opinion, and given evidence gathered it is considered that the magnitude of impact would be **Low**. Noting the asset's previously indicated High relative sensitivity, the resulting cumulative effect on Asset 223 would be **Minor** and not significant.

9.9 CONCLUSIONS

9.9.1 This chapter identifies the archaeological and cultural heritage significance of the Proposed Development Area and assesses the potential both for direct and setting effects on archaeological features and heritage assets resulting from the construction, operation and decommissioning of the Proposed Development. This chapter also identifies measures that should be taken to mitigate predicted adverse effects.

9.9.2 National planning policies and planning guidance as well as the local planning policies require that account is taken of potential effects upon heritage assets by proposed developments and that where possible such effects are avoided. Where avoidance is not possible these policies and guidance documents require that effects on any significant remains be minimised or offset.

9.9.3 Eighty nine known heritage assets are within the Proposed Development Area. No significant impacts are expected upon these as the iterative design process has largely allowed for mitigation through avoidance. Three potential **Negligible effects** upon Assets 3 to 5 are expected. The potential for hitherto unknown archaeological remains to survive within the Proposed Development Area has been considered and mitigation measures have been suggested to ensure identification, assessment and avoidance or recording of any such assets as required.

9.9.4 There is one designated asset within the Proposed Development Area, the crash site of a Blenheim Bomber Mk IV bomber which crashed on 8 November 1939 and under the PMRA Act 1986[73] all aircraft, whether civilian or military are Protected Places if on military service, irrespective of whether any loss of life occurred or whether it was during wartime. Within the 1 km Study Area, there is one Scheduled Monument, one Listed Building of Category B status, one Listed Building of Category C status and one Landscape Park designated as being of Regional Significance in the HER. Within the 5 km Study Area, there are an additional nine Scheduled Monuments, six Listed Buildings of Category B status, four Listed Buildings of Category C status, four assets deemed to be of 'National Significance' in the HER and two Archaeologically Sensitive Areas. Within the 10 km Study Area, there are an additional six Scheduled Monuments, one Listed Building of Category A status and one Archaeologically Sensitive Area. One asset, Scottish Dark Skies Observatory within the nationally designated Garden and Designed Landscape at Craigengillan (Asset 217, List No. GDL00111) is outwith the 10 km Study Area and has been included within this assessment following consultation with HES.

9.9.5 No significant effects are anticipated on the settings of designated assets within the defined Study Areas. No significant effects are anticipated on the settings of specified assets raised in consultation with DGAS.

Table 9.7: Conclusion Table – Historic Environment

Description of Effect	Significance of Potential Effect		Mitigation Measure	Significance of Residual Effect	
	Significance	Beneficial/ Adverse		Significance	Beneficial/ Adverse
Non-significant effects on Assets 180 and 181 and 5/182 during construction	Minor	Adverse	Level 2 Historic Structure Survey be undertaken ensure preservation by record leading to minimal loss of information content	Negligible	Adverse

[73] UNITED KINGDOM. Protection of Military Remains Act 1986: Elizabeth II. Chapter 35 (1986) London: Her Majesty's Stationary Office.

Description of Effect	Significance of Potential Effect		Mitigation Measure	Significance of Residual Effect	
	Significance	Beneficial/ Adverse		Significance	Beneficial/ Adverse
			and **Negligible** effects		
Non-significant effects during construction upon known heritage assets. (Assets 3, 4, 5, 55 and 179).	Low	Adverse	Ensure avoidance of inadvertent damage to heritage assets through 50 m buffer areas and watching briefs on construction works within 50 m of heritage assets. Recording of remains to be undertaken where assets are to be removed. This will ensure preservation by record leading to minimal loss of information content and **Negligible** effects.	Negligible	Adverse
Possible significant effects upon hitherto unknown archaeological remains.	High	Adverse	Employ an Archaeological Watching Brief on a proportion of all ground breaking works to ensure any hitherto unknown remains within the Proposed Development footprint are identified. Where possible micrositing should be used to avoid damage to heritage assets. Where avoidance is not possible the Watching Brief will allow for recording of remains where assets are to be removed; ensuring preservation by record leading to minimal loss of information content and **Negligible** effects.	Low	Adverse
Non-significant effects upon the settings of heritage assets	Low	Adverse	N/A	Low	Adverse
during the operational phase					
Non-significant cumulative effects upon the settings of heritage assets during the operational phase.	Low	Adverse	N/A	Low	Adverse

9.10 MITIGATION AND RESIDUAL EFFECTS

Construction Effects

9.10.1 National and local planning policies and planning guidance require a mitigation response that is designed recognise the possible impacts upon heritage assets by a proposed development and avoid, minimise or offset any such impacts as appropriate. The planning guidance expresses a general presumption in favour of preserving heritage remains in situ. Their 'preservation by record' (i.e. through excavation and recording, followed by analysis and publication by qualified archaeologists) is a less desirable alternative.

9.10.2 The Proposed Development has been designed, where possible, to avoid direct impacts on known heritage assets. The only direct effects on known heritage assets would be on non-designated assets of Low importance with a negligible to medium sensitivity and the magnitude of impact would not exceed **Low** in each case. It is recommended that all known heritage assets within 50 m of the Proposed Development (working areas) should be fenced off with a visible buffer under archaeological supervision prior to the start of the construction phase in order to avoid accidental damage by heavy plant movement; including the possible prehistoric hit circle recorded in LiDAR analysis at Asset 79, situated 11 m to the north of the Proposed Substation, Operations Centre and Battery Storage. As Asset 79 is within any potential 50 m buffer area, a watching brief should also be undertaken during construction works that take place within 50 m of Asset 79 The use of 50 m buffer areas around known heritage assets is also recommended during the plantation of forestry areas within the Marbrack and Furmiston areas of the Proposed Development. An Archaeological Watching Brief would be maintained on ground breaking works which are predicted to cross or be located immediately adjacent to archaeological remains as outlined in Tables 9.5 and 9.6.

9.10.3 It is also recommended that Asset 180, Structure and Asset 181, Enclosure should be subject to a Level 2 Historic Structural Structure[74] which will of archaeological drawing, recording and a photographic survey.

9.10.4 A Watching Brief would also be maintained on a proportion of all other ground breaking works to assess the potential for hitherto unrecorded buried archaeological remains to survive within the Proposed Development Area. The aim of the Watching Brief would be to identify any archaeological remains threatened by the Proposed Development, to assess their significance and to mitigate any impact upon them either through avoidance or, if preservation in situ is not warranted, through preservation by record. If significant archaeological remains are identified during the Watching Brief there is the potential that further works, such as excavation and post-

[74] UNITED KINGDOM. HE (2016) Understanding Historic Buildings: A Guide to Good Recording Practice. P. 26.

excavation analyses, could be required. Details of mitigation would be agreed with DGC in consultation with the Dumfries and Galloway Archaeology Service through a Written Scheme of Investigation (WSI).

Operational Effects

9.10.1 Operational effects include impacts upon the settings of designated assets such as World Heritage Sites, Listed Buildings, Scheduled Monuments, Conservation Areas, Inventoried Battlefields and Inventoried Gardens and Designed Landscapes. Impacts upon setting are a material consideration in the planning process.

9.10.2 No significant operation effects or cumulative effects upon the setting of heritage assets has been predicted. Chapter 2: Site Design and Evolution discusses the design evolution of the Proposed Development which has been informed by multiple different disciplines including landscape and visual. The Proposed Development has been designed to present a clearly structured, balanced arrangement which responds positively to key landscape features and local topography. Such mitigation by design also works to minimise visual impacts upon the setting of heritage assets. Beyond this, no direct mitigation for setting effects is possible.

9.10.3 AOC Archaeology and Vattenfall have initiated discussions with Carsphairn Heritage Initiative with a view to increasing understanding, appreciation and experience of heritage assets in the area. This planning application proposes the establishment a footpath stemming from the Proposed Development's access tracks to facilitate pedestrian access to Asset 17. The wind farm's access tracks would also bring users within appreciative distance of Asset 1 and Asset 164. These footpaths and the wind farm's access tracks could be furnished with interpretive boards and QR codes to increase the readers' understanding and appreciation of some of the cultural heritage assets located on the Site. Stakeholder feedback has also indicated this could be extended to include an understanding of the etymology of some of the placenames within the Site, which shed light on the cultural and natural history of the area. The hiking trails would be laid out to avoid any cultural heritage remains.

Decommissioning Effects

9.10.4 No direct effects are anticipated to arise from decommissioning, provided works are contained within the construction footprint. Demarcation of archaeological assets in close proximity to working areas would ensure that accidental damage resulting from plant movement is avoided.

9.10.5 All operational effects upon the settings of designated assets would be reversed with the removal of the turbines following decommissioning, leading to a neutral residual effect

Residual Construction Effects

9.10.6 Demarcation of known assets through fencing prior to commencement of the construction phase (as outlined in Section 9.10.2 and Table 9.7) would prevent inadvertent damage to known heritage assets. The maintenance of an Archaeological Watching Brief as outlined above would allow for recording of peripheral deposits associated with known remains and investigate the potential for previously unknown assets. This would further allow for the avoidance of direct effects or, in cases where this might not be possible, would allow for recording of elements of assets which would be removed. The maintenance of a 50 m buffer area around the possible prehistoric hit circle at Asset 79, situated .11 m to the north of the Proposed Substation, Operations Centre and Battery Storage. During active construction works on the Proposed Substation, Operations Centre and Battery Storage a watching brief should be undertaken of any works conducted within 50 m of Asset 79. These two mitigation measures will reduce the residual effect on Asset 79 to **Negligible** and not significant. The recording of Assets 180, 181 and 5/182. As such; with these mitigation measures there would be minimal loss of information content and the residual effects would be **Negligible** and not significant. Following the completion of construction, no further groundworks would be undertaken. Mitigation would allow for the detailed recording of any remains encountered during the construction phase and the results would therefore enhance our understanding of the area's archaeological heritage. Residual Operation Effects

9.10.7 The predicted residual operational and cumulative effects on the settings of heritage assets would be the same as assessed for the operational and cumulative effects.

9.10.8 No significant residual operational or cumulative effects are anticipated.

9.11 MONITORING

9.11.1 No monitoring is required outwith the measures noted above under Section 9.10 which are to be undertaking during the construction phase.

VATTENFALL

Document history

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Client Name	Vattenfall Wind Power Ltd

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A	06/09/2021	draft for client review
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Chapter 10

Noise

Contents

Glossary

Term	Definition
A-weighting	A frequency weighting designed to correlate measured sound levels with subjective human response. The human ear is frequency selective and our ears are most sensitive between 500 Hz to 6 kHz, particularly when compared with lower and higher frequencies. The A-weighting applies a frequency correction which reduces the effect of these low and high frequencies on the overall measured level in order to account for the subjective human response at these frequencies.
L_{Aeq}	The A-weighted (see above) equivalent energy average noise level over a given time period.
L_{A90}	The A-weighted noise level exceeded for 90% of the time, often used to describe background or wind turbine noise as it excludes transient noises that affect the L_{Aeq}.

List of Abbreviations

List and describe your abbreviations here.

Abbreviation	Description
IOA	Institute of Acoustics
BS 5228	BS:5228:2009 +A1:2014, Code of practice for noise and vibration control on construction and open sites (February 2014)
PAN1/2011	Planning Advice Note PAN1/2011, Planning and Noise, Scottish Government (March 2011)
GPG	The IOA document, A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Noise from Wind Turbines (May 2013).
ETSU-R-97	ETSU-R-97 The Assessment and Rating of Noise from Wind Farms, Department of Trade and Industry Working Group (September 1996)
CRTN	The Calculation of Road Traffic Noise (CRTN) (Department of Transport, Welsh Office, 1988),
dB	Decibel
m	Metres
ms-1 or m/s	Metres per second
AM	Amplitude Modulation

10.1 STATEMENT OF COMPETENCE

10.1.1 The noise assessment was undertaken by the Hayes McKenzie Partnership Ltd. The lead author is Rob Shepherd (MEng), an associate at Hayes McKenzie, who is a Member of the Institute of Acoustics (MIOA) and who has worked in the field of acoustical engineering for over 15 years. In that time, Rob has specialised in the field of noise from onshore wind farms and has been involved in work on over 300 wind farm projects, also appearing as an expert witness (relating to wind farm noise) in the UK and Ireland. Hayes McKenzie Partnership Ltd are sponsor members of the Institute of Acoustics (IOA) and members of the Association of Noise Consultants (ANC).

10.2 INTRODUCTION

10.2.1 This chapter considers the potential noise effects of the Proposed Development on residential receptors in terms of the expected noise levels arising from its construction, operation, and decommissioning.

10.2.2 Construction and decommissioning noise resulting from the Proposed Development is discussed with reference to BS:5228:2009 +A1:2014, Code of practice for noise and vibration control on construction and open sites.

10.2.3 An operational noise assessment has been performed in accordance with ETSU-R-97, *The Assessment and Rating of Noise from Wind Farms*, with reference to the guidance contained within the Institute of Acoustics document, A *Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise* which is endorsed by Scottish Government. The operational noise assessment includes an assessment of cumulative noise impacts with neighbouring wind farm developments.

10.2.4 The noise assessment was carried out according to the methodology submitted to and agreed by Dumfries and Galloway Council.

10.3 LEGISLATION, POLICY AND GUIDANCE

Operational Noise

Planning Advice Note PAN1/2011, Planning and Noise

10.3.1 PAN1/2011 identifies two sources of noise from wind turbines: mechanical noise and aerodynamic noise. It states that “good acoustical design and siting of turbines is essential to minimise the potential to generate noise”. It refers to the ‘web-based planning advice’ on renewables technologies for onshore wind turbines.

Scottish Government 2014, Web Based Planning Advice, Onshore Wind Turbines

10.3.2 The Web Based Planning Advice (The Scottish Government, 2014) on onshore wind turbines re-iterates the sources of noise as “*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*” and that “*there has been significant reduction in the mechanical noise generated by wind turbines through improved turbine design*”. It states that “*the Report, "The Assessment and Rating of Noise from Wind Farms" (Final Report, Sept 1996, DTI), (ETSU-R-97), 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*”. It notes that “this gives indicative noise levels thought to offer a reasonable degree of protection to wind farm neighbours, without placing unreasonable burdens on wind farm developers, and suggests appropriate noise conditions”.

10.3.3 It introduces the Institute of Acoustics (IOA) *A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise* (GPG), and states that “*The Scottish Government accepts that the guide represents current industry good practice*”.

The Assessment and Rating of Noise from Wind Farms: ETSU-R-97

10.3.4 ETSU-R-97, *The Assessment and Rating of Noise from Wind Farms*, presents the recommendations of the Working Group on Noise from Wind Turbines, set up in 1993 by the Department of Trade and Industry (DTI) as a result of difficulties experienced in applying the noise guidelines existing at the time to wind farm noise assessments. The group comprised independent experts on wind turbine noise, wind farm developers, DTI personnel and local authority Environmental Health Officers. In September 1996 the Working Group published its findings by way of report ETSU-R-97. This document describes a framework for the measurement of wind farm noise and contains suggested noise limits, which were derived with reference to existing standards and guidance relating to noise emission from various sources.

10.3.5 ETSU-R-97 recommends that, although noise limits should be set relative to existing background noise and should reflect the variation of both turbine and background noise with wind speed; this can imply very low noise limits in particularly quiet areas, in which case, “*it is not necessary to use a margin above background in such low-noise environments. This would be unduly restrictive on developments which are recognised as having wider global benefits. Such low limits are, in any event, not necessary in order to offer a reasonable degree of protection to the wind farm neighbour.*”

10.3.6 For day-time periods, the noise limit is 35-40 dB L_{A90} or 5 dB(A) above the 'quiet day-time hours' prevailing background noise, whichever is the greater. The actual value within the 35-40 dB(A) range depends on the number of dwellings in the vicinity; the impact of the limit on the number of kWh generated; and the duration of the level of exposure.

10.3.7 For night-time periods the noise limit is 43 dB L_{A90} or 5 dB(A) above the prevailing night-time hours background noise, whichever is the greater. The 43 dB(A) lower limit is based on an internal sleep disturbance criterion of 35 dB(A) with an allowance of 10 dB(A) for attenuation through an open window and 2 dB(A) subtracted to account for the use of L_{A90} rather the L_{Aeq}.

10.3.8 Residential properties where the occupier has financial involvement with the wind farm are allowed higher ‘financially involved’ noise limits where the lower fixed limits (for both the day-time and night-time) are increased to 45 dB L_{A90}.

10.3.9 Where predicted noise levels are low at the nearest residential properties a simplified noise limit can be applied, such that noise is restricted to the minimum ETSU-R-97 level of 35 dB L_{A90} for wind speeds up to 10 m/s when measured at 10 m height. This removes the need for extensive background noise measurements for smaller or more remote schemes.

10.3.10 It is stated that the $L_{A90,10min}$ noise descriptor should be adopted for both background and wind farm noise levels and that, for the wind farm noise, this is likely to be between 1.5 and 2.5 dB less than the L_{Aeq} measured over the same period. The $L_{Aeq,t}$ is the equivalent continuous 'A' weighted sound pressure level occurring over the measurement period ‘t’. It is often used as a description of the average ambient noise level. Use of the L_{A90} descriptor for wind farm noise allows reliable measurements to be made without corruption from relatively loud, transitory noise events from other sources.

10.3.11 ETSU-R-97 also specifies that a penalty should be added to the predicted noise levels, where any tonal component is present. The level of this penalty is described and is related to the level by which any tonal components exceed the threshold of audibility.

10.3.12 With regard to multiple wind farms in a given area, ETSU-R-97 specifies that the absolute noise limits and margins above background should relate to the cumulative impact of all wind turbines in the area contributing to the noise received at the properties in question. Existing wind farms should therefore be included in cumulative predictions of noise level for proposed wind turbines and not considered as part of the prevailing background noise.

A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise

10.3.13 In May 2013, the IOA *published A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise*, as referred to in the Web Based Planning Advice. This was subsequently endorsed by the Secretary of State for Energy and Climate Change and by the Scottish Ministers. The publication of the Good Practice Guide (GPG) followed a review of current practice carried out for the Department of Energy and Climate Change (DECC) and an IOA discussion document which preceded the GPG.

10.3.14 The GPG includes sections on Context; Background Noise Data Collection; Data Analysis and Noise Limit Derivation; Noise Predictions; Cumulative Issues; Reporting; and Other Matters including Planning Conditions, Amplitude Modulation, Post Completion Measurements and Supplementary Guidance Notes. The Context section states that the guide "*presents current good practice in the application of the ETSU-R-97 assessment methodology for all wind turbine development above 50 kW, reflecting the original principles within ETSU-R-97, and the results of research carried out and experience gained since ETSU-R-97 was published*". It adds that "the noise limits in ETSU-R-97 have not been examined as these are a matter for Government".

10.3.15 As well as expanding on and, in some areas, clarifying issues which are already referred to in ETSU-R-97, additional guidance is provided on noise prediction and a preferred methodology for dealing with wind shear. The guidance within the GPG has been considered and followed for this assessment.

Other Issues Arising

Tonal Noise

10.3.16 As discussed at Paragraph 10.3.11, ETSU-R-97 specifies that, in line with other noise guidance, a penalty should be added to measured or predicted wind turbine noise levels if there is tonal noise above a certain level which is audible at residential properties. In this assessment, it has been assumed that there would be no tonal noise associated with the operation of the wind farm which would give rise to such a penalty as most modern turbines operate without significant tonal noise. A penalty is usually included with the planning conditions for wind farms requiring a tonal penalty to be added to measured noise levels, where required, before comparing them with the noise limits. Warranty agreements with turbine suppliers ensure that any such penalties will not occur in practice.

Low Frequency and Infrasound

10.3.17 Low frequency sound is typically defined as sound in the audible hearing frequency range of 20 Hz up to about 200 Hz. Infra-sound is noise occurring at frequencies below that at which sound is normally audible, i.e. at less than about 20 Hz, due to the significantly reduced sensitivity of the ear at such frequencies. In this frequency range, for sound to be perceptible, it has to be at very high amplitude, which is not the case for wind turbine noise.

10.3.18 Noise from wind turbines is not inherently low-frequency and it is typically broad-band in nature; close to a wind turbine the dominant frequencies are usually in the 250 to 2000 Hz range. As the distance from a wind farm site increases, the noise level decreases as a result of the spreading out of the sound energy and also due to air absorption which increases with increasing frequency. This means that, although the energy across the whole frequency range is reduced, higher frequencies are reduced more than lower frequencies with the effect that, as distance from the site increases, the ratio of low to high frequencies also increases. This effect may be observed with road traffic noise or natural sources, such as the sea, where higher frequency components are diminished relative to lower frequency components at long distances. At such distances, however, the overall noise level is so low, such that any bias in the frequency spectrum is insignificant.

10.3.19 Work carried out in 2006 by Hayes McKenzie for the UK Department of Trade and Industry to investigate the extent of low frequency and infrasonic noise from three UK wind farms concluded that "*the common cause of complaints associated with noise at all three wind farms is not associated with low frequency noise, but is the audible modulation of the aerodynamic noise, especially at night*". It is therefore considered that low frequency noise can be scoped out of the assessment.

10.3.20 In November 2016 a study into low frequency and infrasound was published by the State Office for the Environment, Measurement and Nature Conservation of the Federal State of Baden-Wuerttemberg, Germany that contained a comprehensive review of low frequency and infrasound from wind turbines, and evaluated such noise in relation to other sources. The results state that "*the infrasound level in the vicinity of wind turbines is – at distances between 120 m and 300 m – well below the threshold of what humans perceive*" and that "*at a distance of 700 m from the wind turbines, it was observed by means of measurements that when the turbine is switched on, the measured infrasound level did not increase or only increased to a limited extent. The infrasound was generated mainly by the wind and not by the turbines*".

10.3.21 The report concludes that "*Infrasound is caused by a large number of different natural and technical sources. It is an everyday part of our environment that can be found everywhere. Wind turbines make no considerable contribution to it. The infrasound level generated by them lie clearly below the limits of human perception. There is no scientifically proven evidence of adverse effects in this level range*". It is therefore considered that infrasound can be scoped out of the assessment

Amplitude Modulation

10.3.22 The variation in noise level associated with wind turbine operation, at the rate at which turbine blades pass any fixed point of their rotation (the blade passing frequency), is often referred to as blade swish or Amplitude/ Aerodynamic Modulation (AM). This effect is identified within ETSU-R-97 where it is envisaged that *"… modulation of blade noise may result in variation of the overall A-Weighted noise level by as much as 3 dB(A) (peak to trough) when measured close to a wind turbine..."* and that at distances further from the turbine where there are *"… more than two hard, reflective surfaces, then the increase in modulation depth may be as much as 6 dB(A) (peak to trough)*". There have been instances where level of AM rates are higher than this, which results in the noise being perceived as more intrusive (in the same way as tonal content makes the noise more intrusive).

10.3.23 The Department of Energy & Climate Change commissioned a Wind Turbine AM Review report that was published in two phases: Phase 1 in September 2015 and Phase 2 in October 2016 (although the Phase 2 report is dated August 2016). Phase 1 of the report sets out the approach and methodology to the review and research, and the Phase 2 report includes a literature review, research into human response to AM, and recommends how excessive AM might be controlled through the use of a planning condition. The report includes recommendations on how AM should be addressed when quantified according to the recommendations of a separate Institute of Acoustics (IOA) working group document, *A Method for Rating Amplitude Modulation in Wind Turbine Noise* (August 2016).

10.3.24 The AM Review reports recommend a two-tier approach whereby the first tier seeks a reduction in the depth and/or occurrence of AM with a rating level (according to the IOA Amplitude Modulation Working Group method) ≥3 dB. Whether remedial action is required depends on the prevalence of any complaints, and how often AM rating levels ≥3 dB occur. The second tier is that if AM is deemed to be a significant issue, and if nothing can be done to reduce the level of AM, then a penalty scheme has been proposed whereby a penalty ranging from 3 dB (for a rating level of 3 dB) up to a maximum of 5 dB (for a rating level of 10 dB and above) could be added to the measured level before measured levels are compared with the relevant noise limits.

10.3.25 It should be noted that most wind farms operate without significant AM, and that it is not possible to predict the likely occurrence of AM. At the time of writing there has been no official response to those recommendations from the IOA Noise Working group or endorsement from any Scottish Government Minister or Department. The IOA GPG, states that '*the evidence in relation to "Excess" or "other" Amplitude Modulation (AM) is still developing. At the time of writing, current practice is not to assign a planning condition to deal with AM*', although it is possible to control such noise with an appropriately worded planning condition if necessary.

Construction Noise

10.3.26 The Scottish Government's Technical Advice Note, *Assessment of Noise*, states that, for planning purposes, construction noise should be assessed according to BS 5228:2009+A1:2014, *Noise and Vibration Control on Construction and Open Sites*. The standard provides example criteria for the assessment of the significance of construction noise effects and a method for the prediction of noise levels from construction activities. Two example methods are provided for assessing significance.

10.3.27 The first is based on the use of criteria defined in Department of the Environment Advisory Leaflet (AL) 72, *Noise Control On Building Sites* (1976) which sets a fixed limit of 70 dB(A) in rural suburban and urban areas away from main roads and traffic. Noise levels are generally taken as façade L_{Aeq} values with free-field levels taken to be 3 dB lower, giving an equivalent noise criterion of 67 dB L_{Aeq}.

10.3.28 The second is based on noise change, with a 5 dB increase in overall noise considered to be significant. However, when existing noise levels are low, such as at this site, and construction activities continue for more than one month, minimum criteria are applicable. These are 45, 55 and 65 dB LAeq, for night-time (2300-0700), evening and weekends, and daytime (0700-1900) including Saturdays (0700-1300) respectively. This is referred to the ABC method in BS 5228-1 and is described at paragraph E.3.2 and Table E.1 of the standard.

10.3.29 Road traffic noise from construction vehicles accessing the site can be assessed by calculating the increase in road traffic noise caused by construction vehicles above that caused by the existing traffic flow. Predictions were undertaken using *The Calculation of Road Traffic Noise* (CRTN) (Department of Transport, Welsh Office, 1988).

10.3.30 In terms of increases in noise levels for similar sounds, a 10 dB increase is perceived as a doubling of loudness, a 3 dB increase is typically the minimum perceptible for environmental sounds outdoors, and 1 dB is the minimum change in noise level perceptible under laboratory test conditions.

10.4 METHOD OF ASSESSMENT

Operational Noise

10.4.1 Operational noise has been assessed by comparing predicted noise levels at noise sensitive residential receptors that are not financially involved with the Proposed Development with noise limits derived in accordance with ETSU-R-97

10.4.2 The ETSU-R-97 noise limits apply to cumulative noise from all wind farm developments in the vicinity and not from the Proposed Development acting alone. Consideration therefore needs to be made as to whether cumulative operational wind farm noise levels could exceed the noise limits described above. There are two wind farms in the vicinity that have been considered in the cumulative noise assessment; Windy Rig, and Shepherd's Rig. Windy Rig is an operational wind farm, and Shepherd's Rig is in planning, but not consented. Predicted operational noise levels from Windy Rig are below 25 dB L_{A90} at the nearest noise sensitive receptors to the proposed development, which is more than 10 dB below the ETSU-R-97 simplified noise limit and therefore does not add significantly to noise from the Proposed Development. Windy Rig is therefore not considered further in this assessment. Shepherd's Rig is adjacent to the proposed development, and has, therefore been considered as part of the assessment.

10.4.3 Operational noise is assessed against the relevant noise limits described above. Where the relevant noise limits are met, operational noise levels are determined to be acceptable and therefore not significant.

Construction Noise

10.4.4 Daytime construction activities with a duration of one month or longer are assessed against the 65 dB L_{Aeq} noise limit, and if noise levels from predicted construction activities are below this then no significant noise impacts are predicted. Where construction activities have a duration of less than one month, noise levels above 65 dB LAeq are considered to be acceptable as long as mitigation is implemented to reduce the impact as much as reasonably practicable.

10.4.5 In respect of road traffic noise, a doubling of road traffic would, see a 3 dB increase in noise level at receptor locations above existing road traffic noise levels. It is considered that if road traffic noise increases (predicted using CRTN) during the construction phase are below 3 dB then no significant impacts are predicted, and if the predicted increase is less than 1 dB then no impact is predicted. There will be no impact from road traffic noise during the operational phase of the wind farm as the daily increase in road traffic noise during the operational phase would be less than 1 dB.

10.5 CONSULTATION

Scoping Report

10.5.1 The Scoping Report described the relevant legislation and guidance for operational and construction noise, which is still applicable. The report described that the previous baseline noise measurement results (collected in 2012) would be used to derive appropriate noise limits for the site. It was proposed to scope out construction noise due to the likely low impact at the nearest noise sensitive residential receptor locations.

Scoping Opinion

10.5.2 The Scoping Opinion (dated 14th October 2020) received from the Scottish Government described that Scottish Ministers recommended that '*the final list of receptors in respect of noise assessment should be agreed following discussion between the Applicant and Dumfries & Galloway Council'* and that construction noise should not be scoped out.

10.5.3 The Tynron Community Council consultation response also stated that construction noise should not be scoped out of the assessment on the basis of '*potential for significant construction noise and nuisance from quarrying, traffic, turbine erection, and track construction*'.

10.5.4 Dumfries and Galloway Council did not specifically mention noise in their response within the Scoping Opinion, but state that '*the topics listed in the report are acceptable to the Council and should be fully assessed within the EIA Report*'.

Post Scoping Consultation

10.5.5 Hayes McKenzie wrote to Dumfries and Galloway Council on 5th March 2021 to describe the proposed approach to the assessment. It was proposed that, to simplify the assessment, cumulative noise would be assessed against a flat 40 dB L_{A90} noise limit, (except where noise limits applied to consented schemes are already higher than this). At locations that are financially involved with the development, a 45 dB L_{A90} cumulative noise limit would be applied. It was therefore proposed that an assessment be undertaken that was representative of all properties at which predicted noise level from the proposal acting alone is above 30 dB L_{A90}, as the Proposed Development's contribution to cumulative noise levels can be considered to be negligible when 10 dB below the limit. As operational noise levels are proposed to be assessed against fixed noise limits, it was therefore considered that there was no requirement for additional baseline noise measurements.

10.5.6 It was proposed that construction noise would be assessed according to BS 5228:2009, *Code of practice for noise and vibration control on construction and open sites*, where noise from construction may have a significant impact on neighbouring residential properties.

10.5.7 It was also stated that the proposed development includes an on-site battery storage in the vicinity of the substation which would be located towards the centre of the wind farm, approximately 1 km from the nearest residential property. Operational noise from the battery storage facility and substation was therefore very unlikely to be audible at the nearest residential property, and would be scoped out of the noise assessment.

10.5.8 Hayes McKenzie received a response from Dumfries and Galloway Council on 26th May 2021 stating that they '*have no adverse comment to make regarding your proposed assessment methodology*'.

10.5.9 The noise assessment has been undertaken in accordance with the legislation and standards described in the Scoping Report and subsequent consultation, including an assessment of the potential noise impact on nearby residential receptors.

10.6 BASELINE NOISE

10.6.1 Baseline noise measurements were undertaken in 2012 at 10 measurement locations to derive appropriate noise limits for an earlier proposal on the same site. The baseline noise environment generally consisted of typical semi-rural sounds such as noise from wind in the trees and other foliage, birdsong, running water (in nearby streams and rivers), local road traffic, road traffic noise from the A713, dogs barking, and livestock in fields. There are unlikely to have been any significant changes in the local environment to significantly change the baseline noise environment since the 2012 measurements.

10.6.2 As discussed above, both the construction and operational noise impacts have been assessed against fixed noise limits that apply irrespective of baseline noise levels. No additional baseline noise measurements have therefore been carried out.

10.7 ASSESSMENT OF POTENTIAL EFFECTS

Operational Noise

10.7.1 Operational noise predictions have been carried out according to the methodology described in the IOA GPG, with the full methodology set out in Appendix 10.1. Predictions were carried out for the layout shown at Table 10.1 below.

Table 10.1: Quantans Hill Turbine Layout

Turbine ID	Easting	Northing
1	258471	594886
2	259026	595416
3	257624	594845
4	257699	595372
5	259785	594749
6	258811	594380
7	258222	593893
8	259127	593842
9	259642	594169
10	260607	594374
11	260797	595109
12	261135	593851
13	260785	593404
14	260426	592953

10.7.2 Predictions were made at the residential noise sensitive receptors shown at Table 10.2 below which also indicates whether the inhabitants of each property are financially involved with the proposed development, and therefore qualify for the financially involved noise limits.

Table 10.2: Receptor Locations

Receptor Name	Easting	Northing	Financial Involvement
Bridgend	255745	594484	-
Old Burnfoot Cottage	259010	592316	-
Glendean	256290	593282	-
Knockgray Cottage	257674	593193	-
Marbrack Cottage	259648	593236	Yes
Marscalloch Cottage	260382	591387	-
Nether Loskie	260027	591748	-
Furmiston	260326	592328	Yes
Kensglen	259680	591873	-
Burniston	259214	592308	-
Burnfoot	259119	592426	-
Marbrack Farm	259729	593306	Yes
Bardennoch	257836	591822	-
Cumnock Knowes	257778	592585	-
Stables Cottage	257625	593197	-
Knockgray	257854	593392	Yes
North Liggate	256790	593209	-
South Liggate	256765	593181	-
The Cabin	256212	593360	-
The Birks	256619	592939	-
Carsphairn Primary School	256203	593197	-
4 Mcadams Way	256057	593469	-
Marbrae	258277	592843	-

10.7.3 The candidate turbine assumed for the operational noise predictions is the Siemens Gamesa SG 6.0-170 with a hub height of 115 m. Sound power levels supplied by the manufacturer with 2 dB added to account for uncertainty are shown at Table 10.3 below for the highest sound power level across all wind speed. The maximum sound power level is reached at a hub height wind speed of 9 m/s and does not increase above this, i.e. at higher wind speeds the sound power level remains constant. At lower wind speeds, where the turbines are operating below the maximum sound power level, operational noise levels will be lower.

Table 10.3: Candidate Turbine Assumed Sound Power Level and Octave Band Spectrum (dB L_{WA})

	Octave band centre frequency (Hz)								Total
Turbine Type	63	125	250	500	1000	2000	4000	8000	
SG 6.0-170	89.5	96.3	98.5	99.5	102.7	102.4	97.9	86.1	108.0

Concave Ground Profile

10.7.4 The propagation paths between each turbine and each receptor location have been reviewed according the methodology described in Appendix 10.1 to determine whether any concave ground profile corrections are required. In this case, concave ground profile corrections were identified at a number of locations, and have been implemented where detected, although it should be noted that the formula for identifying concave ground profiles can detect profiles which are unlikely to require a correction in practice, particularly over large propagation distances. The concave ground profile corrections for each property are described in Appendix 10.1.

Topographical Shielding

10.7.5 Due to the topography of the site, the tips of a number of the turbines are not visible at a number of noise sensitive receptor locations resulting in a reduction in predicted noise level. For the purposes of the topographical corrections a tip height of 200 m has been assumed. The topographical shielding identified for each turbine to receptor path is shown are described in Appendix 10.1.

Prediction Results

10.7.6 The results of the operational noise predictions are shown at Table 10.4 below, including the ground profile and topographical shielding corrections identified at in Appendix 10.1. It should be noted that the prediction results assume downwind propagation from all turbines, and assuming that all turbines are operating at their maximum noise output. For lower wind speeds, and wind directions other than downwind, operational noise levels would be lower. It should be noted that at this site the prevailing wind direction is westerly or south-westerly and the nearest receptor properties are to the south of the site, and that therefore nearest properties will not be downwind of the wind farm for the majority of the time (and therefore operational noise levels are likely to be lower than predicted for significant periods).

Table 10.4: Operational Noise Prediction Results for Quantans Hill Acting Alone (dB L_{A90})

Receptor Name	Easting	Northing	Predicted Noise Level (dB L_{A90})
Bridgend	255745	594484	29
Old Burnfoot Cottage	259010	592316	34
Glendean	256290	593282	30
Knockgray Cottage	257674	593193	37
Marbrack Cottage*	259648	593236	41
Marscalloch Cottage	260382	591387	31
Nether Loskie	260027	591748	33
Furmiston*	260326	592328	39
Kensglen	259680	591873	34
Burniston	259214	592308	35
Burnfoot	259119	592426	35
Marbrack Farm*	259729	593306	41
Bardennoch	257836	591822	33
Cumnock Knowes	257778	592585	34
Stables Cottage	257625	593197	37
Knockgray*	257854	593392	40
North Liggate	256790	593209	32
South Liggate	256765	593181	32
The Cabin	256212	593360	30
The Birks	256619	592939	31
Carsphairn Primary School	256203	593197	30
4 Mcadams Way	256057	593469	29
Marbrae	258277	592843	36

NB Financially interested properties are denoted with an asterisk (*)

10.7.7 Predicted noise levels are 30 dB L_{A90} or above at 21 locations, and therefore a cumulative noise impact assessment is required for these locations.

Construction Noise

10.7.8 Detailed construction noise predictions have not been carried out here due to the large separation distances between on-site construction activities and sensitive residential receptors. However, it is highly likely that on-site track construction that is further than 200 m from residential properties would be below the 65 dB L_{Aeq} criterion. There is no on-site track construction proposed within 200 m of residential properties. All other on-site construction activities are likely to be less noisy.

10.7.9 It is likely that blasting will be required at the proposed borrow pit locations to extract rock. It is not possible to carry out meaningful predictions as the frequency, duration and noise levels from blasting all depend very much on the type of rock, depth of charge and surrounding ground conditions onsite, together with the amount of rock that is required. .

10.7.10 Where highways and cabling works are required outside of the site boundary along the route to the grid connection point, noise may be generated at times that is above the 65 dB L_{Aeq} adopted criterion at residential properties close to the works proposed, although the duration of the works is likely to be relatively short (i.e. less than one month). Specific predictions of likely noise levels have not been carried out as the likely noise levels are dependent on the specifics of the works required which are not known at this stage. Where highways and cabling works are carried out at more than 200 m from noise sensitive properties, or the duration of construction activities is less than one month, then no significant effects are predicted.

10.7.11 Detailed road traffic noise predictions have not been undertaken as the predicted daily traffic increases detailed in Chapter 11, Traffic and Transport, indicates that no significant noise impacts on trunk road receptors are predicted, as the increases in road traffic during the construction phase is generally small in relation to general traffic movements. The average increases in overall road traffic and HGV movements are well below 50% such that the predicted noise increase will be significantly less than 3 dB and therefore not significant Where there are increases in road traffic, these will only be during the relatively short construction phase of the development.

10.7.12 Noise predictions have not been undertaken for decommissioning activities, but the large separation distances between breaking up of the concreate foundations (likely to be the noisiest activity) and residential properties would result in noise levels at residential properties that are likely to be significantly below the adopted construction noise limit.

10.8 CUMULATIVE EFFECTS

Operational Noise Effects

10.8.1 The Proposed Development is adjacent to the proposed Shepherd's Rig Wind farm. Cumulative operational noise predictions have therefore been carried out to consider the combined operation of the Proposed Development with Shepherd's Rig.

10.8.2 A number of other wind farms in the vicinity were considered, but are not included in the cumulative operational noise assessment because their prediction operational noise levels are below 30 dB at any receptor location relevant to the Proposed Development. The nearby wind farms considered but excluded from the assessment are:

- Afton
- Benbrack
- Cornharrow
- Glenshimmeroch
- Margree
- South Kyle
- Torrs Hill
- Troston Loch
- Windy Rig
- Windy Standard
- Windy Standard Repower
- Windy Standard II
- Windy Standard III

10.8.3 Operational noise predictions have been carried out according to the methodology described in the IOA GPG, with the full methodology set out in Appendix 10.1. Predictions were carried out for the layout shown at Table 10.6 below.

Table 10.5: Shepherd's Rig Turbine Layout

Turbine ID	Easting	Northing
1	261952	595637
2	262221	595349
3	262915	595224
4	261734	595199
5	262475	594930
6	261915	594785
7	262100	594427
8	262404	594135
9	261985	593849
10	262325	593596
11	261738	593413
12	262667	593305
13	262123	593084
14	261438	592977
15	262482	592799
16	261690	592707
17	262045	592402

10.8.4 The candidate turbine assumed for Shepherd's Rig Wind farm is the Vestas V117 turbine with a hub height of 91.5 m. Sound power levels were taken from the Shepherd's Rig EIA and are shown at Table 10.6 below for the highest sound power level across all wind speed. The maximum sound power level is reached at a hub height wind speed of 9 m/s and does not increase above this.

Table 10.6: Shepherd's Rig Assumed Sound Power Level and Octave Band Spectrum (dB L_{WA})

	Octave band centre frequency (Hz)								
Turbine Type	63	125	250	500	1000	2000	4000	8000	Total
Vestas V117	89.6	97.1	100.1	101.8	102.4	99.8	95.8	84.3	108.0

10.8.5 Topographical corrections have been made to the predicted operational noise levels for the proposed Shepherd's Ring Wind Farm in the same way as carried out for the Proposed Development. For the purposes of the topographical corrections a tip height of 150m has been assumed for all Shepherd's Rig turbines. The topographical correction results are presented in Appendix 10.1.

Results

10.8.6 The predictions of the cumulative noise predictions are presented at Table 10.7 below for the same properties as listed at Table 10.2. It should be noted that at properties where predicted noise levels from the Proposed Development acting alone are below 30 dB L_{A90} cumulative noise impacts are negligible irrespective of the contribution from other wind turbines (as predicted noise levels are more than 10 dB below the adopted cumulative noise limit of 40 dB L_{A90}).

Table 10.7: Cumulative Operational Noise Prediction Results (dB L_{A90})

			Predicted Noise Level (dB L_{A90})		
Receptor Name	Easting	Northing	Total	Quantans Hill	Shepherd's Rig
Bridgend	255745	594484	30	29	21
Old Burnfoot Cottage	259010	592316	36	34	31
Glendean	256290	593282	31	30	25
Knockgray Cottage	257674	593193	37	37	28
Marbrack Cottage*	259648	593236	42	41	34
Marscalloch Cottage	260382	591387	35	31	33
Nether Loskie	260027	591748	36	33	33
Furmiston*	260326	592328	41	39	37
Kensglen	259680	591873	36	34	32
Burniston	259214	592308	37	35	32
Burnfoot	259119	592426	37	35	31
Marbrack Farm*	259729	593306	42	41	35

Receptor Name	Easting	Northing	Predicted Noise Level (dB L_{A90})		
			Total	Quantans Hill	Shepherd's Rig
Bardennoch	257836	591822	34	33	29
Cumnock Knowes	257778	592585	35	34	29
Stables Cottage	257625	593197	37	37	28
Knockgray*	257854	593392	40	40	29
North Liggate	256790	593209	33	32	26
South Liggate	256765	593181	33	32	26
The Cabin	256212	593360	31	30	24
The Birks	256619	592939	32	31	26
Carsphairn Primary School	256203	593197	31	30	25
4 Mcadams Way	256057	593469	30	29	23
Marbrae	258277	592843	37	36	30

NB Financially interested properties to the Proposed Development are denoted with an asterisk (*)

Operational Noise Assessment Results

10.8.7 The cumulative noise assessment results are presented at Table 10.8 below, which shows the predicted cumulative noise levels, the limit applicable to each location, and the margin between the cumulative predicted noise level and the relevant limit.

Table 10.8: Cumulative Operational Noise Assessment Results (dB L_{A90})

Receptor Name	Easting	Northing	Total Predicted Noise Level (dB L_{A90})	Noise Limit (dB L_{A90})	Margin to Limit (dB)
Bridgend	255745	594484	30	40	10
Old Burnfoot Cottage	259010	592316	36	40	4
Glendean	256290	593282	31	40	9
Knockgray Cottage	257674	593193	37	40	3
Marbrack Cottage	259648	593236	42	45	3
Marscalloch Cottage	260382	591387	35	40	5
Nether Loskie	260027	591748	36	40	4
Furmiston	260326	592328	41	45	4
Kensglen	259680	591873	36	40	4
Burniston	259214	592308	37	40	3
Burnfoot	259119	592426	37	40	3
Marbrack Farm	259729	593306	42	45	3
Bardennoch	257836	591822	34	40	6
Cumnock Knowes	257778	592585	35	40	5
Stables Cottage	257625	593197	37	40	3
Knockgray*	257854	593392	40	45	5
North Liggate	256790	593209	33	40	7
South Liggate	256765	593181	33	40	7
The Cabin	256212	593360	31	40	9
The Birks	256619	592939	32	40	8
Carsphairn Primary School	256203	593197	31	40	9
4 Mcadams Way	256057	593469	30	40	10
Marbrae	258277	592843	37	40	3

10.8.8 The results of the operational noise assessment indicated that predicted cumulative noise levels meet either the adopted 40 dB L_{A90} cumulative noise limit, or the financially involved noise limit of 45 dB L_{A90}.

Cumulative Construction Effects

10.8.9 Cumulative construction effects could occur if the Proposed Development is constructed at the same time as the adjacent proposed Shepherd's Rig Wind Farm. However, there are unlikely to be any simultaneous construction activities that would result in construction noise levels exceeding the criterion described at paragraph 10.4.4, and therefore no significant cumulative construction effects are anticipated.

10.9 CONCLUSIONS

10.9.1 Operational noise levels from the Proposed Development, including the effects of cumulative noise, have been assessed against noise limits derived in accordance with national guidance, and agreed with Dumfries and Galloway Council.

10.9.2 The results of the operational noise impacts assessment indicates that predicted noise levels at the nearest noise sensitive receptors would meet the relevant criteria.

10.9.3 Noise from construction and decommissioning activities have been assessed with reference to a fixed noise limit as suggested by BS 5228:2009+A1:2014, *Noise and Vibration Control on Construction and Open Sites*. Detailed predictions have not been undertaken given the separation distances between construction activities and noise sensitive receptor locations. A commitment will be made to ensure that the relevant construction noise limits will not be exceeded during the construction phase.

10.10 MITIGATION AND RESIDUAL EFFECTS

Operational Noise Mitigation

10.10.1 No specific operational mitigation is required as the relevant noise limits are met. It should be noted that noise reduced modes of operation are generally available for wind turbines of the scale proposed here that allow noise levels to be reduced by restricting the rotational speed of the machines. This mitigation could be employed if any noise issues arise that would require mitigation to be implemented.

10.10.2 A number of receptors have the higher financially involved noise limits applied which apply where the occupier of a property has a direct financial involvement with the wind farm. It should be noted that the non-involved noise limits could be met by though application of the necessary mitigation. It should be noted that the Proposed Development has been assessed against a fixed 40 dB L_{A90} cumulative noise limit, and that at night the relevant cumulative noise limit is 43 dB L_{A90} or plus 5 dB above background (whichever is the greater), and therefore, as

predicted cumulative operational noise level are below 43 dB L_{A90} at all receptor location it is likely that mitigation would only be required during the daytime.

Residual Operational Noise Effects

10.10.3 No significant residual noise effects are predicted as the relevant noise limits have been shown to be met.

Construction Noise Mitigation

10.10.4 The results of the assessment show that no significant effects are anticipated, and therefore no specific mitigation is required, however good practice construction techniques will be employed to minimise noise effects. In addition to proposed good practice measures, a noise control plan, as part of the Construction Environmental Management Plan (CEMP) will be produced that includes:

- procedures for ensuring compliance with statutory or other identified noise control limits, including ensuring the maximum set back distance between construction works and residential properties;
- procedures for minimising noise from construction related traffic on the existing road network (likely to be in the form of a Construction Traffic Management Plan (CTMP));
- general induction training for site operatives, and specific training for staff having responsibility for particular aspects of controlling noise from the site; and
- procedures for contacting residents to advise them prior to noisy construction activities within 100m of residential properties and providing a complaints procedure in relation to these activities.

10.10.5 In terms of the blasting for the Development borrow pits, the most appropriate mechanism is for a pre-blasting noise management programme to be prepared which will identify the most sensitive receptors that could be potentially affected by blasting noise. The programme will contain details of the proposed frequency of blasting, and proposed monitoring procedures. The operator will inform the nearest residents of the proposed times of blasting and of any deviation from this programme in advance of the operations. The programme will also contain contact details which will be provided to local residents should concerns arise regarding construction and blasting activities. In addition, each blast will be designed carefully to maximise its efficiency and to reduce the transmission of noise.

Residual Construction Effects

10.10.6 Residual construction effects are expected to be not significant as construction noise levels will either be below the adopted noise limit at all properties within 200 m or construction works or will have a duration of less than one month at these receptors.

10.10.7 Construction traffic noise at receptors on the Northern Access Track will result in noise levels lower than the 65 dB L_{Aeq} construction noise limit, and therefore the residual effect of road traffic noise is considered to be not significant.

10.10.8 Construction traffic noise residual effects are considered to be not significant as no significant increases in road traffic noise due to construction vehicles accessing the site are predicted.

10.11 REFERENCES

British Standard BS 5228-1:2009-A:2014 (2009). *Code of practice for noise and vibration control on construction and open sites* Part 1: Noise', Part 2: Vibration.

ETSU-R-97, *The Assessment and Rating of Noise from Wind Farms*, 1996

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VATTENFALL

Chapter 11

Traffic and Transport

Contents

List of Abbreviations

List and describe your abbreviations here.

Abbreviation	Description
AADT	Average Annual Daily Traffic
AIL	Abnormal Indivisible Loads
CMS	Construction Method Statement
DfT	Department for Transport
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
ES	Environmental Statement
HGV	Heavy Goods Vehicle
IEA/IEMA	Institute of Environmental Assessment (now Institute of Environmental Management and Assessment)
IHT	Institute of Highways and Transportation
LGV	Light Goods Vehicles
SR	Scoping Response
TMP	Traffic Management Plan
CTMP	Construction Traffic Management Plan
BoP	Balance of Plant
TIA	Traffic Impact Assessment

11.1 STATEMENT OF COMPETENCE

11.1.1 Natural Power's Design and Advisory Services (DAS) team have over 20 years' experience in undertaking access assessments, traffic impact assessment, transport studies and traffic management plans for the renewable industry. As well as undertaking these assessments, the DAS team regularly undertake due diligence reviews of third party access studies for project financial closure. The team works closely with developers, turbine suppliers and haulage contractors to keep abreast of the latest developments in turbine component transport.

11.1.2 The DAS team is involved in all stages of wind farm developments from conception, through planning, planning condition discharge, construction and asset management/maintenance. This range provides the team with detailed experience of the various stages and how the traffic related issues follow and influence these stages. This experience is particularly valuable for the current planning stage where the traffic impacts and preliminary traffic management plan will be picked up and further refined during planning condition discharge and into construction.

11.2 INTRODUCTION

11.2.1 This section of the Environmental Impact Assessment Report (EIAR) assesses the traffic and transport impacts and potential effects during the construction of the Proposed Development.

11.2.2 Construction traffic required to construct the wind farm falls into three broad categories; namely Abnormal Indivisible Loads (AILs), Heavy Goods Vehicles (HGVs) and Light Goods Vehicles (LGVs).

11.2.3 The construction of the Proposed Development is expected to last approximately 28 months, from site mobilisation through to installation and commissioning of the turbines, ending with site re-instatement and demobilisation. There will be a temporary site shut down during winter months 22 through 25 as this is anticipated to coincide with poorer weather conditions, turbine erection is estimated to then commence in month 26.

11.2.4 The following Appendices accompany this EIAR chapter:

Appendix 11.1: Abnormal Indivisible Load Route Survey;

Appendix 11.2: Preliminary Traffic Management Plan.

11.2.5 The traffic and transport assessment considered a worst-case scenario and assumes all stone would need to be imported onto site and all foundation concrete would need to be brought to site in ready mix lorries. In reality, the import of stone may be reduced as this planning application also includes proposals for onsite borrow pits, to take advantage of any site-won stone, and onsite concrete batching plants, for the mixing of concrete within the wind farm site.

11.2.6 In addition, the traffic impacts associated with the abnormal load deliveries were also assessed. An Abnormal Indivisible Load Route Survey, including swept path analysis at particular pinch points was also prepared demonstrating the viability of the proposed abnormal load route, see Appendix 11.1.

11.2.7 The assessment concludes that, with the incorporation of embedded best practice mitigation measures, secured through a Construction Traffic Management Plan, there will be no significant traffic effects associated with the Proposed Development.

11.2.8 A preliminary Traffic Management Plan has been prepared. It is expected a Planning Condition will be applied to the development for a final construction TMP to be prepared and approved by Dumfries & Galloway Council post consent and prior to construction works commencing.

11.3 LEGISLATION, POLICY AND GUIDANCE

11.3.1 This section outlines the legislation, policy and guidance that has been reviewed. The transport and traffic issues described in the following planning advice and guidance documents have been taken into account in this assessment, for full details Refer to chapter 4 of the EIAR

- Scotland's Third National Planning Framework (2014), The Scottish Government;
- Scottish Planning Policy (SPP) (2014), The Scottish Government;
- Planning Advice Note (PAN) 75: Transport and Planning (2005), The Scottish Government;
- Onshore Wind Turbines; Online Renewables Planning Advice, The Scottish Government;
- Transport Assessment Guidance (2012), Transport Scotland;
- Guidelines for the Environmental Assessment of Road Traffic (1993), Institute of Environmental Assessment (IEA), now the Institute of Environmental Management and Assessment (IEMA);
- Local Development Plan 2 (2019)

11.3.2 Much of the above policy and guidance deals principally with developments that generate significant increases in travel as a direct consequence of their function (e.g. retail parks, housing, etc) and measures to implement a more sustainable transport solution. The traffic generated by the Proposed Development would almost entirely be limited to vehicle movements during the construction phase. As such, the impact of traffic from the Proposed Development is temporary and of a short-term duration when compared to developments such as retail parks where the traffic impact can be permanent and for a long duration of typically a 60 year design span.

11.4 CONSULTATION

Scoping Opinion

11.4.1 Dumfries and Galloway Council confirmed they were content with the proposed assessment as detailed in the Scoping Report, which included the following key elements:

- The impact of the Proposed Development on the public road network should be assessed using the latest guidance, including the Guidelines for the Environmental Assessment of Road Traffic (IEMA 1993) and Transport Scotland Guidance on Transport Assessment.
- The study would consider effects during construction, operation and decommissioning;
- The traffic and Transport chapter of the EIAR will include the Traffic Impact Assessment, AIL Access Assessment and a preliminary Traffic Management Plan.

Dumfries and Galloway Council

11.4.2 A meeting/call was held with Dumfries and Galloway Council Roads Planning Officer to discuss the Proposed Development and traffic implications. The key outcomes of this meeting/call were:

- Happy with proposed methodology of assessment.
- Suggested looking at areas where can work with other developers to minimise disruption to road users (multiple works, etc)

11.4.3 Following meeting with Transport Scotland (see below), Dumfries and Galloway Council Roads Team were advised on the methodology that was to be adopted. The team indicated that the proposed methodology was satisfactory.

Transport Scotland

11.4.4 A meeting/call was held with Transport Scotland to discuss access EIA methodology for the Proposed Development.

- Transport Scotland indicated the proposed methodology was satisfactory.

Ayrshire Roads Alliance

11.4.5 Following meeting with Transport Scotland to discuss access EIA methodology for the Proposed Development, Ayrshire Roads Alliance were advised on the approach that was to be adopted. Again, was indicated that the proposed methodology was satisfactory.

11.5 TRAFFIC AND TRANSPORT METHODOLOGY

11.5.1 The methodology employed in this assessment has been developed from guidance given in the "Guidelines for the Environmental Assessment of Road Traffic" (IEMA 1993). To assess the effects of the additional traffic generated by the Proposed Development during the construction phase, the sequence of steps detailed below has been followed.

- Establishment of baseline traffic conditions;
- Estimate the traffic numbers and routing for the Proposed Development;
- Determine the magnitude of impact to the baseline traffic conditions due to the Proposed Development;
- Undertake a screening test to delimit the scale and extent of the assessment;
- Identify and assess the sensitivity of receptors with best practice embedded mitigation considered;
- Synthesise the sensitivity of the receptor with the magnitude of impact to determine the significance of effect.
- If the significance is elevated, review opportunities to implement impact mitigation measures and re-assess the significance of effect.

11.5.2 Consideration was given to the construction, operation and decommissioning phases of the Proposed Development.

11.5.3 When considering the magnitude of the impact it should be recognised that the traffic generated by the Proposed Development would be short term due entirely to vehicle movements relating to the construction phase of the Proposed Development. Following completion of the construction phase, traffic levels will return to their baseline conditions as the impact of vehicle movements during the operational phase, largely LGVs, is deemed to be negligible within the context of baseline traffic.

11.5.4 The method of decommissioning would be agreed with the relevant planning authority as outlined in Chapter 4: Description of Development of this EIAR. In line with current practice all turbine components, including blades, nacelles and towers would be removed from the site. If not to be re-used, turbine components would likely be cut to manageable sizes on site to allow use of normal HGV vehicles. Above ground infrastructure would be removed with foundations generally removed to around 1m below ground level, with the remainder left in-situ. Therefore, the HGV movements will be less than during the construction period. The decommissioning would be likely to take place over a similar time period shown. Baseline traffic flows on all of the affected roads may have altered by the end of the up to 35 year lifetime of the wind farm leading to the possibility of a different effect on the roads for HGV traffic. It is envisaged that the decommissioning would result in lesser effects than those identified for this assessment and no further assessment has been undertaken. Decommissioning would be managed in accordance to a decommissioning plan to be agreed with relevant authorities at the timeAs such this assessment will consider the effects during the construction phase only.

Magnitude of Impact

11.5.5 The magnitude of traffic impact is a function of the existing traffic volumes, the percentage increase due to the proposals, the changes in type and the temporal distribution of traffic. The IEMA Guidelines identify magnitude thresholds based on percentage changes in traffic levels as being applicable to severance and intimidation effects. The magnitude of impacts arising from the increase in traffic volumes (taken as being either the traffic flow including all vehicles or the HGV traffic flow, whichever is higher) is categorised in Table 11.1.

Table 11.1: Definitions of magnitude of impact criteria

Magnitude	Criteria	Percentage Increase
High	Total loss or major alteration to key elements/features of the baseline conditions	**>90%**
Medium	Partial loss or alteration to one or more key elements/features or baseline conditi	**>60-90%**
Low	Minor shift away from baseline conditions	**>30-60%**
Negligible	Very slight change from baseline conditions	**0-30%**

11.5.6 The assessment has considered both the change in magnitude of the impacts as well as their absolute levels.

11.5.7 Consideration was given to the composition of the traffic on the road network under both baseline and predicted conditions. For example, Light Goods Vehicles (LGVs) generally have less effect on traffic and the road system than Heavy Goods Vehicles (HGVs). Within the assessment the estimated numbers of LGVs, HGVs and abnormal load vehicles associated with the Proposed Development have been calculated and the resultant percentage increase in these vehicles compared to baseline conditions established to determine the increase in traffic.

11.5.8 Consideration was given to the timing and duration of traffic effects. For example LGVs may be concentrated to particular times of the day and week (start / end of the working day from Monday to Friday) whereas HGVs may be spread over the working day. Abnormal loads may have a considerable effect on the road congestion and delay if they occur during peak periods. Without details of the contractor's proposed working methods, suppliers, detailed construction sequencing, contractor's material procurement procedures and deliveries it was considered inappropriate to include timing and duration of traffic within the assessment. Therefore, good practice recommendations are made for the contractor to manage the timing of works and deliveries to avoid peak traffic periods.

11.5.9

Screening Test

11.5.10 The IEMA Guidelines suggest two general rules for establishing the increase in traffic levels that are likely to affect the environmental conditions of the road, and that therefore warrant consideration, namely:

- **Rule 1** - Include highway links where traffic flows would increase by more than 30% (or the number of HGVs would increase by more than 30%)
- **Rule 2** - Include any other specifically sensitive areas where traffic flows would increase by 10% or more. (IEA Guidelines Paragraph 3.20 defines sensitive areas as including *"accident blackspots, conservation areas, hospitals, links with pedestrian flows etc.").* Paragraph 3.20 also notes that *"normally it would not be appropriate to consider links where traffic flows have changed by less than 10% unless there is a significant change in the composition of traffic, eg. a large increase in the number of heavy goods vehicles".*

11.5.11 Where the predicted increase in traffic flow is lower than these thresholds, the IEMA guidelines suggest that the significance of the effects can be stated to be low or insignificant, and further detailed assessments are not warranted. Further guidance is given for Rule 1 with regard to certain aspects of traffic effects. These indicate that projected changes in traffic of less than 10% create no discernible environmental effect.

11.5.12 These guidelines are intended to be used for the assessment of the environmental effect of road traffic associated with major new developments. The assessment is therefore more pertinent to the operational phase of the wind farm than the construction phase. However, they are used here to assess the short-term transport flow during construction.

The matrix shown in Table 11.2 below has been used for traffic assessment.

Table 11.2: Screening criteria

Rule 1	Rule 2	Further assessment required
Yes	Yes	**Yes**
Yes	No	**Yes**
No	Yes	**Yes**
No	No	**No**

Embedded Mitigation

11.5.13 Embedded mitigation is measures that have been incorporated into the design of the development. In terms of Traffic and Transport, embedded mitigation is primarily delivered through a Traffic Management Plan (TMP). As part of the Traffic and Transport assessment chapter a preliminary TMP has been prepared (Appendix 11.2) and it is expected a Planning Condition will be applied to the development for a final construction TMP to be prepared and approved by Dumfries and Galloway Council post consent and prior to construction works commencing.

11.5.14 Embedded mitigation includes “best practice” processes which are implemented during construction, regardless of the outcome of the traffic impact assessment. Measures which have been included for the Proposed Development are:

- Scheduling of HGV deliveries to avoid peak times
- Temporary signage to direct HGV drivers to the Proposed Development and advise of routes not permitted
- Temporary signage to inform both drivers and pedestrians of risks and highlight rights of ways/ priorities
- Reduced speed limits
- Scheduling of construction activities, with focus on concrete and AIL deliveries to reduce deliveries whilst key activities occurring
- Trail run for AIL movements prior to commencement of construction
- Consultation with Local highway authorities and Police to co-ordinate AIL deliveries
- Consultation with the Local highway authorities and the local community and individuals who will be most affected during the construction period

11.5.15 This Traffic and Transport assessment has been based on a number of conservative assumptions. The most important in terms of the impact on traffic flows being the construction programme/sequencing, source of stone and concrete deliveries. These assumptions can only be clarified post consent and once a BoP contractor is engaged. Hence the requirement for a Planning Condition for a final construction TMP to be prepared and approved prior to construction commencing.

Assessment of Sensitivity

11.5.16 The sensitivity of the roads used by the Proposed Development have been assessed in accordance with the IEMA Guidelines and although not providing specific criteria for evaluating sensitivity. for the purpose of this assessment, a scale of 'low', 'medium' and 'high' has been used.

11.5.17 The assessment has considered three categories of receptors, which consist of;

- Road network and road users;
- Local settlements along the proposed access route(s);
- Road structure.

11.5.18 When judging the sensitivity of the road to the anticipated temporary increase in traffic movements associated with the Proposed Development, a variety of considerations were taken in account including, classification of the road, proximity of schools, housing and local amenities and existing traffic management (e.g. roundabouts, passing places etc.).

Road Network and Road Users

11.5.19 In this Chapter, the sensitivity of the road networks and its users has been determined with respect to its capacity to absorb an increase in traffic. A road with a high capacity to absorb an increase in traffic will have a lower sensitivity to change than a road with little or no capacity to absorb an increase in traffic.

Local Settlements

11.5.20 The sensitivity of local settlements are reviewed in terms of pedestrian severance, pedestrian delay, pedestrian and cyclist amenity, pedestrian intimidation and pedestrian safety.

Pedestrian Severance

11.5.21 Severance is the perceived division that can occur within a community when it becomes separated by a major traffic artery and is used to describe the factors that separate people from other people and places. For example, severance may result from the difficulty of crossing a heavily trafficked road.

Pedestrian Delay

11.5.22 Changes in the volume, composition or speed of traffic may affect the ability of people to cross roads and, therefore, increases in traffic levels can lead to increases to pedestrian delay. Pedestrian delay will also depend on factors such as level of pedestrian activity, visibility and presence of pedestrian crossing points. For example, a settlement with several designated pedestrian crossing points will be less sensitive to increased traffic volumes than a settlement with few or no designated pedestrian crossing points

Pedestrian and Cyclist Amenity

11.5.23 Pedestrian and cyclist amenity can be broadly defined as the perceived pleasantness of a journey and is considered to be affected by traffic flow, traffic composition and pavement width/separation from traffic. For example, a settlement with wide pavements and segregated cycle lanes will be less sensitive to increased traffic volumes than a settlement with narrow pavements.

Pedestrian Intimidation

11.5.24 Intimidation experienced by pedestrians is dependent on the volume of traffic, its composition, its proximity to people and the perceived lack of protection caused by such factors as pavement widths, traffic speed and vehicle size. For example, a settlement with narrow pavements and no pedestrian guardrails will be more sensitive to increased traffic volumes than a settlement with wide pavements that are lined with pedestrian guardrails.

Pedestrian Safety

11.5.25 Safety is affected by such matters as traffic speed, traffic volumes and complexities in the road structure. For example, a straight road is easier to navigate than a road with several junctions and bends, which can lead to increased safety risk. Similarly, the presence of islands can create locations where pedestrians cross the road rather than using the designated crossing points.

Road Structure

11.5.26 The sensitivity of the road structure has been assessed based on its importance and a high-level visual assessment of its condition. For example, a national route or motorway in good condition will be less sensitive to an increase in traffic flow than a regional route with some physical defects.

11.5.27 Table 11.3 below summarises the sensitivity criteria adopted for the different receptors.

Table 11.3: Receptor Grouping and Sensitivity Criteria

Receptor	Low sensitivity	Medium sensitivity	High sensitivity
Public Road Network and Users	Major highways with no junctions, such as motorways, or a road network with suitable capacity to absorb an increase in traffic.	Road networks with some capacity to absorb an increase in traffic.	Road network with little or no capacity to absorb an increase in traffic.
Local Settlements	Local settlements and properties which are set back from the route and/or are located on a single side of the route. No requirement for direct pedestrian access to the road. Good pedestrian facilities (i.e. wide footpaths, barrier provisions, formal crossing facilities).	Local settlements and properties which are near the route and/or potentially on both sides of the route. Limited requirements to cross the road. Adequate pedestrian provisions (i.e. footpaths are available where needed, albeit may be narrow, crossing facilities, some level of barrier provision).	Local settlements and properties directly fronting the route and/or are located on both sides of the route. Facilities and services result in requirement to cross the road. Poor pedestrian provisions (i.e. limited or no footpaths, footpaths narrow, no crossing facilities, no barrier provision). Near to sensitive locations such as hospitals, retirement homes, schools, places of worship, public open spaces and tourist attractions.
Road Structure	Major highways or roads with no obvious physical defects.	Regional highways or roads with some minor physical defects.	Local roads with some physical defects or local roads, infrequently maintained with reoccurring physical defects.

Assessment of Significance

11.5.28 The significance of any given effect is taken to be a synthesis of both the magnitude of the impact and the sensitivity of the receptor. The criteria used in determining significance are set out in Table 11.4 below.

Table 11.4: 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

Note: Only **Major** and **Major / Moderate** significance are considered significant in terms of the EIA Regulations.

Uncertainties and Assumptions

11.5.29 A range of uncertainties are present with any assessment of traffic effects. With respect to this EIAR, such uncertainties and assumptions are detailed below. These uncertainties are minimised by maintaining conservative assumptions and the provision of estimates based on recent wind farm construction experience.

Existing Traffic Flows

11.5.30 The assessment relies on the availability and accuracy of traffic flow data to establish baseline traffic conditions on the surrounding network. The available data for the A713 is reasonably extensive covering a sufficiently broad time frame. This ensures that the baseline traffic conditions derived for this road is an accurate reflection of actual conditions.

Traffic Generation

11.5.31 The estimated traffic generated by the Proposed Development comprises general construction loads such as bulk materials; abnormal loads for turbine components; and light goods vehicles (LGVs). Best estimates based on Natural Power, Vattenfall and RJ McLeod experience have been used (with conservative assumptions) for each of these components, including:

- Concrete for turbine bases (assumptions have been made as to base sizes and concrete designs);
- Geogrids and culverts for road construction (assumptions have been made as to the likely number of cross drains and culverts required and the pavement design);
- LGVs (construction worker traffic) for the construction period (it is not possible to exactly determine the size of the construction team); and
- The duration and sequencing of the construction period will affect the calculation of traffic intensities. If the actual programme is lengthened the traffic intensities would be lower than those assumed. Conversely, but unlikely, if the construction period were to be shortened the traffic intensities would increase.

Assessment of Traffic Effects

11.5.32 The effects on the proposed construction traffic routes and surrounding communities have been assessed with regards to severance, driver and pedestrian delay, safety, pedestrian amenity and fear and intimidation, in line with the IEMA Guidelines. The effects of factors such as noise and ecological impact are assessed in Chapter 10 and 6 respectively of this EIAR.

11.5.33 The methods for assessing the likely effects on traffic volumes, delays and trip times are subject to some uncertainty. These methods have been developed by roads authorities and research bodies over a number of decades and have been found to be reasonably representative. However, the actual capacity of a road segment or junction at any given time may differ from the calculated value due to a wide range of factors.

11.6 BASELINE TRAFFIC CONDITIONS

Construction Traffic Routes

Abnormal Indivisible Loads (AIL)

11.6.1 An Abnormal Indivisible Load Route Survey has been undertaken for the major component deliveries and is included in Appendix 11.1 in Volume 4 of the EIAR.

11.6.2 Due to the size of components being assessed it is not considered possible to transport all component through the Port of Ayr. As such the preferred route for the major component deliveries is as follows:

- From KGV Dock, Glasgow loads would depart KGV Dock and travel west on Kings Inch Drive before turning left onto Mayo Avenue;

- Loads would join the eastbound M8 and continue to Junction 8;
- Loads would leave the M8 and join the M73 travelling south;
- At Junction 4, loads would join the westbound M74;
- Loads would depart the M74 at Junction 1 and join the M8 westbound before leaving at Junction 22 and join the M77 travelling southbound; and
- Loads would continue south onto the A77 to Whitletts Roundabout east of Ayr.
- Loads would join the A77 southbound carriageway;
- Loads would depart the A77 at Bankfield Roundabout and turn left onto the A713; and
- Loads would continue southeast on the A713 to the proposed site entrance.

11.6.3 The AIL route assumes a Port of Entry at KGV Docks, Glasgow and generally utilises trunk roads. The final approved AIL route will not be known until the turbine supplier is appointed and they have in turn reached contractual agreements with the port, sea freight/shipping company and a road haulier.

General Construction Traffic

11.6.4 General construction traffic and material deliveries will travel to site via the A713, depending on their origin, either via Dalmellington or via St John's Town of Dalry. Beyond these routes the general construction traffic would be more dispersed.

Road Description

A713

11.6.5 The A713 is a Local Authority maintained road which runs from North West to South East through the East Ayrshire, South Ayrshire and Dumfries and Galloway Council areas. The Proposed Development is located near Carsphairn, between Dalmellington to the north and St Johns Town of Dalry to the south. The A713 is a two-lane single carriageway and a major road artery for the area. The geometry of the road is considered to be mixed with several sections reasonably clear while other sections are tight with corners and constrained. National speed limit applies to the majority of the route.

11.6.6 The overall the condition of the A713 is considered to be good, being well maintained as would be expected given its strategic importance to East Ayrshire, South Ayrshire and Dumfries and Galloway Councils.

11.6.7 The route is a proven delivery route for a number of recent wind farm developments.

B729 From North Liggat to Site Entrance

11.6.8 The B729 junction with the A713 is located to the east of Carsphairn near the properties known as North Liggat and South Liggat. The B729 is a Local Authority maintained road. It is a two-lane single carriageway in reasonable condition. From this junction to the site entrance is c. 300 meters, the majority of which forms a circular route around Carsphairn War Memorial.

11.6.9 This route has been discounted from the traffic assessment due to the close proximity of the site entrance to the junction, however North and South Liggat have been included.

Geographical Scope of Assessment

11.6.10 As Section 11.6.2, the distribution of general construction traffic from potential material sources to the site was considered to utilise the A713 from either Dalmellington or St John's Town of Dalry as the primary routes to site. Beyond these routes the general construction traffic would be more dispersed.

11.6.11 The number of AIL deliveries are likely to be limited to one delivery or convoy per day and will not contribute significant vehicle movements. Hence, it is not considered appropriate to assess the percentage increase on baseline traffic numbers that these would cause beyond the primary routes used by the AILs (i.e. A713 from Dalmellington).

11.6.12 The Abnormal Load Access Assessment identified a number of pinch points from the Port of Entry to the site entrance. The proposed modifications works to enable AIL loads to navigate these pinch points range from oversail over the pavement edge, temporary removal of street furniture, vegetation trimming and clearance to forming temporary overrun areas. The works are considered localised, short term and minor in nature and do not involve significant modifications to the highway network. It is considered the type of work being proposed could predominantly be undertaken off, of the highway with, appropriate traffic management.

11.6.13 Therefore, the geographical scope of the assessment includes consideration of the traffic effects associated with:

- general construction traffic on the A713;
- the AIL deliveries over the whole AIL route from Port of Entry to the site entrance.

Baseline Traffic Data

11.6.14 Data for traffic baseline for the A713 road was taken from the Department for Transport (DfT) website. Two count locations were adopted:

- DfT Count ID 1074 on the A713 north of Carsphairn (2019 data adopted),
- DfT Count ID 50995 on the A713 South of Carsphairn (2019 data adopted).

11.6.15 The most up to date data for the two DfT traffic counters is 2019. This was adopted for the baseline traffic data with no adjustment (growth) figures applied to bring it to the intended construction year. Consideration was given to adjusting the data by applying standard growth factors. However, for the following reasons it was considered more appropriate to maintain the 2019 figures:

- Applying the standard growth factors would result in an increased ADDT figure for the roads. Therefore, any increase in traffic due to the Proposed Development would be measured against this increased AADT figure, resulting in lower percentage increases than presented in this assessment. Therefore, maintaining the latest AADT figures will present a conservative assessment.
- Current transport planning policies are generally all aimed at reducing traffic flows and adopting more sustainable transport methods. It is hoped in future the impact of these policies will result in a reduction in traffic flows. As such it is considered contradictory to forecast increasing traffic flows in the future in which to set as a baseline for the assessment.
- The impact of COVID 19 on traffic flows is unknown at this stage. The temporary change in working patterns during the COVID pandemic (i.e. increased working from home) may become a more permanent state with the potential to reduce traffic flows.

11.6.16 Baseline AADT flows are shown in Table 11.5 below.

Table 11.5: Baseline Traffic Data

COUNT ID	LOCATION	AADT (Total Traffic)	AADT (HGV Traffic)
1074	A713 north of Carsphairn, by Brochloch	1330	166
50995	A713 South of Carsphairn, adjacent to Earlstoun Loch	1254	143

Source: DfT Website

11.7 INITIAL SCREENING ASSESSMENT

Quantification of Development Activities

11.7.1 A programme of construction activities has been included in Chapter 3: Project Description of the EIAR (Table 3.3).

11.7.2 Vehicles and equipment would be delivered to site at the commencement of the relevant construction phase and would remain on site until work relating to that stage was completed. Such equipment would include excavators, dump trucks and bulldozers for access track and crane pad earthworks, drainage, turbine foundations and cable installation, and cranes for erecting the turbines. An indicative list of the equipment needed is given in Chapter 3: Project Description, of the EIAR.

11.7.3 Each vehicle travelling to the site will generate two "vehicle movements"; one movement to the proposed wind farm and one movement away from the wind farm i.e. 1 delivery to the wind farm = 2 vehicle movements.

11.7.4 The application includes onsite borrow pits that would be utilised to source stone for the construction of the access tracks and hardstands. It is anticipated these will provide sufficient quantities and quality of stone for the Proposed Development. Similarly, given the size of the anticipated turbine foundations (1000m^3 of concrete) it is anticipated the concrete would be mixed on site to reduce the risks associated with the volumes and supply for these critical structural elements.

11.7.5 However, this Chapter assesses the worst-case scenario and assumes all stone would need to be imported onto site and all foundation concrete would need to be brought to site in ready mix lorries.

11.7.6 Most vehicles used during the construction activities would be below the width requirement for wide loads, with the exception of the turbine deliveries (nacelle, tower sections and blades) and possibly the 800/1000 tonne and 400/500 (or less) tonne cranes that would be used for the erection of the turbines. The roads authorities and local constabulary are likely to request a police escort necessary for the abnormal loads. The cranes are likely to require only a single journey along the public highway to and from the Proposed Development. Road axle weights would not exceed regulated levels unless agreed with the relevant authorities. Consultations with local authorities will be held prior to movement of any abnormal loads.

11.7.7 The Abnormal Indivisible Load Route Survey identified a number of points of interest from the Port of Entry to the site entrance. The proposed modifications works to enable AIL loads to navigate these points of interest range from oversail over the pavement edge, temporary removable of street furniture, vegetation trimming and forming temporary overrun areas. The modification works are considered temporary and minor in nature and do not involve significant modifications to the highway network.

11.7.8 Given the potential for a variation to the route to be adopted, the minor nature of the modifications works and the short duration of the modification works (particularly with reference to the overall proposed development assessment period), it was not considered appropriate to assess the potential traffic impacts associated with the construction of all the points of interest modification works identified. However, traffic delay has still been considered in the AIL Transport Management Plan (Appendix 11.2).

11.7.9 **Abnormal Load Deliveries**. In addition to the deliveries noted above, the abnormal load deliveries have also been assessed. The number of these vehicles has been included within the assessment of general construction traffic to ensure a robust assessment including all vehicles. It is however important to consider the effect of these particular vehicles in isolation, as the effects are quite different to those attributed to general construction traffic, hence they have been assessed separately.

11.7.10 Indicative HGV traffic loads for the various phases of the construction operations are as follows:

- **Mobilisation to Site**: Mobilisation to site would involve the transport of plant for the construction works (including dump trucks, dozers/graders, excavators, forklifts), temporary office facilities, welfare units and storage containers, and general construction equipment such as fencing for site compounds and fuel bowsers. Rock crusher/processing plant would also be transported to site to crush and grade material from the borrow pits suitable for use in the construction works. It is estimated up to 63 HGV deliveries (126 movements) would be required for site mobilisation.
- **Forestry**: includes for the advance works undertaken to either key-hole fell or clear fell an area prior to construction activities commenting. It is assumed that 8 HGV loads will be removed from site (16 movements).
- **Site Tracks, Crane Pads and Compounds** It is assumed that all stone for the site tracks, crane pads and compounds (temporary construction and substation platforms) would be imported from a local quarry. It is considered unpractical for HGVs delivering the stone to transport it throughout the site due to the number of deliveries potentially sterilising access around the site as well as the damage road going HGVs would inflict on the site tracks. Therefore, it has been assumed that HGVs would deliver the stone to the site entrance compound with site dump trucks transporting it from there around the site. For 14.65km of access track, 14 turbine crane-pads and associated hardstand laydown areas and three other hardstands it is estimated around 119,900 tonnes of stone would be required, resulting in around 6,784 HGV deliveries (13,568 movements).

  This scenario would only occur if the onsite borrow pits were unable to produce enough stone or stone of sufficient quality for the permanent works. Even if this were the case, it is likely the majority of the material would still be sourced from site with only the top running surface (c. 200 mm) of the tracks, crane-pads, and hardstands finished with imported material. However, this has not been taken into account in this scenario and a full depth of construction material (c. 500mm to 600mm) has been adopted.

  Concrete batching plant platforms have been excluded from the stone quantities as this assessment assumes delivery onto site of all concrete. As above, the expectation is that this platform would be sourced from site won materials.
- **Geogrid and Culverts**: An allowance has been included for laying geogrids along the access tracks and crane-pads. Geogrid rolls are generally 4m wide and therefore it is assumed two geogrids would be required per length of track to provide sufficient width coverage. For 14.65km of track and 14 crane-pads it is estimated 458 rolls of geogrid at 75m per roll would be required. It is estimated a total of 23 deliveries would be required (46 movements). Similarly, an allowance has been included for culverts for drainage and pipe crossings at a rate of one culvert for every 100 m of track plus an additional allowance for specific locations resulting in an estimate of 162 culverts. It is estimated a total of five deliveries would be required (10 movements).
- **Turbine Foundations**: Based upon the proposed tip heights it is estimated a typical gravity foundation design would require up to 1000m^3 of concrete and 110 tonnes of steel reinforcement. A typical concrete lorry can carry between 6 to 8 cubic metres of concrete, equating to a rate of up to 14 deliveries per hour over a 10-hour day for turbine foundation pours. As noted previously, due to the risks associated with the logistics, travel time and criticality of foundation concrete, it is considered unlikely ready-mix concrete would be adopted for the project. However, to present a worst-case this scenario assumes ready-mix concrete. For ready-mix concrete it is estimated 2,338 HGV deliveries (4,676 movements) would be required. For reinforcement it is estimated 103 HGV deliveries (206 movements) would be required. Combined this equates to 2,441 HGV deliveries (4,882 movements) for the turbine foundations.
- **Turbine Abnormal Loads:** For the size of turbines being considered for the site, the abnormal loads would consist of 3 blade deliveries, up to 3 tower section deliveries, 1 nacelle delivery and 1 hub delivery (8 abnormal load deliveries per turbine). The transport of abnormal loads is undertaken by specialist vehicles designed and manufactured for the purpose of wind turbine component delivery. These vehicles are designed such that following delivery, they can reduce to a standard HGV size. Hence, although they arrive to site as an abnormal load, they leave as a standard HGV. In this assessment, they are included in the HGV numbers although they are referred to as abnormal loads. Hence, there would be 112 abnormal load deliveries (224 movements) for transporting the turbine components to site.
- **Turbine Assembly**: Around 4 HGV deliveries for items that would be fitted within the turbines would be required for each turbine. The cranes (larger 800/1000 tonne and smaller 400/500 tonne crane) for assembling the wind turbines would be brought to site at the start of turbine assembly and remain on site until completion.

It is estimated up to approximately 36 HGV deliveries (72 movements) would be required for mobilising and demobilising the cranes. This equates to 36 HGV deliveries (72 movements) at the start of turbine assembly works, 56 HGV deliveries (112 movements) throughout the turbine assembly period and 36 HGV deliveries (72 movements) following completion of turbine assembly.

- **Substation and Battery Storage area (excluding stone platform)**: The substation would consist of a stoned hardstand area and building to house the wind farm electrical and grid connection equipment and basic office facilities for maintenance staff. Battery storage is also proposed on the substation site. HGV values for the delivery of the stone to form the platforms have been included in "Site Tracks, Crane Pads and Compounds" above. Material, such as concrete blocks, roof trusses, roof cladding and windows/doors for the substation building as well as the electrical equipment would need to be brought to site. The battery storage consists of containers (similar to shipping containers) and would be transported by HGV. It is estimated 250 HGV deliveries (500 movements) would be required for the substation building, electrical equipment and battery storage.
- **Cable Installation**: Cable installation includes the Low Voltage (LV) electrical cables, SCADA signalling/control cables and sand associated with the cable bedding and surround in the cable trench. Depending on the ground conditions encountered, it is possible that the sand could be sourced from site borrow pits. However, this is uncommon on wind farm construction and hence sand has been assumed to be imported. It is estimated 11 HGV deliveries would be required for the LV cables, 4 HGV deliveries for the SCADA cables and 405 HGV deliveries for the sand bedding and surround. This equates to a total of 420 HGV deliveries (840 movements) for the cable installation.
- **Transport of site personnel**: Approximately 20-40 car/van movements per day would be required for the construction personnel and any small deliveries, at the peak of the site activity.

Table 11.6 below summarises the HGV movements for the expected construction.

Table 11.6: Estimated HGV construction traffic volumes

Item	HGV Deliveries	HGV Movements	Notes
Mobilisation to Site	63	126	At start of construction. Demobilisation will occur partially following completion of earthworks, with the remainder following completion of the project.
Forestry	8	16	
Site Tracks, Crane Pads and Compounds	6,784	13,568	Assessment is based upon import of all stone.
Geogrids and Culverts	28	56	
Turbine Foundations	2,441	4,882	Assessment is based on concrete being imported to site.
Wind Turbine Abnormal Loads	112	224	These are included in the HGV numbers although referred to as abnormal loads.
Turbine Assembly	128	256	HGVs at start and end of turbine assembly for crane mob/de-mob. HGVs throughout turbine assembly period.
Substation and Battery Storage area	250	500	Excluding stone as included above
Cable Installation	420	840	Sand imported.

11.7.11 The increase in traffic movements that would be generated by the Proposed Development have been assessed against the baseline traffic flow figures for the A713 (southbound and northbound). The construction of the Proposed Development is estimated to lead to around 16,002 HGV movements (including AILs) and 13,640 light personnel and LGV movements over the proposed 28-month period.

11.7.12 Table 11.7 below illustrates this distribution of traffic over the 28-month construction period. Within the table, the turbine foundations numbers only include for reinforcement deliveries as it is not considered appropriate to simply distribute HGV numbers for concrete pours for the foundations over a month duration. Concrete pours for turbine foundations typically take place over a single day and hence the estimated 1000m^3 of concrete for a foundation would be delivered by HGVs within typically a 10-to-12-hour period. Therefore, the effect of this is discussed separately below.

11.7.13 Month 14 is expected to generate the most Average Daily Movements (circa 98 combined HGV and LGV movements with circa 58 of those HGV movements and the remaining circa 30 LGV movements).

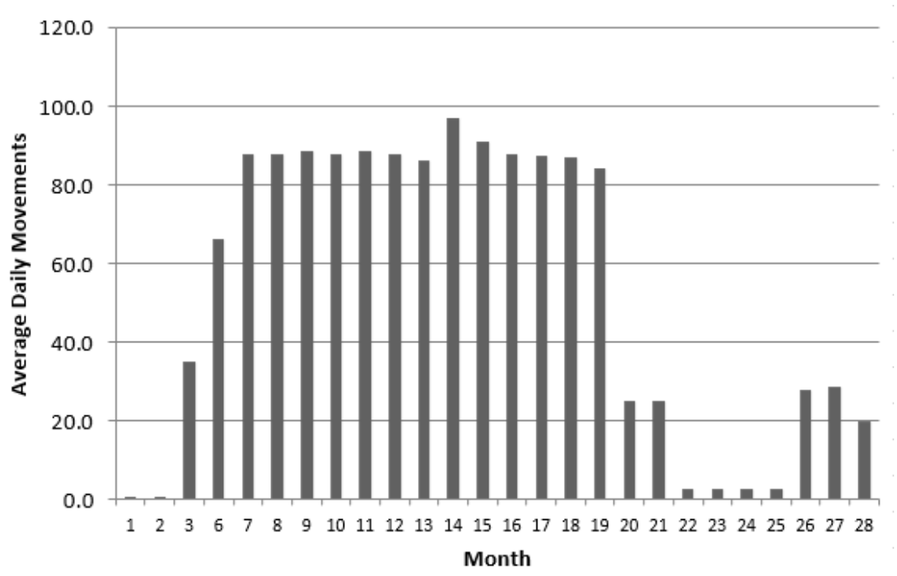

Chart 11.1: Average daily vehicle movements over proposed 28-month construction period

Table 11.7: Predicted vehicle movements during the construction period

Activity	Month																											
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	Total
Heavy Goods Vehicles Movements (including abnormal loads)																													
Mobilisation to site			50	50	26																								126
Forestry	8	8																											16
Offsite AIL Enabling Works																													0
Import of Bulk Fill					30	30	30	30	30	30	30	30	30	30	30	30	30	30	20										440
Access / site tracks				500	500	500	476	450	450	450	450	450	450	450	450	450	450	450	450										7376
Crane Hard-Standing														350	350	350	350	350	318										2068
Misc Hardstands							500	500	500	500	500	484	400	300															3684
Geogrids & Culverts						4	4	4	4	4	4	4	4	4	4	4	4	4	4										56
Bridges									20				12																32
Met Mast															52														52
Turbine foundations													30	30	30	30	30	28	28										206
Turbine Transformer and Housing																													0
Substation											24	24	24	24	24														120
Energy storage compound											76	76	76	76	76														380
Cabling															120	120	120	120	120	120	120								840
Turbine Abnormal Loads																										80	144		224
Turbine Assembly																										100	56	100	256
Demob / Site clearance																												126	126
Monthly HGV Total Movements	**8**	**8**	**50**	**550**	**556**	**534**	**1010**	**984**	**1004**	**984**	**1084**	**1068**	**1026**	**1264**	**1136**	**984**	**984**	**982**	**940**	**120**	**120**	**0**	**0**	**0**	**0**	**180**	**200**	**226**	**16002**
Light Vehicle Movements (car, minibuses and small van deliveries)																													
Forestry LGV	8	8	0	0	0																								
General Construction Traffic	0	0	650	217	217	866	866	866	866	866	866	866	866	866	866	866	866	866	866	433	433	65	65	65	65	433	433	217	13640
Monthly total LGV Movements	**8**	**8**	**650**	**217**	**217**	**866**	**866**	**866**	**866**	**866**	**866**	**866**	**866**	**866**	**866**	**866**	**866**	**866**	**866**	**433**	**433**	**65**	**65**	**65**	**65**	**433**	**433**	**217**	**13640**
Monthly Total Vehicle Movements	16	16	700	767	773	1400	1876	1850	1870	1850	1950	1934	1892	2130	2002	1850	1850	1848	1806	553	553	65	65	65	65	613	633	443	29642
Average Daily Movements (assumes 5 working days per week)	0.7	0.7	31.8	34.8	35.1	63.6	85.3	84.1	85.0	84.1	88.6	87.9	86.0	96.8	91.0	84.1	84.1	84.0	82.1	25.1	25.1	3.0	3.0	3.0	3.0	27.9	28.8	20.1	
Average Daily HGV Movements (assumes 5 working days per week)	0.4	0.4	2.3	25.0	25.3	24.3	45.9	44.7	45.6	44.7	49.3	48.5	46.6	57.5	51.6	44.7	44.7	44.6	42.7	5.5	5.5	0.0	0.0	0.0	0.0	8.2	9.1	10.3	

Note 1: The distributed turbine foundation numbers include only for reinforcement as it is not considered appropriate to distribute/average ready-mix concrete deliveries over a monthly basis as each pour would be undertaken in a day. The number in the total column includes for the ready-mix concrete deliveries. The impact of the ready-mix concrete deliveries and associated number of movements during a foundation pour has been assessed separately.

Distribution of Construction Traffic

11.7.14 Consideration was given to the likely distribution of construction traffic from material/supply sources to the site, Due to the limited routes available traffic will travel to site along the A713 either from the north via Dalmellington or from the south via St Johns Town of Dalry. The B729 has been discounted as a route as there is minimum benefit to accessing site via this route rather than the A713.

11.7.15 The AIL deliveries will only approach site from the north and therefore the figures used in the assessment for traffic from the south will be inflated.

11.7.16 From the distribution of material sources (concrete, aggregate, etc) and the route to site it is considered that a 50% split between the north and south is likely. At this stage, it was not considered appropriate to refine this split further as it may result in skewed results and omission of potential receptors that could subsequently be impacted once the construction stage commences and contractors determine their material sources. Therefore, a conservative approach has been undertaken to assume 100% of the traffic would approach from both the north and the south on the A713. A comparative 50% split in traffic distribution has also been presented as part of the screening process to illustrate the highway links that would exceed the thresholds and merit more detailed assessment.

11.7.17 Applying 100% of traffic movements to the A713 (southbound and northbound), the resultant percentage increase in traffic versus the baseline is indicated in Table 11.8 below over the 28-month construction duration for the total vehicles and HGV vehicles. The 50% split is also presented in Table 11.8 for comparative purposes.

Table 11.8 Estimated percentage increases in traffic over construction period

Location	Construction Month 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
% Increase in Total Traffic																												
A713 (southbound from Dalmellington) Carrying a 50% split of traffic	0.0	0.0	1.2	1.3	1.3	2.4	3.2	3.2	3.2	3.2	3.3	3.3	3.2	3.6	3.4	3.2	3.2	3.2	3.1	0.9	0.9	0.1	0.1	0.1	0.1	1.0	1.1	0.8
A713 (northbound from New Galloway) Carrying a 50% split of traffic	0.0	0.0	1.3	1.4	1.4	2.5	3.4	3.4	3.4	3.4	3.5	3.5	3.4	3.9	3.6	3.4	3.4	3.3	3.3	1.0	1.0	0.1	0.1	0.1	0.1	1.1	1.1	0.8
A713 (southbound from Dalmellington) Carrying 100% of traffic	0.1	0.1	2.4	2.6	2.6	4.8	6.4	6.3	6.4	6.3	6.7	6.6	6.5	7.3	6.8	6.3	6.3	6.3	6.2	1.9	1.9	0.2	0.2	0.2	0.2	2.1	2.2	1.5
A713 (northbound from New Galloway) Carrying 100% of traffic	0.1	0.1	2.5	2.8	2.8	5.1	6.8	6.7	6.8	6.7	7.1	7.0	6.9	7.7	7.3	6.7	6.7	6.7	6.5	2.0	2.0	0.2	0.2	0.2	0.2	2.2	2.3	1.6
% Increase in HGV Traffic																												
A713 (southbound from Dalmellington) Carrying a 50% split of traffic	0.1	0.1	0.7	7.5	7.6	7.3	13.8	13.5	13.7	13.5	14.8	14.6	14.0	17.3	15.6	13.5	13.5	13.4	12.9	1.6	1.6	0.0	0.0	0.0	0.0	2.5	2.7	3.1
A713 (northbound from New Galloway) Carrying a 50% split of traffic	0.1	0.1	0.8	8.7	8.8	8.5	16.1	15.6	16.0	15.6	17.2	17.0	16.3	20.1	18.1	15.6	15.6	15.6	14.9	1.9	1.9	0.0	0.0	0.0	0.0	2.9	3.2	3.6
A713 (southbound from Dalmellington) Carrying 100% of traffic	0.2	0.2	1.4	15.1	15.2	14.6	27.7	26.9	27.5	26.9	29.7	29.2	28.1	34.6	31.1	26.9	26.9	26.9	25.7	3.3	3.3	0.0	0.0	0.0	0.0	4.9	5.5	6.2
A713 (northbound from New Galloway) Carrying 100% of traffic)	0.3	0.3	1.6	17.5	17.7	17.0	32.1	31.3	31.9	31.3	34.5	33.9	32.6	40.2	36.1	31.3	31.3	31.2	29.9	3.8	3.8	0.0	0.0	0.0	0.0	5.7	6.4	7.2

11.7.18 Assessing against the criteria in Table 11.2 against 50% of traffic movements being applied from each direction;

- the A713 to site via Dalmellington does not exceed the requirements of Rule 1 threshold as traffic flows have not increased by more than 10% nor have HGV numbers have increased by more than 30%
- the A713 to site via St Johns Town of Dalry / New Galloway does not exceed the requirements of Rule 1 threshold as traffic flows have not increased by more than 10% nor have HGV numbers have increased by more than 30%
- Both routes have exceeded the Rule 2 threshold as, although traffic flows remain below 10%, there is an increase of more than 10% of HGVs which is deemed to represent a major change in composition of traffic flow.

11.7.19 Assessing against the criteria in Table 11.2 against 100% of traffic movements being applied from each direction;

- the A713 to site via Dalmellington exceeds the requirements of Rule 1 threshold as, although traffic flows have not increased by more than 10%, HGV numbers have increased by more than 30%
- the A713 to site via St Johns Town of Dalry / New Galloway exceeds the requirements of Rule 1 threshold as, although traffic flows have not increased by more than 10%, HGV numbers have increased by more than 30%
- Both routes have exceeded the Rule 2 threshold as, although traffic flows remain below 10%, there is an increase of more than 10% of HGVs which is deemed to represent a major change in composition of traffic flow.

11.7.20 Accordingly, the links identified assuming 100% of traffic movements have been taken forward for further assessment to ensure a worst-case scenario.

11.7.21 As noted earlier, the above numbers do not include for the concrete foundation pours. For a 1000m^3 foundation it is anticipated 167 HGV deliveries (334 movements) will be required over a single 10–12-hour period. With an AADT total traffic of 1330 movements and AADT HGVs of 166 movements from Dalmellington, this equates to an increase in total traffic of around 13% and in HGVs of 100% in a single day. With fourteen foundations, this increase in traffic will occur on 14 separate days over the 6-month foundation construction period, equating to around 3 days per month.

11.7.22 Although the impacts from this is very infrequent and over a very short period, the concrete foundation pours have been taken forward for further assessment.

11.8 DETAILED ASSESSMENT OF EFFECTS

Assessment of Magnitude

11.8.1 As identified in section 11.7.18 above, the screening identified both directions of travel on the A713 as links meriting more detailed assessment when 100% of Proposed Development traffic was applied. Table 11.8 shows the duration over which the percentage increase in HGV traffic exceeded the thresholds as follows:

- A713 (south from Dalmellington) carrying 100% of construction traffic exceeded the thresholds with an HGV traffic increase above 30% in months 14 and 15.
- A713 (north from St John's Town of Dalry) carrying 100% of construction traffic exceeded the thresholds with an HGV traffic increase above 30% in months 7 through to 19.

11.8.2 Based on the criteria in Table 11.1, the following magnitudes of impact have been assigned to the highway links:

- A713 (south from Dalmellington): maximum of 35%, results in magnitude of Low.
- A713 (north from St John's Town of Dalry): maximum of 41%, results in magnitude of Low.

11.8.3 In addition to the above, the impact of the abnormal loads has also been assessed in further detail.

Assessment of Receptor Sensitivity

11.8.4 A detailed assessment of the receptors on each of the highway links has been undertaken and their sensitivity assessed in accordance with the criteria outlined in Section 11.4. Table 11.9 below summarises the assessment of the sensitivity (L = Low, M = Medium, H = High) for the receptors identified on the applicable highway links.

Table 11.9: Receptor sensitivity assessment

Receptor Description	Effect	L	M	H	Rationale
Public Road Network and Users					
A713 (Dalmellington to Site)	Increase in HGV movements		X		Two lane major road artery that is well maintained reasonably good geometry. Generally considered to have capacity to absorb more traffic.
	Vehicle delays due to increase in traffic		X		
B729 to Site Entrance	Increase in HGV movements	X			Local road in reasonable condition. Lightly trafficked and would have capacity to absorb more traffic. Short section of route used (c. 300m)
	Vehicle delays due to increase in traffic	X			
A713 (Site to St Johns Town of Dalry)	Increase in HGV movements		X		Two lane major road artery that is well maintained reasonably good geometry. Generally considered to have capacity to absorb more traffic.
	Vehicle delays due to increase in traffic		X		
Local Settlements					

Receptor Description	Effect	L	M	H	Rationale
Dalmellington	Pedestrian Severance		X		Two lane carriageway with properties and shops fronting onto A713. Footpaths on both sides along majority of route. On street parking. Speed reduction measures in place through settlement.
	Pedestrian Delay		X		
	Pedestrian Amenity	X			
	Pedestrian Fear and Intimidation	X			
	Pedestrian Safety	X			
Eriff A713 (North)	Pedestrian Severance	X			Property fronting onto A713. No requirement or facilities for pedestrian access to A713.
	Pedestrian Delay	X			
	Pedestrian Amenity		X		
	Pedestrian Fear and Intimidation		X		
	Pedestrian Safety		X		
Carsphairn	Pedestrian Severance		X		Two lane carriageway with no formal crossing points, additional widening for on street parking. Wide footpath provision on both sides of carriageway. Properties and businesses fronting A713. Restricted parking to assist pedestrian
	Pedestrian Delay		X		
	Pedestrian Amenity		X		
	Pedestrian Fear and Intimidation	X			
	Pedestrian Safety	X			

Receptor Description	Effect	L	M	H	Rationale
					crossing at school location.
North and South Liggat B729	Pedestrian Severance		X		Properties fronting onto B729, located on both sides of the carriageway. Informal pedestrian footpath available to access Carsphairn.
	Pedestrian Delay		X		
	Pedestrian Amenity	X			
	Pedestrian Fear and Intimidation		X		
	Pedestrian Safety		X		
Allangibbon Bridge	Pedestrian Severance		X		Property fronting on to A713. Minor footpath along A713 connecting to St Johns Town of Dalry
	Pedestrian Delay		X		
	Pedestrian Amenity	X			
	Pedestrian Fear and Intimidation		X		
	Pedestrian Safety		X		
Kenside	Pedestrian Severance		X		Property fronting on to A713. Minor footpath along A713 connecting to St Johns Town of Dalry
	Pedestrian Delay		X		
	Pedestrian Amenity	X			
	Pedestrian Fear and Intimidation		X		
	Pedestrian Safety		X		
St John's Town of Dalry A713/A702	Pedestrian Severance		X		Properties and shops fronting onto A713. On street parking which can reduce the traffic flow through the
	Pedestrian Delay		X		
	Pedestrian Amenity		X		
	Pedestrian Fear and Intimidation		X		

Receptor Description	Effect	L	M	H	Rationale
	Pedestrian Safety		X		town. Footpath provision along sections. Reduced traffic speed, no formal crossing points.
Road Structure					
A713 (Dalmellington to Site)	Degradation of highway structure	X			Major road artery that is well maintained, designed to carry vehicle loads and with no obvious physical defects.
B729 to Site Entrance	Degradation of highway structure		X		Circa 300m length of Local road with no obvious physical defects. Considered unlikely to have similar levels of maintenance and A713.
A713 (Site to St Johns Town of Dalry)	Degradation of highway structure	X			Major road artery that is well maintained, designed to carry vehicle loads and with no obvious physical defects.

11.8.5 Synthesising the magnitude and sensitivity provides the resultant significance for these highway links and associated receptors as detailed in Table 11.10 below.

Table 11.10: Significance of effect

Receptor Description	Effect	Sensitivity	Magnitude	Significance
Public Road Network and Users				
A713 (Dalmellington to Site)	Increase in HGV movements	Medium	Low	Moderate / Minor
	Vehicle delays due to increase in traffic	Medium	Low	Moderate / Minor
B729 to Site Entrance	Increase in HGV movements	Low	Low	Minor
	Vehicle delays due to increase in traffic	Low	Low	Minor
A713 (Site to St Johns Town of Dalry)	Increase in HGV movements	Medium	Low	Moderate / Minor
	Vehicle delays due to increase in traffic	Medium	Low	Moderate / Minor
Local Settlements				
Dalmellington	Severance	Medium	Low	Moderate / Minor
	Pedestrian Delay	Medium	Low	Moderate/ Minor
	Pedestrian Amenity	Low	Low	Minor
	Pedestrian Fear and Intimidation	Low	Low	Minor
	Safety	Low	Low	Minor
Eriff A713 (North)	Severance	Low	Low	Minor
	Pedestrian Delay	Low	Low	Minor
	Pedestrian Amenity	Medium	Low	Moderate / Minor
	Pedestrian Fear and Intimidation	Medium	Low	Moderate / Minor
	Safety	Medium	Low	Moderate / Minor
Carsphairn	Severance	Medium	Low	Moderate / Minor
	Pedestrian Delay	Medium	Low	Moderate / Minor
	Pedestrian Amenity	Medium	Low	Moderate / Minor
	Pedestrian Fear and Intimidation	Low	Low	Minor
	Safety	Low	Low	Minor
North Liggat B729	Severance	Medium	Low	Moderate / Minor
	Pedestrian Delay	Medium	Low	Moderate / Minor
	Pedestrian Amenity	Low	Low	Minor
	Pedestrian Fear and Intimidation	Medium	Low	Moderate / Minor
	Safety	Medium	Low	Moderate / Minor
Allangibbon Bridge	Severance	Medium	Low	Moderate / Minor
	Pedestrian Delay	Medium	Low	Moderate / Minor

Receptor Description	Effect	Sensitivity	Magnitude	Significance
	Pedestrian Amenity	Low	Low	Minor
	Pedestrian Fear and Intimidation	Medium	Low	Moderate / Minor
	Safety	Medium	Low	Moderate / Minor
Kenside	Severance	Medium	Low	Moderate / Minor
	Pedestrian Delay	Medium	Low	Moderate / Minor
	Pedestrian Amenity	Low	Low	Minor
	Pedestrian Fear and Intimidation	Medium	Low	Moderate / Minor
	Safety	Medium	Low	Moderate / Minor
St John's Town of Dalry A713/A702	Severance	Medium	Low	Moderate / Minor
	Pedestrian Delay	Medium	Low	Moderate / Minor
	Pedestrian Amenity	Medium	Low	Moderate / Minor
	Pedestrian Fear and Intimidation	Medium	Low	Moderate / Minor
	Safety	Medium	Low	Moderate / Minor
Road Structure				
A713 (Dalmellington to Site)	Degradation of highway structure	Low	Low	Minor
B729 to Site Entrance	Degradation of highway structure	Medium	Low	Moderate / Minor
A713 (Site to St Johns Town of Dalry)	Degradation of highway structure	Low	Low	Minor

Turbine Foundation Concrete Pours

11.8.6 As noted earlier, for the proposed development it is expected that concrete would be batched on site. However, to provide a worst-case analysis, the assessment has assumed ready-mix concrete deliveries. Due to the nature of this activity and because it is such a unique event (short duration with limited occurrence), it was not considered appropriate to include these traffic numbers within the overall assessment, and as such, the concrete turbine foundation pour HGV numbers have been assessed separately.

11.8.7 With fourteen foundations, this increase in traffic will occur on 14 separate days over the 6-month foundation construction period, equating to around 3 days per month. Given the criticality of the foundation pours and the number of HGV movements involved it is assumed that there will be limited, if any, other site works undertaken on a foundation pour day to ensure concrete deliveries through the site road network remain uninterrupted. This means that HGV numbers associated with foundation pours can be assessed in isolation against baseline figures.

11.8.8 A 1000m^3 foundation is anticipated to require 167 HGV deliveries (334 movements) over a single 10–12-hour period, equating to an increase of 200% in HGV numbers. Based upon Table 11.1, this results in a magnitude of High.

11.8.9 Should the import of concrete be adopted for the project, considering the High magnitude and Medium sensitivities at locations along the respective link, and based upon the assessment criteria in Table 11.4, the resultant effects associated would be considered Major / Moderate which is classified as Significant. However, in Natural Power's professional opinion, with the incorporation of embedded mitigating measures (as outlined in section 11.5.14), appropriate impact mitigation (such as advanced notification of concrete pour days and specific signage from concrete plant to site) and recognising the very short duration (single day event) and infrequency (14 occasions), the effects of this can be suitably managed to minimise the brief impacts caused.

Abnormal Load Modification Works

11.8.10 It was recognised that the construction of the modification works required to facilitate abnormal load deliveries would have the potential to impact traffic. Due to the distance from the Proposed Development and advanced nature of the works the HGV movements associated with the construction of these works has not been included in the assessment.

11.8.11 However, it is important to consider the effect of undertaking these works along the route. The works along the length of the route are considered minor. At all locations the roads are a minimum of two lanes, and it is considered that if there is insufficient existing carriageway width to continue to provide two running lanes under traffic management then a lane could be temporarily closed using traffic lights to facilitate these works.

11.8.12 In Natural Power's professional experience, undertaking of these modification works will have Minor effect if best practice measures are considered.

Abnormal Load Transportation

11.8.13 As noted previously, the abnormal load numbers have been included within the assessment of general construction traffic to ensure a robust assessment including all vehicles. It is however important to consider the effect of these particular vehicles in isolation, as the effects are different to those attributed to general construction traffic.

11.8.14 The primary effect associated with the transportation of abnormal loads is considered to be driver delays on other road users. The effect on local settlements (i.e. severance, pedestrian, delay, safety, etc) and road structure are not considered to merit further detailed assessment as:

- The duration of an abnormal load delivery through/past the settlement is short (i.e. a timescale of minutes).
- A significant level of preparation goes into planning these deliveries with the police and local authorities and the management/control measures in place during the delivery (i.e. police escorts, etc).
- Prior to any abnormal load delivery, the structural capacity of the road and bridges/culverts would be assessed, and any strengthening works implemented. The necessary permits to deliver abnormal loads would not be released from the relevant road authorities until they are satisfied that this aspect has been fully addressed.

11.8.15 As part of the EIAR an Abnormal Indivisible Load Route Survey was undertaken to assess the abnormal load delivery route from both the Port of Ayr and King George V docks, Glasgow to the Proposed Development site (Refer to Appendix 11.2). In the Abnormal Indivisible Load Route Survey 60 points of interest were identified requiring further consideration including engineering works to create areas of overrun to negotiate these points.

11.8.16 The transportation of abnormal loads requires careful planning in consultation with the Local Authority, Police Scotland and Transport Scotland. The anticipated distribution of abnormal loads indicates that abnormal loads would occur over a 2-month period with a peak vehicle movement of 144 per month.

11.8.17 During the period when the loads are being transported there is potentially some effect on driver delays. This effect is increased at junction locations where vehicles in both directions would be required to wait until each load has negotiated the obstacle. There are sections where the abnormal load would use both carriageways while negotiating a point of interest or narrow sections of the road. This possible cause for journey delay to other road users would occur along the route from port to site.

11.8.18 Discussions with Police Scotland would determine the likely traffic management arrangements for these vehicle movements. These would be incorporated into the construction programme and the Traffic Management Plan to be produced by the contractors and would be agreed with the Local Authority, Police Scotland and Transport Scotland prior to commencement of construction. Particularly important details to be established within the Traffic Management Plan would include determining an acceptable time for transporting abnormal loads and the number of loads it may be possible to transport at one time. It has been assumed that each abnormal load would require an escort of two police vehicles and one haulage company escort vehicle.

11.8.19 Careful management of the timing of the abnormal loads and management of the traffic during abnormal load delivery would minimise driver delay. There are various options available to minimise the impact of journey delay, such as:

- Vehicles permitted to overtake the abnormal loads at either existing passing places or on suitable sections of roads in conjunction with escort vehicles managing the traffic flows reducing the risk of any large build-up of traffic. This provision is considered appropriate on the sections of route where dual carriageway is available such as the A77;
- Night-time deliveries of the abnormal loads to avoid delays to the general public; and/or
- Scheduling deliveries to avoid peak travel times at sensitive locations (e.g. morning and evening peak on the A77 around Ayr).

11.8.20 The A713 is a major “A” road, with the national speed limit of 60mph. Due to the various turns and towns present it can be assumed that the average speed is 45mph. Applying this to the 23-mile length from the junction with the A77 to the site entrance it would take around 31 minutes to travel this section under normal conditions. The abnormal load will be required to travel at a reduced speed and would take approximately 1.5 hours to travel along the same section. This equates to an estimated driver delay of approximately 1 hour for vehicles following the abnormal load.

11.8.21 The abnormal load will, for the majority of the route from the A77 to the site entrance, be required to utilise the full width of the A713 carriageway. Oncoming vehicles to the abnormal load would be stopped at the junction with the B729 and hence would have an estimated delay of around 1.5 hours.

11.8.22 Driver delay may also occur in Glasgow where the abnormal load is required to contraflow roundabouts. Such delays should be limited to a matter of minutes as the AIL vehicle negotiates the particular junction. Following the junction, the route is predominantly on dual carriageway/motorway and hence any vehicles would be able pass the AIL convoy.

11.8.23 Proactive communication with the local community and road users on the delivery arrangements, dates and timings of the abnormal load deliveries will also provide advance warning to residents on the route and frequent road users. This will enable them to plan their journeys and avoid abnormal load delivery times if possible.

11.8.24 Given the delay which will be incurred by road users during the AIL delivery, along with the frequency of the event while taking cognisance of the short duration of AIL deliveries over the lifetime of the wind farm, in Natural Power’s professional opinion it is considered the effect on driver delay is assessed to be moderate.

11.9 IMPACT MITIGATION

11.9.1 As noted previously, the above assessment has included best practice mitigation that would be embedded in the Proposed Development through the TMP. Many of the mitigation measures proposed are considered good practice for wind farm construction and would be incorporated into the TMP regardless of the outcome of the traffic impact assessment.

11.9.2 Where effects were assessed as not Major nor Major / Moderate significance, no further impact mitigation measures are required.

11.10 CUMULATIVE IMPACT ASSESSMENT

11.10.1 Other developments in the areas served by the roads assessed herein may generate their own construction, operational and decommissioning traffic (new urban development, shopping centres, quarries, forestry, etc.). The greatest changes in traffic associated with the proposed development will be short term, occurring during the construction phase.

11.10.2 If the construction of another development were to coincide with that of the Proposed Development and was considered to have an unacceptable joint impact, then discussions would be held between developers and other relevant parties (in conjunction with the Roads Authorities) prior to the commencement of the projects, with a view to mitigating any such effects. The measures to be adopted would be enshrined in a robust Traffic Management Plan applying to each development, to ensure that any cumulative effects were avoided (e.g. by staging of deliveries and construction phasing).

11.11 CONCLUSIONS

11.11.1 The traffic and transport assessment has assessed the traffic impacts associated with the Proposed Development. The assessment considered a worst-case scenario and assumes all stone would need to be imported onto site and all foundation concrete would need to be brought to site in ready mix lorries.

11.11.2 In addition, the traffic effects associated with the abnormal load deliveries were also assessed. An Abnormal Load Access Assessment, including swept path analysis at particular pinch points was also prepared demonstrating the viability of the proposed abnormal load route and is included as an appendix to this chapter (Appendix 11.1).

11.11.3 The assessment concludes that, with the incorporation of suitable mitigation measures secured through a construction Traffic Management Plan, there will be no significant traffic effects associated with the Proposed Development.

11.11.4 A preliminary Traffic Management Plan has been prepared and is included as an appendix to this chapter (Appendix 11.2). The assessment has been based on a number of conservative assumptions around the construction programme/sequencing, source of stone and concrete deliveries. These assumptions can only be clarified post consent. Hence it is expected a Planning Condition will be applied to the development for a final construction TMP to be prepared and approved by the Local Authority post consent and prior to construction works commencing.

11.11.5 In relation to potential cumulative impacts, these are predicted to be ‘Negligible / Low’ depending on if other developments are constructed concurrently. If the construction of the Proposed Development coincided with another, using the same transport routes, then communication with the other developers would take place with the aim to mitigate effects to a non-significant level. This would be delivered through the construction Traffic Management Plan.

Document history

Author	Neil McKay	28/10/2021

Client Details	
Contact	Matthew Bacon
Client Name	Vattenfall Wind Power Ltd

Issue	Date	Revision Details
A	28/10/2021	draft for client review
B	15/12/2021	Final draft

Chapter 12

EIAR Forestry Chapter

Contents

Glossary

Term	Definition
Harvesting	Timber felling extraction and haulage
Cultivation	Creating improved planting positions by means of ploughing or mounding the surface layer
Forest residue	Non marketable woody matter, small tree tops, branches and tree stumps
Brash	Cut-off tree branches and tree tops

List of Abbreviations

Abbreviation	Description
ICF	Institute of Chartered Foresters
UKFS	UK Forestry Standards
SF	Scottish Forestry
CoWRP	The Scottish Government's 'Control of Woodland Removal Policy'
FGS	Forestry Grant Scheme
LIS	Land Information Search
SS	Sitka spruce
DF	Douglas fir
SP	Scots pine
LP	Lodgepole pine
MB	Mixed broadleaves
NBL	Native broadleaves
DOG	Designed open ground
OG	Open ground
OL	Other land

12.1 STATEMENT OF COMPETENCE

12.1.1 The assessment has been carried out by Neil McKay MICFor, Director of Neil McKay Forestry Consultant Limited, a professional member of the Institute of Chartered Foresters (ICF) since 1994 with more than 35 years' forestry practice in the state and private sectors throughout Scotland. Neil McKay has ten years' experience producing forestry sections for EIARs for renewable energy and energy transmission infrastructure developments across Scotland. The assessment has been carried out in line with ICF code of conduct and relevant standards and guidance.

12.2 INTRODUCTION

12.2.1 Neil McKay MICFor has carried out the assessment considering the impact of the Proposed Development on the woodlands within the Proposed Development Area. The assessment details the permanent and temporary woodland loss resulting from the infrastructure requirements including tracks, turbine layouts and associated stand-off distance to trees for bats, substation, compounds and borrow pit search areas.

12.2.2 Four wind turbines (out of up to 14) and associated tracks, with a proposed 35 year operational period, and one temporary borrow pit search area lie within the woodland areas. For the purposes of this assessment, it is assumed that one of the woodland areas proposed at Furmiston, which is consented but at the time of writing not yet planted, will progress through to planting in advance of any wind farm construction activities.

12.2.3 The wind farm tree clearance programme will be largely driven by technical and environmental constraints. Areas of trees would require to be cleared to accommodate the construction and operation of the Proposed Development. Typically, a minimum area of about 3.14 ha (equivalent to approximately a 200 metre diameter circle) would be required to be cleared for each turbine and this will also serve as a proposed ecological buffer during operation of the wind farm to reduce bat collision risk; a 30 m buffer around each item of infrastructure, in addition to the area required for the infrastructure; and a 100 m corridor for access roads. Pre-construction Geotechnical Investigation would require tree clearance pre-commencement. This requirement is included in total woodland removal allowance.

12.2.4 Much of the felled areas can be replanted upon completion of the construction, only leaving felled areas to allow the safe operation and maintenance of the proposed Development for its life time. The replanting requirements are discussed below in part 12.7 of this Chapter.

12.2.5 The permanent woodland loss of 13.81 ha of woodland is predicted, the vast majority of which are immature productive conifer plantation. With the required compensatory planting (CP) the residual effect of the Proposed Development is assessed to be **not significant**.

12.2.6 This chapter considers the likely significant effects on the forests and woodland associated with the construction, operation and decommissioning of the Proposed Development. The specific objectives of the chapter are to:

- describe the forest baseline;
- describe the assessment methodology and significance criteria used in completing the impact assessment;
- describe the potential effects, including direct, indirect and cumulative effects;
- describe the mitigation measures proposed to address likely significant effects; and
- assess the residual effects remaining following the implementation of mitigation.

This chapter is supported by the following figures and technical appendices:

- Figure 12.1: Forestry study area;
- Figure 12.2: Baseline species; and
- Figure 12.3: Wind farm permanent and temporary woodland loss;

Technical Appendices

- Technical Appendix 12.1: Planting year and species in hectares by forest;
- Technical Appendix 12.4: Total permanent felling area in hectares by forest.

12.3 POLICY AND GUIDANCE

12.3.1 The scope of the assessment has been informed by consultation responses summarised in Table 12.1 and the following guidelines/policies:

- Forestry Commission Scotland (2009). The Scottish Government's Policy on Control of Woodland Removal, Edinburgh and
- Forestry Commission Scotland (2019): Scottish Government's policy on control of woodland removal: implementation guidance February 2019.
- Forestry Commission (2017). The UK Forestry Standard: The Government's Approach to Sustainable Forestry, 4th Edition, Forestry Commission, Edinburgh.
- Forestry Commission (2017): The UK Forestry Standard Guidelines. Edinburgh.
- The Scottish Government (2019) Scotland's Forestry Strategy 2019-2029. Edinburgh.
- The Scottish Government (2011). Scottish Land Use Strategy. Edinburgh.
- The Scottish Government (2014a). Scotland's Third National Planning Framework (NPF3). Edinburgh.
- The Scottish Government (2014b). Scottish Planning Policy. Edinburgh.
- SEPA (2013): SEPA Guidance Notes WST-G-027 "Management of Forestry Waste".
- SEPA (2014): LUPS-GU27 "Use of Trees Cleared to Facilitate Development of Afforested Land.
- UKWAS (2012) The UK Woodland Assurance Standard, Third Edition, UKWAS, Edinburgh.

12.4 METHOD OF ASSESSMENT

12.4.1 This chapter considers effects on of the Proposed Development on forestry within the Proposed Development Area.

12.4.2 The chapter assesses cumulative effects arising from the addition of the Proposed Development to other cumulative developments, for which an application for consent has been submitted. Operational, under construction and consented developments are considered as part of the baseline.

12.4.3 The assessment is based on the proposed development as described in EIAR Chapter 3: Project Description and woodland creation plans provided by the landowners/agents.

12.4.4 The key legislation and guidance which the assessment is based on are the Scottish Government's Policy on Woodland Removal (CoWRP) with the subsequent implementation guidance and The UK Forestry Standard (UKFS) Guidelines.

12.4.5 The criteria for the assessment of effects on forestry are based on CoWRP and the implementation guidance starting with a strong presumption in favour of protecting Scotland's woodland resources.

The policy on control of woodland removal identifies situations where:

• there is a strong presumption against removal of woodland;

• woodland removal is acceptable without compensatory planting (CP);

• woodland removal is acceptable with CP.

Furthermore, guidance is provided stating that, where woodland removal is justified, that the area of CP must exceed the area of woodland removed to compensate for the loss of environmental value.

12.4.6 UKFS is the reference standard for sustainable forest management in the UK. The standards for the planning, design and sustainable management of forests and woodlands in the UK use an approach based on internationally recognised science and best practice. Both felling operations and on and off-site CP must be carried out in accordance to good forestry practice.

The UKFS includes guideline points associated with each of these seven elements, which in turn enable an assessment to be made as to whether the relevant requirements of the UKFS have been achieved

The seven elements of sustainable forest management within UKFS are;

- Forests and Biodiversity;
- Forests and Climate Change;
- Forests and Historic Environment;
- Forests and Landscape;
- Forests and People;
- Forests and Soil; and
- Forests and Water.

The UKFS includes guideline points associated with each of these seven elements, which in turn enable an assessment to be made as to whether the relevant requirements of the UKFS have been achieved.

12.4.7 Scottish Forestry (LIS) and Scottish Forestry Map Viewer are reviewed for environmental features and approved forestry activities in the area.

12.4.8 Secondary effects resulting from the forestry activities required to facilitate the Proposed Development, including effects on habitats and species, ornithology, hydrology and landscape and visual effects, are considered within their respective chapters of this EIA Report and are not included within this Chapter.

12.5 CONSULTATION

12.5.1 Scottish Forestry is the Scottish Government agency responsible for forestry policy, support and regulations. Scottish Forestry was not initially consulted as there were no forestry implications resulting from the Proposed Development at that time. However, since scoping, two woodland creation projects have been approved within the Proposed Development Area.

12.5.2 A request for scoping was communicated to the South Scotland Conservancy office by email on 13 October 2021

Table 12.1: Consultation

Consultee	Issue raised	Response/ Action taken
Scottish Forestry by email 28 October 2021	The Control of Woodland Removal will apply to woodland loss by the developer and SF would need information and evidence as to how that requirement is being met	Woodland Loss has been assessed and detailed in Table 12.2

12.6 BASELINE (FIGURE 12.2)

12.6.1 Two FGS Woodland Creation projects have been approved by Scottish Forestry within the Proposed Development Area:

- Marbrack woodland case reference 20FGS49683 has a Forestry Grant Scheme (FGS) planting claim year of 2021; and
- Furmiston Woodland 20FGS55105 has a FGS planting claim year of 2022

12.6.2 The compartment schedule or sub compartment database for each forest management unit has been provided by the forest managers/agents.

12.6.3 Marbrack Woodland is a mainly conifer planting scheme covering 57.76 ha in total; Sitka spruce 34.82 ha, Pacific silver fir 4.48 ha, Scots pine 1.44 ha, and native broadleaved 4.36 ha. The balance is 0.88 ha of existing coniferous woodland and the remainder is unplanted open ground. The woodland was planted in 2021 and is contained fully within the development boundary.

12.6.4 Furmiston Woodland conifer woodland creation plan partially covers and extends beyond the development boundary and totals 305.58 ha of new woodland and associated open ground. The main coniferous species being Sitka spruce covering 159.13 ha, Douglas fir 10.95 ha, and lodgepole pine 6.18 ha. The broadleaf content including designed open ground amounts to some 24.15 ha. The gross area of the woodland creation plan within the Proposed Development Area is 197.22 ha. Furmiston Woodland works are underway and is expected to be planted by 2022 in line with the FGS planting claim year.

12.6.5 Additionally, within the Proposed Development Area, there are a number of small individual woodland blocks amounting to 4.85 ha. These woodland blocks, largely shelterbelts, will likely have been planted in the 1980s and are mainly Sitka spruce of mixed stocking.

12.6.6 Scottish Forestry LIS, Scottish Forestry Map Viewer and published datasets indicate that there are no Ancient Woodland Inventory sites or Native Woodland Survey of Scotland within the Proposed Development Area. It is noted that two NWSS areas lie just outside the Proposed Development Area.

12.6.7 It is assumed that the baseline described above would form the ongoing environmental baseline against which the impacts of the Proposed Development are assessed in the absence of the Proposed Development.

12.7 ASSESSMENT OF POTENTIAL EFFECTS

12.7.1 A permanent woodland loss of some 13.81 ha is calculated as worst case, with a potential temporary tree removal of 2.25 ha which can be replanted on site.

12.7.2 The Proposed Development has taken into account, through design modifications, the presence of the woodland creation projects as well as the small woodlands currently on site.

12.7.3 However, to provide an effective wind energy resource it has proved necessary to include some parts of these woodlands within the overall design.

12.7.4 Consequently, some permanent tree removal is required for the construction of tracks and underground electricity cables along with turbine bases, including crane pads, which will be left in situ following erection of turbines to allow for maintenance and replacement of parts as necessary during the lifetime of the project. Following the current NatureScot guidance, a stand-off distance between wind turbine blade tips and trees shall be cleared and maintained clear of trees to minimise impacts on bat species.

12.7.5 The worst-case scenario for permanent woodland loss required to facilitate the Proposed Development compared to the baseline without the proposal has been calculated as follows in Table 12.2

Table 12.2: Permanent Woodland Loss

Woodland	Conifer	Broadleaf	Total (Ha)
Marbrack	4.44	0.34	4.78

Woodland	Conifer	Broadleaf	Total (Ha)
Furmiston	7.99	0.29	8.28
Shelterbelt	0.75		0.75
Totals (Ha)	13.18	0.63	**13.81**

12.7.6 Temporary clearance with replanting in situ after reinstatement may be required for a single temporary borrow pit search area within 2.25 ha Sitka spruce area within Furmiston.

12.7.7 With the exception of the small shelterbelt trees to be removed, all will have been recently planted and provide no harvestable timber nor any residues under the Forestry Waste guidance.

12.7.8 The small shelterbelt will be conventionally harvested with an estimated 125 - 150 tonnes of wood products to be removed from site and into the wood processing markets.

12.8 CUMULATIVE EFFECTS

12.8.1 On the basis that the overall forest resource will be maintained across the board in line with CoWRP and UKFS, then no cumulative effects are anticipated.

12.9 MITIGATION AND RESIDUAL EFFECTS

12.9.1 The assessment of residual effects is based on the change of forest structure with the Proposed Development taking account of the proposed mitigation.

12.9.2 Mitigation through the design process has reduced the amount of woodland loss required by the Proposed Development. Where infrastructure has impacted upon the current woodland design, this has been directed, where practical, to utilise open ground and minimise the disruption of planted compartment.

12.9.3 The construction effects on forestry, following mitigation through design, are a reduction of planted ground within each forest unit, in total by 13.81 ha. However, when considering the proposed mitigation measures, including compensatory planting, the overall magnitude of impact would be negligible and there would be no likely significant effect

12.9.4 Compensatory planting is calculated in accordance with Annex 5 of the Scottish Government's policy on *Control of Woodland Removal: Implementation Guidance* (February 2019). Accordingly, CP arrangements shall be provided for at least 13.81 ha, which may be met by the final approved Habitat Management proposals

12.9.5 CP will be subject to a planting plan, to the UKFS, approval by Scottish Forestry. CP will follow the guidance Scottish Forestry (2020) *Preparing Woodland Creation Applications A guide for land managers,* Edinburgh.

12.9.6 The temporary felling indicated for the borrow pit search area within Furmiston will be replanted in situ with the species as the current woodland creation plan. This area is therefore not included within the CP calculations.

12.9.7 Given the small areas of woodland to be removed the magnitude of change is considered to be negligible. With CP as mitigation there will be no residual woodland loss. Given that no NWSS or AWI woodlands are affected by this Proposed Development the sensitivity of effects is considered to be Low. Therefore, as per table 12.4 below, the overall significance of effect is deemed to be Minor/Negligible and therefore not significant.

Table 12.3: Magnitude of Change

Magnitude	Description
High	Total loss or major alteration to key elements/features of the baseline conditions
Medium	Partial loss or alteration to one or more key elements/features of the baseline conditions
Low	Minor shift away from the baseline conditions
Negligible	Very slight change from baseline conditions

Table 12.4: 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

12.10 CONCLUSIONS

12.10.1 Following completion of compensatory planting, the residual effect of the Proposed Development would be **not significant.**

12.10.2 The total forestry study area extends to 363.34 ha of newly planted woodland under different private ownership. 2.54 ha of shelterbelt woodlands are present within the Proposed Development Area.

12.10.3 Permanent woodland removal of 13.81 ha would be required to construct the Proposed Development.

12.10.4 The species composition would remain materially unaltered as a result of the Proposed Development as most infrastructure lies within spruce compartments.

12.10.5 In order to comply with the CoWRP, CP would be required to mitigate the loss of woodland area. The Applicant is committed to providing appropriate CP. The extent, location and composition of such planting would be agreed with Scottish Forestry. It is noted that the proposed riparian planting arrangements presented in the draft Habitat Management Plan accompanying this EIAR will more than exceed the anticipated woodland removal.

12.10.6 The layout, tracks and four turbine locations of the Proposed Development impact the two woodland creation schemes and one small shelterbelt. This permanent woodland loss of 13.81 ha of mainly newly planted woodland is required to facilitate the construction and operation of the Proposed Development and comprises mainly productive conifer, a loss of 6% to these two new woodlands. Broadleaf loss is 2% within these new woodlands.

12.10.7 Since these are recently (2021) and about to be planted (2022) woodlands concern for windthrow are not material.

12.10.8 Long Term Forest Plans will be shaped by the access tracks and open ground associated with the turbines in the future when woodland felling and replanting proposals are considered in 30 to 40 years from planting. This is potentially around the years 2050 to 2060. This is around the end of the anticipated operational life of the Proposed Development.

VATTENFALL

Document history

Author	Malcolm Spaven	10/09/2021
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Approved	Emily Galloway	15/09/2021

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Contact	Matthew Bacon
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A	14/07/2021	draft for client review
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Chapter 13

Other Effects

Contents

Glossary

Term	Definition
Environmental Impact Assessment	Environmental Impact Assessment (EIA) is a means of carrying out, in a systematic way, an assessment of the likely significant environmental effects from a development.
Environmental Impact Assessment Regulations	The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (EIA Regulations).
Environmental Impact Assessment Report	A document reporting the findings of the EIA and produced in accordance with the EIA Regulations.
The Proposed Development	The Quantans Hill Wind Farm Project.
The Proposed Development Area	The area within the “Site boundary” as illustrated on Figure 1.1 which the Proposed Development will be located
Applicant	In the event of the Proposed Development being granted Section 36 Consent, this is the Company developing the Project.

List of Abbreviations

Abbreviation	Description
AGL	Above Ground Level
AIP	Aeronautical Information Publication
ATC	Air Traffic Control
ATCSMAC	ATC Surveillance Minimum Altitude Chart
CAA	Civil Aviation Authority
GPA	Glasgow Prestwick Airport
IFR	Instrument Flight Rules
LDP	Local Development Plan
MOD	Ministry of Defence
NATS	(formerly) National Air Traffic Services
NERL	NATS En Route plc
NVIS	Night Vision Imaging Systems
RAF	Royal Air Force
SPP	Scottish Planning Policy

13.1 STATEMENT OF COMPETENCE

13.1.1 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.

13.2 EXISTING INFRASTRUCTURE

13.2.1 This section of the chapter summarises the potential effect of the Proposed Development on 'other infrastructure' in the Proposed Development Area.

Microwave Fixed Links

13.2.2 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.

13.2.3 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 also responded to scoping indicating that links would not be affected. It is acknowledged that the turbine layout has changed since scoping however it appears that these particular assets do not feature within the Proposed Development Area and therefore it is expected that these stakeholders will remain unaffected.

13.2.4 An EE telecommunications mast was identified on the edge of the Proposed Development Area post scoping. EE were consulted when identified and the Applicant received confirmation that Proposed Development layout was unlikely to cause any interference.

13.2.5 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.

Other Radio Communication Networks

13.2.6 Where turbines with low amount of metal in the blades are used, as is envisaged for the Proposed Development, there is little evidence of adverse interactions with radio transmission and reception, including domestic radio service, Citizen's Band (CB) and services communications due to the low frequency of the signals.

13.2.7 Therefore, the potential effect of the Proposed Development is considered to be not significant with respect to other radio communication networks.

Overhead Electricity Network

13.2.8 Scottish Power Energy Network have proposed an overhead transmission grid line which dissects the Proposed Development.

13.2.9 The Applicant has consulted with SPEN throughout EIA to establish suitable locations and buffers for several turbines which has been factored into the final design assessed in this application.

Water Supply

13.2.10 Chapter 8: Hydrology, Geology, and Hydrogeology presents the relevant hydrological assessment.

Private Water Supplies

13.2.11 Increased sediment erosion as a result of wind farm construction and decommissioning can have significant impacts on the quality, quantity and continuity of water supply to the properties.

13.2.12 Dumfries and Galloway Council provided a list of PWS to allow a gap analysis of the potential effects on PWS by the proposed development.

13.2.13 Potential effects and appropriate mitigation are detailed in Chapter 8: Hydrology, Geology & Hydrogeology.

Public Water Supplies

13.2.14 One public water supply was identified; the Scottish Water Carsphairn Water Supply.

13.2.15 The Applicant consulted with Scottish Water during the EIA process to ensure this asset remains safeguarded.

13.2.16 There should therefore be no significant adverse effect upon the public water supply. The potential effects upon water supplies is assessed in Chapter 8.

SUMMARY

13.2.17 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.

13.2.18 The potential effect of the Proposed Development is considered to be not significant with respect to other radio communication networks.

13.2.19 There should be no significant adverse effect upon public and private water supplies

13.3 SAFETY

13.3.1 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 or mechanical failure, however, such incidents occur infrequently.

13.3.2 No passing member of the public has ever been directly injured during the normal operation of a wind turbine (Irish Wind Energy Association Environmental Impacts, 2019).

13.3.3 The safe operation of wind turbines is ensured through a combination of design, quality control and manufacturing to high safety standards.

13.3.4 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.

13.3.5 The wind turbines installed in the Proposed Development Area will comply with the British Standard BS EN 61400-1 'Wind turbines, Design Requirements.'

13.3.6 The primary safety system at the Proposed Development Area will include a computerised central control system housed within the control building. 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

13.3.7 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).

13.3.8 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.

Lightning Strike

13.3.9 A small number of wind turbines have been known to lose parts of the rotor assembly through damage caused by lightning, however, such incidents occur rarely.

13.3.10 Turbines are equipped with lightning conductors as mitigation to lightning strikes which could damage internal components.

Air Quality

13.3.11 The air quality of the site is expected to be good due to the rural location, with few pollution sources.

13.3.12 During the construction of the Proposed Development, the increased traffic flow on local roads and the on-site 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.

13.3.13 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.

13.3.14 An operational wind farm produces no notable atmospheric emissions. The operation of the wind farm would therefore have no discernible adverse effects on local or national air quality.

13.3.15 Relevant mitigation measures for air quality, dust and pollution control will be captured within the site-specific CEMP.

Ice Throw

13.3.16 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.

13.3.17 Wind turbines are fitted with vibration sensors which can shut the wind turbines down should any imbalance that might be caused by icing be detected. Turbines are then restarted after any ice which has formed as melted away.

13.3.18 It is noted that there is a public right of way that traverses the Proposed Development Area however the risk associated with ice throw affecting members of the public is considered to be very low given the frequency of risk and technical mitigation as mentioned above.

13.3.19 To further minimise the risk, the following mitigation measures will be taken:

- Service crews will be trained regarding the potential for ice throw;
- Ice risk conditions will be monitored by the wind farm operator; and
- Public notices will be displayed at access points to the Site, alerting members of the public and staff accessing the Site of the possible risk of ice throw under certain weather conditions.

Public Access

Public Rights of Way

13.3.20 There is a Public Right of Way that traverses the site but does not physically exist in The Proposed Development Area. Nonetheless, the Proposed Development has been designed to ensure a safe passage across the site is maintained.

13.3.21 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.

13.3.22 The Applicant would provide funding for improvements to outdoor access on the site, should the consent be granted. See Chapter 3 for more information.

13.3.23 Furthermore, the Applicant is looking into the potential for a community heritage program; linking the recreational access benefits the project is seeking to provide, with sign posting and interpretation of some key historic features. See chapter 9: Cultural Heritage for details.

SUMMARY

13.3.24 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 site-specific 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 onsite, will further help to minimise ongoing safety risks through the Proposed Development's operational life.

13.3.25 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. Paths would be appropriately managed during construction for health and safety purposes.

13.4 SHADOW FLICKER

13.4.1 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 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 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.

13.4.2 A technical paper by A D Clarke[1] (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 turbine and properties of at least 10 rotor diameters. Scottish Government guidance[2] advocates that beyond this distance, shadow flicker should not be a problem. UK Government guidance[3] also states that 'only properties within 130 degrees either side of north, relative to the turbines can be affected at these latitudes in the UK – turbines do not cast long shadows on their southern side'.

[1] A.D. Clarke 'A Case of Shadow Flicker/Flashing: Assessment and Solution', Technology Policy Unit, Open University, Walton Hall, Milton Keynes, UK.

[2] Available online: https://www.gov.scot/publications/onshore-wind-turbines-planning-advice/ (last accessed 26/11/2020)

[3] "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)

13.4.3 The candidate turbines under consideration for use at the Proposed Development have a maximum rotor diameter of 170 m making the separation recommended by Clarke between the property and the nearest turbine 1700 m. Figure 13.1 identifies 14 properties in the immediate area which are within 1700 m of proposed turbine(s), 4 of which are financially involved with the Proposed Development.

Table 13.1 Shadow Flicker Hours Per Year

Receptor	Unscaled Shadow Flicker Hours	Scaled Shadow Flicker Hours	Status
Stables Cottage	16	-	
Knockgray Cottage	21	-	
Knockgray	20	-	Financially Interested
Marbrack Cottage	95	30.3	Financially Interested
Marbrack	92	28.9	Financially Interested
Furmiston	0	-	Financially Interested
Bridgend	22	-	Non - financially interested
Liggat	29	-	Non - financially interested
Marbrae	0	-	Non - financially interested
Burnfoot	27	-	Non - financially interested
Old Burnfoot Cottage	20	-	Non - financially interested
Burniston	31	9.5	Non - financially interested
Kensglen	0	-	Non - financially interested
Nether Loskie	0	-	Non - financially interested

Source: Natural Power

13.4.4 Original unscaled calculated shadow flicker hours per year were deemed to be a worst case scenario and comes from a point in central England which is not the most representative of sunshine in the Proposed Development Area. Therefore for a more accurate representation, these results were scaled for three receptors that saw over 30hrs (Marbrack, Marbrack Cottage and Burniston) using a reference site's 'sunshine hours per day', obtained from the Met Office for the nearby Dumfries & Galloway Solar Station. This is located approx. 44km SE of Quantans. Deemed reasonably representative as sunshine hours unlikely to vary significantly across this spatial distance.

13.4.5 Daily daylight hours for the site were obtained[4]. For each month, the percentage of sunshine hours relative to daylight hrs was calculated to create a sunshine to daylight ratio (sunshine / daylight). For each location of interest, the total number of shadow flicker minutes per month was calculated (single year, 2021). This number was then scaled using the monthly ratio values to give a scaled shadow flicker hours per month. These were then summed across all months to give a scaled number of shadow flicker hours per year. **Note:** It is not possible to map this as multiple scaling adjustments were made for each receptor and these varied from receptor to receptor, depending on when each one was predicted to be impacted by shadow flicker.

13.4.6 A report produced for the Department of Energy and Climate Change[5] explains different approaches to assessing shadow flicker across Europe citing a commonly used guide by Predac, (a European Union sponsored organisation that promotes best practice in energy use and supply) which recommends that shadow flicker does not exceed 30 hours per year or 30 minutes per day. As can be seen from Table 13.1, none of the non-financially interested properties are assessed to experience shadow flicker beyond that threshold. It is therefore concluded that the Proposed Development would not cause a significant effect upon residential amenity due to shadow flicker. The only property exceeding this value did so by a very small margin.

13.4.7 Potential effects upon residential visual amenity are also assessed in Chapter 5: LVIA.

SUMMARY

13.4.8 14 properties may potentially experience shadow flicker from the Proposed Development, 4 of which have financial interest with the Proposed Development. These properties have been assessed to be within a deemed acceptable threshold for shadow flicker. It is therefore concluded that the Proposed Development would not cause a significant effect upon amenity due to shadow flicker.

13.5 CARBON BALANCE ASSESSMENT

13.5.1 Appendix 13.1 reveals the carbon losses and carbon gains for the Proposed Development.

13.5.2 The net emissions of CO_2 of the Proposed Development is 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 alternative Proposed Development (described in the preceding paragraphs).

13.5.3 The wind farm 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 of this into account is the carbon payback time and it is this value that evidences the carbon balance of the Proposed Development.

13.5.4 The carbon payback time for the wind farm is calculated by comparing the net loss of CO_2 from the site due to wind farm development with the carbon savings achieved by the wind farm while displacing electricity generated from coal-fired generation, grid-mix generation or fossil-fuel mix electricity generation.

13.5.5 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 1.1 years, if it replaced with the fossil fuel 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 0.5 to 2.1 years respectively.

13.5.6 In this context, the results of this assessment reveal that the net impact of the Proposed Development at Quantans Hill will be positive overall, as over the 30-year lifespan (in the expected scenario, however consent is being sought for 35 years which would be considered best case) of the Proposed Development, it is expected to generate over 28 years' worth of clean energy if it replaced fossil fuel electricity generation. In addition, over the expected 28 years that the wind farm is likely to be generating carbon-free electricity, this could result in expected CO_2 emission savings of over 3,926,524 tonnes of CO_2 when replacing fossil fuel electricity generation. This illustrates a positive net impact through contributing significantly towards the reduction of greenhouse gas emissions from energy production.

[4] https://gml.noaa.gov/grad/solcalc/.

[5] Available online: {C8444A91-2117-4480-9667-44570C9D279D}.pdf (last accessed 16/02/2021)

13.6 AVIATION

Statement of Competence

13.6.1 This section of the chapter has been compiled by Gladhouse Planning Ltd, trading as Aviatica. Aviatica is a specialist aviation consultancy with 25 years' experience of assessing the impacts of wind energy developments on aviation. This has included the preparation of more than one hundred Environmental Impact Assessment (EIA) chapters for projects across the UK and assessment of more than fifty wind farm developments in the south of Scotland.

Introduction

13.6.2 This section considers the likely significant effects on aviation and defence associated with the construction, operation and decommissioning of the Proposed Development. It has been compiled by Malcolm Spaven, Director of Gladhouse Planning Ltd.

Legislation, Policy and Guidance

Legislation

13.6.3 Relevant legislation and guidance documents have been reviewed and taken into account as part of this aviation assessment. This includes the Air Navigation Order 2016 (as amended in September 2021) and aviation Statutory Instruments enacted under the European Union (Withdrawal) Act 2018.

13.6.4 The assessment has also taken account of the provisions of the Ministry of Defence (Eskdalemuir Seismic Recording Station) Technical Site Direction 2005.

Planning Policy

13.6.5 Scottish Planning Policy (SPP) (2014) advises that wind energy proposals should take account of impacts on aviation and defence interests and seismological recording. **Note:** A revised version of the Scottish Planning Policy was published in 2020 but has since been removed following a legal challenge in the Court of Session in August 2021[6]

13.6.6 The Scottish Government Onshore Wind Policy Statement (December 2017) advised of the government's intention to pursue a more strategic approach to the mitigation of effects of wind farms on civil and military radar.

13.6.7 The Dumfries & Galloway Council Local Development Plan 2 (LDP2), Policy IN2, advises that wind energy proposals will be assessed against the extent to which the proposal addresses any impacts arising from location within an area subject to potential aviation and defence constraints, including the Eskdalemuir Safeguard Area.

Guidance

13.6.8 The Dumfries & Galloway Council LDP2 Supplementary Guidance on Wind Energy Development - Development Management Considerations advises that the main aviation and defence constraints in the region are the NATS radar safeguarding zone; a 13km radar management zone around the MOD range at West Freugh; the CAA consultation zone around Carlisle Airport; areas that may be subject to low flying military aircraft; and the Eskdalemuir seismic monitoring station. The document states that effects on aviation and defence require detailed consultation with the relevant stakeholders.

13.6.9 The assessment in this chapter of potential effects on aviation and defence has also been informed by the following aviation guidance and sources of information:

- CAA Policy and Guidelines on Wind Turbines (CAP 764);
- CAA Air Traffic Services Safety Requirements (CAP 670);
- CAA Policy Statement: Lighting of Onshore Wind Turbine Generators in the United Kingdom with a maximum blade tip height at or in excess of 150m Above Ground Level (June 2017);
- International Civil Aviation Organisation (ICAO), Annex 14 to the Chicago Convention, Vol.1, Eighth Edition (2018);
- UK Aeronautical Information Publication (AIP); and
- UK Military AIP.

Method of Assessment

Study Area

13.6.10 Study areas with the following radii were used in determining the aviation and defence baseline:

- 120 km for air traffic control and air defence primary surveillance radars;
- 30 km for Meteorological Office rainfall radars;
- 20 km for secondary surveillance radars and aeronautical radio navigation aids;
- 30 km for licensed, certificated and Government aerodromes;
- 10 km for unlicensed aerodromes, airstrips and gliding sites; and
- 50 km for the Eskdalemuir seismic array.

Desk Study

13.6.11 The description of baseline conditions for aviation and defence has been completed using the following methods:

- Assessment of the turbine visibility to all potentially affected air traffic control and air defence radars;
- Desk studies to identify all potentially affected airfields, airstrips and other aviation activity sites in the vicinity of the Proposed Development Area, referencing the UK Aeronautical Information Publication, the UK Military Aeronautical Information Publication, aeronautical charts and published pilot's guides;
- Measurement of the distance of the Proposed Development Area from the Eskdalemuir seismic array; and
- Consultation with identified aviation consultees.

13.6.12 The potential impacts of the Proposed Development on aviation and defence have been assessed by considering whether any of the turbines would be within line of sight of, and in an area of operational significance to, any aeronautical or defence radar equipment; whether any of the turbines would breach the obstacle limitation surfaces around civil or military airfields, or pose an obstacle hazard to aircraft in the vicinity of airfields or conducting military low flying; and whether the turbines would be within the safeguarding zones for aeronautical radio navigation or communication equipment or the Eskdalemuir seismic array.

Assessment of Likely Effect Significance

13.6.13 The significance of an impact on the use of air traffic control or air defence radar has been determined by assessing any technical effects on the radar in the context of the classification of the airspace in which the radar provides a service; the nature and density of air traffic in the airspace; the routes flown by aircraft in the vicinity of the Proposed Development Area; the types of service requested by, and provided to, aircraft using services provided from the affected radar; and the capacity of normal operational air traffic management measures to address the effects on the radar.

13.6.14 Potential obstacle hazard impacts of the turbines have been determined by assessing the proximity of the Proposed Development to airfields, airstrips and aerodromes, including whether any obstacle limitation surfaces

[6] Available at https://www.gov.scot/publications/scottish-planning-policy/ (accessed 01/09/2021)

at Government or licensed aerodromes would be infringed; and whether the turbines, in combination with the terrain and other vertical obstructions in the area, would impose constraints on military low flying.

13.6.15 The significance of potential effects on aviation and radar receptors is based on industry regulations for safe obstacle avoidance and the ability to maintain radar separation from radar clutter. The criteria used in determining significance are set out in Table 13.2 below. Major and moderate effects are considered significant in relation to the EIA Regulations.

Table 13.2: 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

Source: Natural Power

Consultation

13.6.16 Scoping consultations have been undertaken with NATS, Glasgow Prestwick Airport (GPA) and the MOD.

13.6.17 NATS advised that they would object to an application at the Proposed Development Area due to predicted impacts on the radars at Lowther Hill and Great Dun Fell.

13.6.18 GPA advised that the Proposed Development is likely to be terrain shielded from its radars and that an assessment may need to be conducted of impacts on the airport's Instrument Flight Procedures (IFPs).

13.6.19 The MOD advised that, subject to the provision of appropriate lighting, they have no concerns in relation to the Proposed Development.

13.6.20 The Scottish Government Scoping Opinion advised the Applicant to have discussions with NATS Safeguarding to agree mitigation schemes to overcome the interference the turbines of the Proposed Development on the Lowther Hill and Great Dun Fell radars.

Baseline

13.6.21 The Proposed Development Area is located in uncontrolled airspace from ground level to 5,500 feet above mean sea level (amsl). Above that level is the Class D controlled airspace of the Scottish Terminal Control Area (TMA), within which air traffic services are provided by the NATS En Route (NERL) Prestwick Centre. Radars used to provide these services include those at Great Dun Fell (Cumbria) and Lowther Hill (South Lanarkshire).

13.6.22 The following primary surveillance radars are located within a radius of 120 km of the Proposed Development Area:

- Glasgow Prestwick Airport EN-4000;
- Glasgow Prestwick Airport Terma Scanter;
- Glasgow Airport NASR-10;
- Glasgow Airport Terma Scanter;
- Cumbernauld;
- Kincardine;
- Edinburgh Airport NASR-10;
- Edinburgh Airport Terma Scanter;
- NATS Lowther Hill;
- RAF Spadeadam Deadwater Fell;
- RAF Spadeadam Berry Hill;
- NATS Great Dun Fell; and
- QinetiQ West Freugh.

13.6.23 Wind turbines within line of sight and operational range of a primary surveillance radar may cause false targets to be displayed on the radar, which may have an adverse effect on the provision of air traffic services by controllers.

13.6.24 The Proposed Development Area is located within Low Flying Area (LFA) 16, where military aircraft are permitted to fly as low as 250 ft above ground level. It is also within Low Flying Area 20(T), the Borders Tactical Training Area, where fixed wing aircraft may be authorised to fly as low as 100 feet above ground level during daylight hours. This area is designated by the MOD as a "high priority military low flying area likely to raise considerable and significant concerns".

13.6.25 There are no Meteorological Office radars within range and line of sight of turbines up to 200 m tip height on the Proposed Development Area. There are also no airfields, airstrips, gliding or other aviation sites within 20 km of the Proposed Development Area.

13.6.26 The Proposed Development is approximately 66 km from the Eskdalemuir seismic array and is therefore beyond the 50km consultation zone specified in the Ministry of Defence (Eskdalemuir Seismic Recording Station) Technical Site Direction 2005.

13.6.27 Wind turbines with blade tip heights of 150 m or more are subject to the obstruction lighting provisions of Article 222 of the Air Navigation Order and the CAA Policy Statement: Lighting of Onshore Wind Turbine Generators in the United Kingdom with a maximum blade tip height at or in excess of 150m Above Ground Level (June 2017).

Assessment of Potential Effects

13.6.28 The radars at Glasgow Prestwick Airport, Glasgow Airport, Cumbernauld, Kincardine, Edinburgh Airport, RAF Spadeadam and QinetiQ West Freugh have no line of sight to the Proposed Development due to intervening terrain. Consequently, the Proposed Development will have no effects on those radars.

13.6.29 Assessment of the line of sight from the NERL radar at Lowther Hill indicates that it is likely to be capable of detecting Turbines 3, 5, 6, and 7 of the Proposed Development. Assessment of the line of sight from the NERL radar at Great Dun Fell indicates that it is likely to be capable of detecting all turbines in the Proposed Development except for T4, T11 and T14. The Proposed Development is likely to generate false plots on the Lowther Hill and Great Dun Fell radars. NERL has indicated that it will object to the Proposed Development. The Applicant is in discussions with NERL on technical mitigation measures to address the impacts on these radars. This will lead to agreement on a Radar Mitigation Scheme, to be secured by a planning condition, to ensure that the effects of the Proposed Development are satisfactorily mitigated for the lifetime of the wind farm. Following implementation of the Radar Mitigation Scheme the residual adverse effect will be a low magnitude of change to a receptor of medium sensitivity, resulting in a residual adverse effect of Moderate/Minor significance.

13.6.30 The highest turbine in the Proposed Development will be Turbine 2, whose blade tips will be 1807 ft amsl. However the summit of Cairnsmore of Fleet, 2.5 km north of the Proposed Development, has an elevation of 2615 ft amsl. Aircraft flying under the Instrument Flight Rules (IFR) are required to fly at a level that is not lower than 1000 ft above the highest obstacle within 8 km of the aircraft. This will mean that any aircraft flying IFR within 8 km of the Proposed Development will be required to fly no lower than 3700 ft amsl. This minimum IFR altitude will be unaffected by the Proposed Development.

13.6.31 The height of the Proposed Development also has the potential to require increases in the minimum altitudes to which radar controllers can clear aircraft to descend, as depicted on ATC Surveillance Minimum Altitude Charts (ATCSMAC). The minimum altitudes are based on aircraft maintaining a minimum vertical clearance of 1000 ft above the highest obstacle within five nautical miles (nmi) of the aircraft. The Glasgow Prestwick Airport ATCSMAC currently specifies a minimum altitude of 3900 ft amsl in the vicinity of the Proposed Development. This allows for obstacles up to 2900 ft to be present in the area. Since the Proposed Development will have a maximum altitude of 1807 ft amsl, it will have no effect on the Glasgow Prestwick Airport ATCSMAC.

13.6.32 The MOD scoping response (5 August 2020) advised that the Proposed Development has the potential to compromise the safety of military low flying training and that it would be necessary for the Proposed Development to be fitted with aviation safety lighting in accordance with the requirements of the Air Navigation Order. In addition, to mitigate potential effects on military low flying during daylight as well as at night, the MOD advised that it would request details of turbine positions and heights prior to construction, to ensure that all structures associated with the Proposed Development are marked on aeronautical charts.

13.6.33 The Proposed Development will be notified to the MOD and civil airspace users and marked on aeronautical charts and electronic aviation obstacle databases to enable aircrew to avoid the turbines in accordance with ANO Article 225A. The Proposed Development is located in the military night low flying area known as Allocated Region (AR) 2B. All users of this night military low flying airspace operate using Night Vision Imaging Systems (NVIS). These enable aircrew to see obstacles fitted with infra-red lights. The MOD policy guidance on lighting of wind turbines states that developments of between 11 and 15 turbines should be fitted with 25 candela visible spectrum red lights or infra-red lights on the perimeter turbines. The Applicant proposes to fit 2000 candela steady red visible spectrum lights on the nacelles of five turbines marking the perimeter of the Proposed Development to meet civil aviation requirements, and infra-red lights on the nacelles of all perimeter turbines to meet the requirements of military and specialist civil operators. The effect on military low flying will be of low magnitude affecting a receptor of medium sensitivity, resulting in a residual adverse effect of Moderate/Minor significance.

13.6.34 Since all 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 (agl) to be fitted with medium intensity steady red lights on the highest practicable point. Article 222 also permits the CAA to approve a lighting scheme other than medium intensity steady red lights on each turbine. ICAO Annex 14 provides for alternative lighting schemes to be designed on the basis of a special aeronautical study. In order to minimise the night-time visual impact of lighting on the turbines, a study has been conducted of the use of the night low level airspace in the vicinity of the Proposed Development Area to explore the potential for reducing the number and intensity of lights on the turbines. The study concluded that:

- the Proposed Development is relatively small in area and number of turbines;
- almost all night low level air traffic in the area operates with Night Vision Imaging Systems and does not, therefore, require obstacles to be lit with visible spectrum lighting; and
- since there is extensive terrain higher than the Proposed Development in the vicinity, aircraft other than those operated by the military and emergency services are highly unlikely to be flying at low level at night in this area.

13.6.35 The study concluded, therefore, that there is scope for medium intensity steady red lights to be fitted to the 'corner' turbines of the Proposed Development only - Turbines 1, 3, 10, 12 and 14. In addition, Turbines 1, 2, 3, 4, 9, 10, 11, 12, 13 and 14, marking the perimeter of the wind farm, will be fitted with infra-red lights to meet the requirements of military and specialist civil aviation operators. The proposed lighting scheme has been submitted to the CAA for approval. **Note:** This lighting scheme was approved by the CAA on 17th February 2022. See Technical Appendix 13.3: CAA Approval Letter.

13.6.36 In addition to reducing the number of turbines fitted with visible lighting, the applicant is exploring the potential for using an aircraft proximity detection system which would switch on the five visible spectrum lights only when an aircraft approaches the Proposed Development at low altitude. The estimated frequency with which the lights would be switched on by such a system is assessed in Appendix 13.2.

13.6.37 Since the Proposed Development is located outside the 50km consultation zone specified in the Ministry of Defence (Eskdalemuir Seismic Recording Station) Technical Site Direction 2005, it will have no effects on that facility.

Cumulative Effects

13.6.38 The cumulative effects of the Proposed Development on NERL radars have been considered in relation to all operational, consented and in-planning wind farms within 10 km of the Proposed Development. NERL has indicated that a radar mitigation scheme is feasible for the Proposed Development, taking all other wind farm developments in the area into account. The cumulative effects on NERL assets will therefore be of minor/negligible significance and will not adversely affect the feasibility of the Radar Mitigation Scheme for the Proposed Development.

13.6.39 The cumulative effects of the Proposed Development on the minimum altitudes for IFR flight were also considered in relation to existing and consented wind farms within 10 km of the Proposed Development. None of these have blade tip heights that would impose limits on minimum IFR altitudes greater than those currently set out in the Glasgow Prestwick ATC Surveillance Minimum Altitude Chart (see paragraph 13.4.31). Consequently, the Proposed Development will have no cumulative effects on minimum IFR altitudes in the area.

13.6.40 The potential cumulative effects of the Proposed Development on military low flying relate primarily to the combined effects of the Proposed Development with those generated by the Shepherds Rig proposed wind farm, immediately to the east of the Proposed Development. The MOD has advised in the consultation responses to both projects that effects on military low flying are acceptably mitigated by the provision of lighting and the provision of turbine location and height data for inclusion on charts. The cumulative effects on military low flying are therefore assessed as of negligible magnitude affecting a receptor of medium sensitivity, resulting in a residual adverse effect of minor significance.

13.6.41 The effects of the Proposed Development on the Eskdalemuir seismic array are by their nature cumulative, since they are assessed in terms of the cumulative noise budget for all wind energy developments within a 50 km radius of the array. However, since the Proposed Development is located beyond that distance, it can have no cumulative effects on the Eskdalemuir seismic array.

Mitigation and Residual Effects

13.6.42 A Radar Mitigation Scheme will be agreed by the Applicant and NATS to address the effects of the Proposed Development on the Lowther Hill and Great Dun Fell radars. The residual effects on those radars will be of Moderate/Minor significance.

13.6.43 The Proposed Development will be notified to the MOD and civil airspace users and marked on aeronautical charts and electronic aviation obstacle databases to enable aircrew to avoid the turbines horizontally and/or vertically.

13.6.44 Infra-red lighting will be fitted to all turbines in the Proposed Development to enable aircrew using NVIS to see and avoid them at night. Medium intensity steady red lights will be fitted to 'corner' Turbines 1, 3, 10, 12 and 14 to assist non-NVIS-equipped aircraft to avoid the turbines at night. An aircraft proximity lighting system may be employed. This will switch the medium intensity lights on only when an aircraft passes at low level and is assessed in more detail in Technical Appendix 13.2: Transponder Activated Lighting Report. The residual effects on low flying aircraft will be of Moderate/Minor significance.

13.6.45 The Proposed Development will have no significant effects on the Eskdalemuir seismic array.

Document history

Author	S Cleary	19/01/2023

Client Details	
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Client Name	Vattenfall Wind Power Ltd

Issue	Date	Revision Details
A4	07/10/2021	Pre-design chill iteration
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Chapter 14

Socio-economics, Tourism and Recreation

Contents

Glossary

Term	Definition
Gross Value Added	A measure of the economic value added by an organisation or industry, typically estimated to be the revenue of a company less its expenditure on supplies
Years of Employment	A measure of employment which is equivalent to one person being employed for an entire year and is typically used when considering short-term employment impacts, such as those associated with construction activity.
Jobs	A measure of employment, which considers the headcount employment of industry or organisation.
Direct Economic Impact	The employment and GVA supported directly by the Applicant and identified suppliers
Indirect Economic Impact	The employment and GVA supported by the wider supply chain to the Applicant and the identified suppliers
Induced Economic Impact	The employment and GVA supported by the directly employed staff spending their wages elsewhere in the economy

List of Abbreviations

List and describe your abbreviations here.

Abbreviation	Description
AGER	Advisory Group on Economic Recovery
Capex	Capital Expenditure
EIA	Environmental Impact Assessment
GDP	Gross Domestic Product
GVA	Gross Value Added
GW	Giga Watt
MW	Mega Watt
NPF	(Scotland's) National Performance Framework
ONS	Office for National Statistics
Opex	Operational Expenditure
SABS	Scottish Annual Business Statistics
SIC	Standard Industrial Classification
SIMD	Scottish Index of Multiple Deprivation
TS2020	Tourism Scotland 2020

14.1 STATEMENT OF COMPETENCE

14.1.1 The socio-economic, tourism and recreation assessment was undertaken by BiGGAR Economics, an independent economic consultancy. Over the last 20 years, BiGGAR Economics has developed considerable experience in assessing the socio-economic and tourism impacts of similar developments, having worked on approximately 150 wind farm projects across the UK.

14.2 INTRODUCTION

14.2.1 This chapter includes the socio-economics, tourism and recreation assessment for the Proposed Development. The assessment of socio-economic benefits is based on the Proposed Development featuring 14 turbines for a total combined generating capacity of around 92.4MW.

14.2.2 This assessment did not identify any residual significant effects for on economic, tourism or recreational receptors.

14.2.3 The Proposed Development will generate economic benefits both during its development and construction and during its operation and maintenance. In particular, its development and construction are expected to generate:

- £56 million GVA and 810 years of employment in the UK; including
- £33 million GVA and 440 years of employment in Scotland as a whole; including
- £11 million GVA and 150 years of employment in the South West of Scotland; including
- £7 million Gross Value Added (GVA) and 90 years of employment in Dumfries and Galloway.

14.2.4 The expenditure for the operation and maintenance of the Proposed Development could deliver up to:

- £1.9 million GVA and 31 jobs in the UK; including
- £1.3 million GVA and 22 jobs across Scotland; including
- £0.6 million GVA and support 8 jobs in the South West of Scotland; including
- £0.5 million GVA and support 7 jobs in Dumfries and Galloway.

14.2.5 The Proposed Development will also support local government's revenue through the annual payment of £0.6 million in non-domestic rates.

14.2.6 The Applicant is also committing to supporting the long-term ambitions of local communities through local community benefits worth an estimated £16 million over up to 35 years. The Applicant is actively engaging with local community groups to ensure that this funding has the maximum socio-economic benefit to local communities and is identifying investment priorities through a Community Development Strategy.

14.2.7 The tourism and recreation assessment found that no significant adverse residual effect would be expected. The Applicant will develop an Access Management Plan to minimise disruption of access to the Cairnsmore of Carsphairn Corbett and improve access to the Site for recreational users, particularly those with less mobility.

14.3 LEGISLATION, POLICY AND GUIDANCE

14.3.1 There is no specific legislation, policy or guidance available on the methods that should be used to assess the socio-economic effects of a proposed onshore wind farm development for the purposes of an EIA. The proposed method has, however, been based on established best practice, including that which is used in UK Government and industry reports.

14.3.2 In particular, this assessment draws on studies by BiGGAR Economics on the UK onshore wind energy sector, including a report published by RenewableUK and the then Department for Energy and Climate Change (DECC) in 2012[1] on the direct and wider economic benefits of the onshore wind sector to the UK economy and a subsequent update to this report published by RenewableUK in 2015[2].

14.3.3 The evidence collected in those studies is frequently reviewed and updated by BiGGAR Economics, based on its most recent experience working with wind farm developers. Evaluations of costs and the extent to which contracts are carried out in Scotland and within local authority areas, as well as experience working with developers in the South West of Scotland have all contributed into this assessment.

14.3.4 Similarly, there is no formal guidance on the methods that should be used to assess the effects that wind farm developments may have on tourism assets.

14.3.5 For recreational assets, guidance has been provided by NatureScot on how to assess effects on recreational amenity[3] and the approach outlined has been used. This takes into consideration a number of potential effects, including direct effect on facilities, such as limitation or restrictions on access, and effects on the intrinsic quality of the resources enjoyed by people.

14.4 METHOD OF ASSESSMENT

Study Area

14.4.1 The socio-economic and tourism baseline considers the study areas of:

- Dumfries and Galloway;
- South West Scotland defined as the four local authority areas of:
  - Dumfries and Galloway;
  - South Ayrshire;
  - North Ayrshire;
  - East Ayrshire);
- Scotland; and
- the UK.

14.4.2 The quantifiable economic impacts reported in this document are inclusive, i.e. the reported impact for Scotland includes the impacts within Dumfries and Galloway.

14.4.3 The tourism and recreation assessment is based on assets which lie within 15 km of the Proposed Development.

Assessment Methodology

Socio-Economics

14.4.4 The assessment of economic effects was undertaken using a model that has been developed by BiGGAR Economics specifically to estimate the socio-economic effects of wind farm developments. This model, which was also the basis of an assessment of the UK onshore wind sector for the then Department of Energy and Climate Change, is frequently updated to reflect the most recent evidence available on the onshore wind sector in Scotland.

14.4.5 The units of measurement which are used to quantify the economic impacts of the Proposed Development are:

- GVA – this is a measure of the economic value added by an organisation or industry and is typically estimated by subtracting the non-staff operational costs from the revenues of an organisation;
- years of employment – this is a measure of employment which is equivalent to one person being employed for an entire year and is typically used when considering short-term employment impacts, such as those associated with construction; and
- jobs – this is a measure of employment, which considers the headcount employment of industry or organisation.

14.4.6 To begin estimating the economic activity supported by the Proposed Development, it is first necessary to calculate the expenditure during the development and construction, and operation and maintenance phases. The total expenditure figure is then divided into its main components using assumptions regarding the share that could be expected by main and sub-contractors in each study area.

14.4.7 There are three sources of economic activity:

- component contracts and the jobs they support;
- wider spending in the supply chain (indirect effect); and
- spending of the employed in these contracts (induced effect).

14.4.8 There are four key stages of this model:

- estimation of the total capital expenditure;
- estimation of the value of component contracts that make up total expenditure;
- assessment of the capacity of businesses in the study area to perform and complete component contracts; and
- estimation of economic impact from resultant figures.

Tourism and Recreation

14.4.9 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:

- Wind Farms and Tourism Trends in Scotland: Evidence from 44 Wind Farms[4];
- A Report on the Achievability of the Scottish Government's Renewable Energy Targets[5]; and
- The Economic Impacts of Wind Farms on Scottish Tourism[6].

[1] DECC, RenewableUK (2012). *Onshore Wind: Direct and Wider Economic Impacts*.

[2] RenewableUK (2015). *Onshore Wind: Economic Impacts in 2014*.

[3] Scottish Natural Heritage (2013). *A handbook on environmental impact assessment*.

[4] BiGGAR Economics (2021). *Wind Farms and Tourism Trends in Scotland: Evidence from 44 Wind Farms*.

[5] Scottish Parliament Economy, Energy and Tourism Committee (2012). *Report on the achievability of the Scottish Government's renewable energy targets.*

[6] Moffat Centre (2008). *The Economic Impacts of Wind Farms on Scottish Tourism*.

14.4.10 Tourist assets have been identified and the analysis focuses on whether the Proposed Development is likely to lead to change in behaviour, for example fewer tourists visiting the area.

14.4.11 Recreational assets, such as trails, have been identified, 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

14.4.12 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 14-1.

Table 14-1 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., Dumfries and Galloway). 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).
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).

14.4.13 The magnitude of the potential effect will be assessed based on criteria presented in Table 14-2.

Table 14-2 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

14.4.14 The sensitivity of the asset and the magnitude of the predicted effects will be used as a guide, in addition to professional judgement to predict the significance of the likely effects. Moderate and major effects are assessed as significant in EIA terms (and shown in bold). The significance criteria are outlined in Table 14-3.

Table 14-3 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

14.5 CONSULTATION

14.5.1 The assessment carried out in this chapter has taken into account the responses to the scoping report regarding socio-economics, tourism and recreation.

14.5.2 The responses to the scoping opinion and where they have been addressed in the report are set out in Table 14-4 below.

Table 14-4 Responses to the scoping report

Consultee	Issue	Response and how considered in the chapter
British Horse Society	Consideration of economic impact on equestrian access or local equestrian businesses	Impacts on tourism and recreation assets are considered in section 14.7
Mountaineering Scotland	Consideration of the effect of wind turbines on outdoor recreational interests	Impacts on recreational trails are considered in section 14.7
Tynron Community Council	Inclusion of a chapter on the impact on tourism. Consideration of displacement of existing employment in the tourism sector and long-term employment opportunities.	Impacts on tourism and recreation are considered in section 14.7. The assessment considers long-term employment opportunities associated with operations and maintenance contracts and impact on the tourism economy in 14.7. Community benefits will also support long-term investment in the community

14.6 BASELINE

Strategic Economic Context

Scotland's National Strategy for Economic Transformation

14.6.1 In March 2022, the Scottish Government released the National Strategy for Economic Transformation[7], which set out its ambition for Scotland's economy over the next 10 years. The Scottish Government's vision is to create a wellbeing economy where society thrives across economic, social and environment dimensions, which delivers prosperity for all Scotland's people and places. Of particular importance is the ambition to be greener, with a just transition to net zero, a nature-positive economy and a rebuilding of natural capital.

14.6.2 A key longer term key challenge identified in the strategy is to address deep-seated regional inequality, which includes in rural and island areas that face problems such as a falling labour supply, poorer access to infrastructure and housing. The transition to net zero presents a further challenge of delivering positive employment, revenue and community benefits.

14.6.3 To deliver its vision and address the economy's challenges, five programmes of action have been identified (with a sixth priority of creating a culture of delivery), including:

- establishing Scotland as a world-class entrepreneurial nation;
- strengthening Scotland's position in new markets and industries, generating new, well-paid jobs from a just transition to net zero;
- making Scotland's businesses, industries, regions, communities and public services more productive and innovative;
- ensuring that people have the skills they need to meet the demands of the economy, and that employers invest in their skilled employees;
- reorienting the economy towards wellbeing and fair work.

14.6.4 The strategy notes that Scotland has substantial energy potential, with a quarter of Europe's wind potential, and that it has developed a growing green industrial base. This provides a strong foundation for securing new market opportunities arising from the transition to net zero, for example in the hydrogen economy and in the decarbonisation of heating systems, where Scotland may be able to secure first-mover advantage and will need continuing investment and support. Renewable energy also has a role to play in supporting productive businesses and regions across Scotland.

National Performance Framework

14.6.5 Scotland's National Performance Framework[8] explicitly includes 'increased well-being' as part of its purpose and combines measurement of how well Scotland is doing in economic terms with a broader range of well-being measures. The NPF is designed to give a more rounded view of economic performance and progress towards achieving sustainable and inclusive economic growth and well-being across Scotland and aims to:

- create a more successful country;
- give opportunities to all people living in Scotland;
- increase the well-being of people living in Scotland;
- create sustainable and inclusive growth; and
- reduce inequalities and give equal importance to economic, environmental and social progress.

14.6.6 The NPF sets out 11 outcomes, underpinned by 81 indicators, that combine to give a better picture of how the country is progressing towards these goals. As well as GDP and employment measures, the NPF's outcomes reflect the desired fabric of communities and culture, education, the environment, health and well-being and measures to help tackle poverty. It is these indicators on which the Scottish Government focuses its activities and spending to help meet the national outcomes.

14.6.7 The Proposed Development would contribute to achieving several of the national outcomes through the development and operation of the windfarm as well as through community investment and development.

Climate Change (Emissions Reduction Targets) (Scotland) Act

14.6.8 In 2019, the Scottish Parliament passed the Climate Change (Emissions Reduction Targets) (Scotland) Act (Scottish Parliament, 2019). The Act sets a legally binding target of achieving "net-zero" carbon emissions by 2045, five years ahead of the date set for the UK. Amendments to the bill also raised the interim targets to 70% carbon emissions reductions by 2030 and 90% by 2040. Renewable energy is part of this strategy. By promoting and supporting the efficiency and growth of the renewable energy sector, the development of the Proposed Development, would contribute to the changes the Scottish Government seeks to bring about.

Local Energy Policy Statement

14.6.9 The Scottish Government's latest statement on Local Energy Policy[9] highlights the role of localised energy solutions as part of a green recovery to the Covid-19 pandemic and towards a net-zero and decarbonised economy. The strategy is interlinked with other strategic documents in a concerted effort to increase energy efficiency; reduce emissions and eradicate fuel poverty.

14.6.10 The statement identifies the wide range of stakeholders involved in local energy and sets out the following key principles:

- people: engaging with stakeholders from the outset and supporting the different ways each of these will want to be involved;
- places: local energy projects should reflect the features of the local area and work in collaboration with others;

[7] Scottish Government, (2022). Scotland's National Strategy for Economic Transformation.

[8] Scottish Government (2018). *Scotland's National Performance Framework*.

[9] Scottish Government (2021). *Local Energy Policy Statement*.

- network and infrastructure: consider the existing energy infrastructure in the area and secure high level and quality of supply to all;
- pathway to commercialisation: create projects that are commercially viable, can be replicated in the future and support net zero emissions; and
- opportunity: projects should create high value jobs and support the wider industry and its workforce.

South of Scotland Regional Economic Strategy

14.6.11 In September 2021, the South of Scotland Regional Economic Partnership published a Regional Economic Strategy[10], outlining the aims of the organisations for the South of Scotland, including:

- supporting fairer, more meaningful work;
- creating affordable, desirable and energy-efficient homes and widening choice;
- improving the health and welfare of those who are most disadvantaged within the region;
- building the capability and capacity of social enterprises and the Third Sector;
- investing in social infrastructure and education to enhance life prospects;
- putting the environment and sustainability at the forefront of the region's growing economy;
- protecting, enhancing and enjoying the region's abundant natural capital; cultural and heritage assets and vibrant arts and festivals backdrop; and
- building wealth which benefits the local economy, communities and people

14.6.12 The ten-year strategy outlines the vision for the South of Scotland to be a region which is 'green, fair, and flourishing'. As part of its aim to become a green economy leader, the partners will work to support piloted approaches to land use and natural capital; encourage a growing circular economy enabling local green jobs; and support enhanced, future-proofed energy networks and zero carbon technologies.

14.6.13 The strategy highlights the partners' priorities of growing and diversifying the economy, in part through building upon the region's sectoral strength in the generation of renewable energy. The strategy also sets the priority of utilising the economic opportunities presented by the transition to net zero, noting that the region is well placed to develop renewable heat and power to support Scotland's net-zero targets and create green jobs.

Ayrshire Growth Deal

14.6.14 The Ayrshire Growth Deal is part of a series of city region deals that have been agreed across Scotland and the rest of the UK to decentralise regional economic development. Signed in November 2020, the Deal is set to benefit East Ayrshire, North Ayrshire and South Ayrshire with £251 million, including £103 million from the UK Government, £103 million from the Scottish Government and the remainder from local partners.[11]

14.6.15 The deal is expected to unlock £300 million in private sector investment and could support up to 7,000 new jobs. Both energy and tourism feature across the themes of the projects selected for funding.

Socio-Economic Indicators

Population

14.6.16 In 2021, Dumfries and Galloway had a population of 148,790, accounting for 28.8% of the total population of South West Scotland (517,480) and 2.7% of Scotland's total population (5,479,900).[12] As shown in Table 14-5, the share of the population of Dumfries and Galloway aged 16-64 years old was 58.0%, slightly below the average across South West Scotland (59.7%) and lower than the share accounted for by this demographic in both Scotland (63.8%) and the UK as a whole (62.9%).[13] Both Dumfries and Galloway and South West Scotland have significantly older populations than Scotland and the UK. People aged 65 and over account for 26.6% of the population of Dumfries and Galloway and 28.8% of the total in South West Scotland compared to 19.6% and 18.7% in Scotland and the UK, respectively.

Table 14-5 Population structure, 2021

	Dumfries and Galloway	South West Scotland	Scotland	UK*
Total Population	148,790	517,480	5,479,900	67,026,290
0-15	15.4%	16.0%	16.6%	18.4%
16-64	58.0%	59.7%	63.8%	62.9%
65+	26.6%	28.8%	19.6%	18.7%

Source: National Records of Scotland (2022), Mid-2021 Population Estimates. ONS (2022), Population estimates.

Population Projections

14.6.17 The population of both Dumfries and Galloway and South West Scotland are projected to decrease between 2018 and 2043, by 8.4% and 7.9% respectively. Comparatively, Scotland's population is expected to increase by 2.5% over this period,[14] while the total UK population is projected to increase by 9.2%.[15] [16] [17]

14.6.18 The trends currently experienced in the population structure of the study areas are expected to continue or become more pronounced. As shown in Table 14-6, the share of the population accounted for by people aged 16-64 in Dumfries and Galloway is expected to fall from 58.8% to 53.0% between 2018 and 2043. In South West Scotland, the share accounted for by this demographic is also expected to fall, from 60.3% to 54.1%. This is equivalent to a decline in the working age population of 15,300 in Dumfries and Galloway and 54,300 across South West Scotland. It is projected that both areas will have a below average share of the population accounted for by people of working age when compared to Scotland (60.3%) and the UK (58.9%).

14.6.19 It is expected that the share of the population of Dumfries and Galloway aged 65 and over will increase from 25.5% to 33.7% between 2018 and 2043. South West Scotland is expected to experience a similar trend, with the share of this demographic increasing from 23.3% to 31.4%. Both areas are projected to have a significantly older than average population when compared to the 24.9% accounted for by people aged 65+ projected across Scotland and 24.0% projected for the UK as a whole.

[10] South of Scotland Regional Economic Partnership (2021), South of Scotland Regional Economic Strategy

[11] UK Government (2020). *Ayrshire Growth Deal - Deal Document*.

[12] National Records of Scotland (2022), Mid-2021 Population Estimates. [Online] Available from https://www.nrscotland.gov.uk/statistics-and-data [Accessed 19 January 2023].

[13] ONS (2022), Population estimates. [Online] Available from https://www.nomisweb.co.uk/ [Accessed 19 January 2023].

[14] National Records of Scotland (2020), Population Projections 2018 – 2043. [Online] Available from https://www.nrscotland.gov.uk/statistics-and-data [Accessed 19 January 2023].

[15] ONS (2020), 2018-based Population Projections. [Online] Available from https://www.nomisweb.co.uk/ [Accessed 19 January 2023].

[16] StatsWales (2021), Population Projections by year and age. [Online] Available from https://statswales.gov.wales/ [Accessed 19 January 2023].

[17] NISRA (2021), 2018-Based Population Projections: Principal Projection. [Online] Available from https://www.nisra.gov.uk/ [Accessed 19 January 2023].

14.6.20 The proportion of the population aged under 16 in Dumfries and Galloway and South West Scotland is projected to decrease to 13.2% and 14.4% of their respective populations, compared to 14.8% in Scotland and 17.0% in the UK.

Table 14-6 Population projections, 2018-2043

	Dumfries and Galloway		South West Scotland		Scotland		UK*	
	2018	2043	2018	2043	2018	2043	2018	2043
Total Population (thousands)	148.8	136.3	518.5	477.6	5,438.1	5,574.8	66.4	72.6
0-15	15.7%	13.2%	16.4%	14.4%	16.9%	14.8%	19.0%	17.0%
16-64	58.8%	53.0%	60.3%	54.1%	64.2%	60.3%	62.7%	58.9%
65+	25.5%	33.7%	23.3%	31.4%	18.9%	24.9%	18.3%	24.0%

*Source: National Records of Scotland (2020), Population Projections 2018 – 2043. *ONS (2020), 2018-based Population Projections., StatsWales (2021), Population Projections by year and age and NISRA (2021), 2018-Based Population Projections: Principal Projection.*

Economic Activity and Employment

14.6.21 As shown in Table 14-7, Dumfries and Galloway has a lower than average economic activity rate (at 74.1% compared to the Scottish average of 76.5%) and a higher than average unemployment rate, at 4.5% compared to 3.5%. Across South West Scotland this trend continues, with an economic activity rate of 73.9% and unemployment rate of 4.8%.[18]

14.6.22 As shown in Table 14-7, median annual gross wages in Dumfries and Galloway (£23,919) and South West Scotland (£25,988) are comparatively low compared to both Scotland as a whole (£27,698) and the UK (£27,901).[19]

Table 14-7 Labour market indicators

	Dumfries and Galloway	South West Scotland	Scotland	UK
Economic Activity Rate	74.1%	73.9%	76.5%	78.5%
Unemployment Rate	4.5%	4.8%	3.5%	4.2%
Median Annual Gross Income (£)	£23,919	£25,988	£27,698	£27,901

Source: ONS (2022), Annual Population Survey, April 2021-March 2022 and ONS (2022), Annual Survey of Hours and Earnings, 2022.

Industrial Structure

14.6.23 The nature of employment in Dumfries and Galloway and across South West Scotland are broadly similar, with both areas having the highest level of employment in wholesale and retail trade. The sector accounts for 16.2% of the workforce in Dumfries and Galloway and 17.1% of the workforce in South West Scotland, above average compared to Scotland (14.1%) and the UK (14.4%).

14.6.24 A significantly above average proportion of the workforce of Dumfries and Galloway and South West Scotland are employed in the agriculture, forestry and fishing industries, at 13.1% and 7.2%, respectively, while the sector accounts for 3.4% of employment across Scotland and 1.5% across the UK.

14.6.25 The local areas also have an above average share of employees working in the health sector, accounting for 16.2% of the workforce in Dumfries and Galloway and 16.1% across South West Scotland compared to the Scottish average of 15.3% and UK average of 13.3%. This nature of employment reflects the older population of the study areas in comparison to Scotland as a whole as older residents are likely to require greater healthcare.

14.6.26 Sectors such as construction and manufacturing are likely to benefit from the Proposed Development should local workers and suppliers be utilised in the construction phase. Construction accounts for a relatively average share of employment in Dumfries and Galloway (5.4%) and South West Scotland (6.0%) compared to the Scotland (6.0%) and the UK (5.0%) while manufacturing is overrepresented in the local area. Employment in manufacturing is equivalent to 9.2% of the workforce in Dumfries and Galloway and 10.1% in South West Scotland, above average compared to Scotland (6.8%) and the UK (7.4%).[20]

[18] ONS, (2022). *Annual Population Survey*. [Online] Available from https://www.nomisweb.co.uk/. [Accessed 19 January 2023].

[19] ONS, (2022). *Annual Survey of Hours and Earnings*. [Online] Available from https://www.nomisweb.co.uk/. [Accessed 19 January 2023].

[20] ONS, (2022). *Business Register and Employment Survey*. [Online] Available from https://www.nomisweb.co.uk/ [Accessed 19 January 2023].

Table 14-8 Industrial structure, 2021

	Dumfries and Galloway	South West Scotland	Scotland	UK
Wholesale and retail trade	16.2%	17.1%	14.1%	14.4%
Human health and social work activities	16.2%	16.1%	15.3%	13.3%
Agriculture, forestry and fishing	13.1%	7.2%	3.4%	1.5%
Manufacturing	9.2%	10.1%	6.8%	7.4%
Accommodation & food services	7.7%	8.7%	7.5%	7.5%
Education	7.7%	7.9%	8.3%	8.5%
Construction	5.4%	6.0%	6.0%	5.0%
Transportation and storage	4.2%	4.3%	4.1%	5.1%
Public administration & defence	3.9%	3.8%	6.4%	8.9%
Professional, scientific & technical	3.9%	4.7%	6.3%	4.5%
Administrative and support service activities	3.7%	4.5%	7.7%	8.7%
Real estate activities	2.3%	1.9%	1.5%	1.9%
Arts, entertainment and recreation	2.3%	2.6%	2.4%	2.3%
Other service activities	1.5%	2.0%	1.8%	2.0%
Water supply; sewerage, waste management and remediation activities	0.9%	1.0%	0.8%	0.7%
Information and communication	0.8%	0.8%	3.0%	4.3%
Financial and insurance activities	0.5%	0.8%	3.0%	3.5%
Electricity, gas, steam and air conditioning supply	0.4%	0.5%	0.7%	0.4%
Mining and quarrying	0.1%	0.2%	0.9%	0.1%
Total Employment	**64,750**	**199,100**	**2,617,000**	**31,359,000**

Source: ONS (2022), Business Register and Employment Survey, 2021

Qualifications

14.6.27 As shown in Table 14-9, the share of people in Dumfries and Galloway aged 16-64 who hold NVQ4+ qualifications, equivalent to a higher education certificate, is 42.9%. This is average in the context of South West Scotland as a whole (42.9%), as well as the UK average of 43.6%, but significantly lower than the Scottish average of 50.0%. Similarly, the share of people with NVQ3+ qualifications is lower in Dumfries and Galloway (61.5%) and South West Scotland (58.7%) compared to Scotland (64.8%), though both areas are relatively average compared to the UK (61.5%). A similar proportion of those aged 16-64 hold NVQ2+ qualifications, with 79.5% in Dumfries and Galloway and 79.6% in Scotland as a whole.

14.6.28 The share of people with no qualifications in Dumfries and Galloway (8.9%) is relatively average compared to South West Scotland (8.0%), but higher than across Scotland as a whole (7.8%) and the UK (6.6%).[21]

[21] *ONS (2022), Annual Population Survey Jan 2021- Dec 2021.* [Online] Available from https://www.gov.scot/collections/scottish-index-of-multiple-deprivation-2020/. [Accessed: 19 January 2023].

Table 14-9 Qualifications, 2021

	Dumfries and Galloway	South West Scotland	Scotland	UK
NVQ4+	42.9%	42.8%	50.0%	43.6%
NVQ3+	61.5%	58.7%	64.8%	61.5%
NVQ2+	79.5%	77.3%	79.6%	78.1%
NVQ1+	85.7%	84.9%	86.4%	87.5%
Other Qualifications	5.4%	7.0%	5.8%	5.9%
No Qualifications	8.9%	8.0%	7.8%	6.6%

Source: ONS (2022), Annual Population Survey Jan 2021-Dec 2021

Deprivation

14.6.29 The Scottish Index of Multiple Deprivation (SIMD)[22] is a relative measure of deprivation which ranks each data zone in Scotland in terms of deprivation across the domains of income, employment, education, health, access to services, crime and housing. These areas can be ranked by quintiles (one fifth shares), with a small area in the first quintile being in the 20% most deprived areas in Scotland.

14.6.30 There are 201 data zones in Dumfries and Galloway, of which 9% are ranked in the most deprived quintile. Conversely, 8% of are ranked in the country's 20% most deprived. As shown in Table 14-10, the majority of households in Dumfries and Galloway are ranked in the 2nd, 3rd and 4th quintiles, accounting for 82% of small areas in the region. This suggests that the region, as a whole, is neither overly deprived nor overly affluent in regard to the domains considered in the analysis yet there are slightly more (5%) areas falling in the 40% most deprived than the 40% least deprived.

14.6.31 South West Scotland as a whole is ranked higher in terms of deprivation than Dumfries and Galloway individually with 24% of the 703 data zones ranked in the 20% most deprived and 47% within the 40% most deprived across the country. At the same time, a higher share of data zones compared to Dumfries and Galloway (8%) are in the least deprived 20% (12%).

Table 14-10 Scottish Index of Multiple Deprivation by quintile, 2020

	Dumfries and Galloway	South West Scotland
1 (most deprived quintile)	9%	24%
2	24%	23%
3	38%	23%
4	20%	17%
5 (least deprived quintile)	8%	12%

Source: Scottish Government (2020), Scottish Index of Multiple Deprivation, 2020.

Fuel Poverty

14.6.32 Fuel poverty represents household deprivation in terms of the proportion of income a household spends on fuel, when this is more than 10% a household is said to be in fuel poverty. In Dumfries and Galloway, 20,000 households are classified as being in fuel poverty, accounting for 29% of all households in the region, higher than the 24% it accounts for across Scotland. A further 15% of households in the region are classified as being in extreme fuel

[22] Scottish Government, (2020). *Scottish Index of Multiple Deprivation 2020.* [Online] Available from https://www.gov.scot/collections/scottish-index-of-multiple-deprivation-2020/. [Accessed: 25 August 2021].

poverty (requiring more than 20% of income), again higher than the national figure of 12%. Across South West Scotland, 26% of households are deemed to be in fuel poverty and 12% in extreme fuel poverty.[23]

Strategic Tourism Context

Scotland's Outlook 2030

14.6.33 Following on from the Tourism Scotland 2020 (TS2020) strategy (Scottish Tourism Alliance, 2012)[24], a collaborative network of industry experts created Scotland's Outlook 2030 (Scottish Tourism Alliance, 2020),[25] which is focused on creating a world-leading tourism sector in Scotland that is sustainable in the long-term.

14.6.34 The strategy is focused on four key priorities:

- people;
- places;
- businesses; and
- experiences.

14.6.35 The strategy recognises the effects of climate change, technological advancements, Brexit and changing consumer behaviour on tourism and highlights the need for collaboration between government, communities and the public and private sectors.

14.6.36 There are six conditions that the strategy has highlighted as being crucial for success:

- ensuring policies are in place that support the vision;
- enabling investment opportunities into Scotland's tourism market;
- improving transport and digital infrastructure;
- greater collaboration between businesses in the industry; and
- positioning Scotland as a great place to live and visit locally and globally.

14.6.37 A main commitment of the strategy is to address the effects of energy demand associated with tourism and make the sector commit fully to Scotland's ambition of becoming a net-zero society by 2045.

Tourism and Recreation

Sustainable Tourism

14.6.38 In its 2015 economic strategy, the Scottish Government identified six sectors as growth sectors; that is, economic sectors where Scotland had a comparative advantage. Sustainable tourism was one of the sectors identified.

14.6.39 In 2019, sustainable tourism in Dumfries and Galloway generated £77.1 million GVA. Across South West Scotland, the sector generated £332.2 million GVA, equivalent to 8.1% of the total £4,497.3 million GVA generated by sustainable tourism across Scotland.

14.6.40 As shown in Table 14-11, in 2019 the sector employed 6,000 people in Dumfries and Galloway and 20,000 in South West Scotland. Employment across South West Scotland accounted for 8.7% of the total 229,000 jobs generated by the sector across Scotland.

Table 14-11 Sustainable tourism GVA and employment

	Dumfries and Galloway	South West Scotland	Scotland
GVA (£ million)	77.1	332.2	4,497.3
Employment	6,000	20,000	229,000

Source: Scottish Government (2022), Growth Sector Statistics, 2019

Visitor Numbers and Spending

14.6.41 A range of statistics are available on tourism visitor numbers and visitor spend in Scotland, including the Great Britain Day Visitor Survey, the Great Britain Tourism Survey and the International Passenger Survey which are averages over a 3-year period (2017-2019).

14.6.42 In 2019, there were 5.3 million annual day visitors to Dumfries and Galloway, spending £243.5 million in total, an average of £46 per trip. Across South West Scotland, there were 16.0 million day visitors, spending a total £17.5 million for an average £39 per trip. South West Scotland as a whole accounted for 39% of day visits to Scotland, where there were 144.9 million visitors, spending a total of £5.2 billion, an average of £36 per trip. Visitors to Scotland accounted for 8% of all day visitors to the UK (1,795.1 million), which received a total £58.6 billion in day visitor spending.

14.6.43 In the same year, there were 0.6million annual domestic overnight visitors to Dumfries and Galloway, with a total spend of £130.7 million. Domestic overnight visitors spent more on average compared to day visitors, with an average spend per trip of £187. This was also the case for South West Scotland, where the 1.4 million domestic overnight visitors spent £270.3 million, equivalent to £198 per trip. Across Scotland, the total 12.4 million domestic overnight visitors spent £3.0 billion, £241 per trip. There were 121.3 million domestic overnight visitors across the UK, who spent a total £24.1 billion, £199 per trip.

14.6.44 In 2019, there were 35.6 thousand international overnight visitors to Dumfries and Galloway, contributing £17.0 million in spending. While total visitors and spending are significantly lower amongst international overnight visitors, spend per trip is significantly higher, with visitors to Dumfries and Galloway spending £476 per trip on average. Similarly, South West Scotland received 116.9 thousand international overnight visitors who spent £66.6 million, equivalent to 569 per trip. There were 3.5 million international overnight visitors to Scotland, with a total spend of £2.5 million, £694 per trip. The UK received 40.7 million international overnight visitors, whose total spend amounted to £27.6 million, £678 per trip.

[23] Scottish Government, (2021). *Scottish house condition survey: 2019 key findings.* [Online] Available from https://www.gov.scot/publications/scottish-house-condition-survey-2019-key-findings/. [Accessed 25 August 2021]

[24] Scottish Tourism Alliance (2012). *Tourism Scotland 2020*.

[25] Scottish Tourism Alliance (2020). *Scotland's Outlook 2030*.

Table 14-12 Visits and spend of tourists

	Dumfries and Galloway	South West Scotland	Scotland	UK
Visitor Numbers				
Day Visits	5,332,000	16,024,000	144,914,000	1,795,092,000
Domestic Overnight Visits	699,000	1,362,000	12,426,000	121,370,000
International Overnight Visits	35,600	116,900	3,540,400	40,740,288
Total	**6,066,600**	**17,502,900**	**160,880,400**	**1,957,202,300**
Spend (£)				
Day Visits	£243,485,000	£632,943,000	£5,186,557,000	£58,623,224,000
Domestic Overnight Visits	£130,667,000	£270,333,000	£2,989,333,000	£24,098,667,000
International Overnight Visitors	£16,977,900	£66,573,900	£2,458,607,844	£27,637,180,500
Total	**£391,129,900**	**£969,849,900**	**£10,634,497,800**	**£110,359,071,500**

*Source: Kantar (2020), Great Britain Tourism Survey, 2019. Kantar (2020), Great Britain Day Visitor Survey. ONS (2020), International Passenger Survey, 2019. *Average for 2017 -2019.*

Regional Attractions

14.6.45 Data on visits to regional attractions are published each year by Glasgow Caledonian University, in partnership with the Moffat Centre Visitor Attraction Monitor. Out of the top five free and paid attractions in 2019, the most visited in Dumfries and Galloway was the Gretna Green Famous Blacksmiths Shop which attracted 772,448 visitors[26].

14.6.46 The closest attraction to the Site is Galloway Forest Park. It attracts approximately 800,000 visitors a year[27] and covers around 721 square kilometres across South West Scotland. A portion of the forest is located near Carsphairn, around 3-4 km to south-west of the Proposed Development. However, none of the Park's visitor centres are located within 15 km.

14.6.47 Other popular attractions across Dumfries and Galloway and Ayrshire include a series of forestry parks, gardens and historic sites. None of these attractions are located within 15 km of the Site.

Local Attractions

14.6.48 The nearby village of Carsphairn has a small number of local attractions, including a Heritage Centre and community garden.

14.6.49 There is also a company called Forrest Estate Experiences, which offers a number of sporting activities such as shooting and fishing across its 11,000 acres estate. It is located to the south-west and the distance from the Proposed Development is around 5 km at its closest point and around 11 km at its furthest.

14.6.50 The Galloway Tourist Route is 92 miles in length, stretching from Gretna to Ayr, and passes through St Johns Town of Dalry and Carsphairn, within 15 km of the Site.

Accommodation

14.6.51 A web search of Visit Scotland[28], booking.com and further Google map search identified a total of 30 accommodation providers within 15 km of the Site. As shown in Table 14-13, the vast majority of providers are self-catered accommodation and also include six B&B's, five hotels and two caravan/camp sites.

14.6.52 The identified accommodation in each area includes:

- The Knowe Bed & Breakfast, Cumnock Knowes Country Retreat and a self-catered accommodation provider in Carsphairn, around 1-3 km south of the Proposed Development;
- 2 accommodation providers off the B729, approximately 2-4 km south-east of the Proposed Development. Hawkrigg Camping and Caravan site is located approximately 4 km south of the Proposed Development
- 2 accommodation providers near St Johns Town of Dalry on the B7000, approximately 6-8 km from the Proposed Development.
- 6 accommodation providers are located in and around St Johns Town of Dalry, including the Clachan Inn and OYO Lochinvar Hotel which are approximately 11 km south the Proposed Development;
- The Eglinton Hotel and Dalmellington House in Dalmellington, approximately 13-14 km from the Proposed Development;
- 6 accommodation providers in and around Auchenbrack, with the closest approximately 14-17 km east of the Proposed Development;
- The Kenbridge Hotel and Cross Keys Hotel in New Galloway, approximately 14-15 km from the Proposed Development;
- 4 accommodation providers around Balmaclellan including Barscobe Castle B&B, approximately 13-17 km from the Proposed Development;
- Afton Water B&B and Glen Afton Caravan Park near New Cumnock, approximately 14-15 km north of the Proposed Development; and
- a self-catered cottage approximately 4 km east of the Proposed Development, and a bothy around 10 km to the north-east.

[26] VisitScotland Insight Department, (2020). *Dumfries and Galloway Factsheet, 2019*. [Online] Available from https://www.visitscotland.org/binaries/content/assets/dot-org/pdf/research-papers-2/regional-factsheets/dumfries-and-galloway-factsheet-2019.pdf. [Accessed 25 August 2021].

[27] VisitScotland (2021), Galloway Forest Park. [Online] Available from https://www.visitscotland.com/info/towns-villages/galloway-forest-park-p249171 [Accessed 29th September]

[28] VisitScotland, (2022). *Accommodation.* [Online] Available from: https://www.visitscotland.com/accommodation/. [Accessed 19 January 2023].

Table 14-13 Accommodation providers within 15 km of the Proposed Development

	Hotels	Guest House/B&Bs	Self-Catered Cottages	Camping and Caravan Sites	Total
Carsphairn		2	1		**3**
B729			2		**2**
B7000			2	1	**3**
St Johns Town of Dalry	2	1	3		**6**
Dalmellington	2				**2**
Auchenbrack			6		**6**
New Galloway	2				**2**
Balmaclellan		1	3		**4**
New Cumnock		1		1	**2**
Other			2		**2**
Total	**5**	**7**	**17**	**2**	**30**

Source: Visit Scotland (2022)

Recreational Paths and Trails

14.6.53 As identified through a web search of walkhighlands.com[29], there are six recreational paths located within 15 km of the site.

14.6.54 The largest of these trails is Part 4 of the Southern Upland Way (St John's Town Dalry to Sanquhar), a 344 km long-distance walking trail recognised as one of Scotland's Great Trails, which connects Portpatrick on the coast of Dumfries and Galloway and Cockburnspath on the Scottish Borders coast. This is also recognised as a core path (504) under Dumfries and Galloway's core path list[30]. At its closest point it is around 3-4 km from the Proposed Development.

14.6.55 An estimated 64,000 people a year use the Southern Upland Way's western section, with around 1,000 people a year traversing its whole length. The estimated economic value to end users is around £0.5 million[31].

14.6.56 The Cairnsmore of Carsphairn trail passes within the Site and is a recognised core path. It is an 11.7 km circular trail beginning at the Green Well, which summits the Cairnsmore of Carsphairn Corbett.

14.6.57 Other recreational trails in the surrounding areas include:

- Striding Arches, a 9.5 km trail located approximately 8 km to the north-east of the Proposed Development, near Moniaive;
- Dundeugh Forest/Hill, near Dalry, a 7 km circular forest walk starting approximately 2 km to the south of the Proposed Development. This is also recognised as a core path under Dumfries and Galloway's core path list;
- Craiglea Trail and Loch Doon Castle, a short trail approximately 8 km to the west of the Proposed Development; and
- Ness Glen, near Loch Doon, a 3 km walk located approximately 11 km to the north-west of the Proposed Development.

14.6.58 Core path 182 passes into the Site. There are an additional 12 core paths located within 15 km of the Proposed Development.

14.7 ASSESSEMENT OF POTENTIAL EFFECTS

14.7.1 The effects of the Proposed Development on the economies of Dumfries and Galloway, the South West of Scotland and Scotland have been assessed as non-significant. While no mitigation has been identified with regards to socio-economics, this section outlines enhancement measures that, if implemented, could maximise local economic benefits.

14.7.2 A literature review on the relationship between the tourism economy and onshore wind development was carried out, alongside a more granular analysis of the impact the Proposed Development may have on tourism and recreation assets within 15 km from it. The assessment found no significant residual effects with respects to tourism and recreation assets.

14.7.3 The assessment of economic benefits is based on BiGGAR Economics' experience with developers in the South West of Scotland. BiGGAR Economics is currently undertaking a supply chain analysis of the Applicant's South Kyle Wind Farm, an onshore wind development in East Ayrshire and Dumfries and Galloway. The economic impacts from the construction and development of the Proposed Development have been updated to reflect the findings from the supply chain analysis.

Construction and Development

14.7.4 The approach followed in estimating the economic benefits from the construction and development of the Proposed Development is based on sectoral best practice. In particular, it draws on BiGGAR Economics' experience working with onshore wind developers in the South West of Scotland and across Scotland.

14.7.5 Total construction and development costs depend on a mixture of the onshore wind farm's capacity and the number of turbines. The candidate turbines have not been selected at the time of writing, therefore for the purposes of this analysis it has been assumed that the Proposed Development will consist of up to 14 6.6 MW turbines and a combined installed capacity of 92.4 MW. Based on estimates provided by the Applicant for similar projects, it was estimated that the total capital expenditure (Capex) on the project will be around £90 million.

14.7.6 Construction and development expenditure will occur over a range of contracts, including:

- development and planning;
- turbines;
- balance of plant; and
- grid connection.

14.7.7 The relative weight of each of these contracts depends on a development's number of turbines and its generating capacity. On this basis, it was estimated that turbines would constitute the largest set of construction and development contracts, accounting for £49.9 million of Capex or 55% of total construction and development spending. Balance of plant contracts are expected to account for a further £21.0 million (24% of Capex). The remainder of development and construction expenditure will take place in development and planning and grid connection, which will account respectively for £10.8 million and £8.1 million of Capex.

[29] Walkhighlands, (2021). Walks. [Online] Available from https://www.walkhighlands.co.uk/. [Accessed 25 August 2021].

[30] Dumfries and Galloway Council, (2021). *Core Paths List.* [Online]. Available from https://info.dumgal.gov.uk/mapviewers/pathsmap.aspx. [Accessed 25 August 2021].

[31] Southern Upland Way (2019). *Western Section Route Development Plan Summary 2019-2024*.

Table 14-14 Development and construction expenditure by contract type

	% Capex	Value (£m)
Development and Planning	12%	10.8
Turbines	55%	49.9
Balance of Plant	24%	21.0
Grid Connection	9%	8.1
Total	**100%**	**90.0**

Source: BiGGAR Economics Analysis

14.7.8 To assess economic impacts, it was necessary to establish the extent to which contractors in each of the study areas would be able to fulfil contracts across these four areas of spending. Based on the evidence from similar developments in the South West of Scotland, it was estimated that the largest spending in Dumfries and Galloway would take place in balance of plant contracts, worth around £6.0 million. Similarly, balance of plant contracts are expected to be the main opportunity for businesses in the South West of Scotland and Scotland as a whole, with the value of these opportunities respectively at £7.7 million and £19.5 million. Opportunities in the UK are expected to be worth £46.4 million.

Table 14-15 Development and construction expenditure by study area

	Dumfries and Galloway		South West of Scotland		Scotland		UK	
	%	£m	%	£m	%	£m	%	£m
Development and Planning	13%	1.4	16%	1.7	54%	5.8	99%	10.7
Turbines	1%	0.3	6%	3.1	9%	4.3	14%	7.1
Balance of Plant	28%	6.0	36%	7.7	92%	19.5	97%	20.5
Grid Connection	35%	2.8	39%	3.2	100%	8.1	100%	8.1
Total	**12%**	**10.6**	**17%**	**15.6**	**42%**	**37.7**	**52%**	**46.4**

14.7.9 The next step was to estimate the direct GVA that could be supported by spending on these contracts. This was done by first dividing each into their component contracts and by allocating spending across the industrial sectors where it will take place, based on their Standard Industrial Classification (SIC) code[32]. It was then possible to divide the spending in each economic sector within each study area by the corresponding turnover per GVA ratio, as sourced from the Scottish Annual Business Statistics (SABS)[33].

14.7.10 In this way, it was estimated that during its construction and development the Proposed Development could generate £4.8 million direct GVA in Dumfries and Galloway, £7.4 million direct GVA in the South West of Scotland, £18.6 million direct GVA across Scotland and £23.4 million GVA in the UK.

Table 14-16 Development and construction, direct GVA by study area (£m)

Contract Type	Dumfries and Galloway	South West of Scotland	Scotland	UK
Development and Planning	0.8	1.0	3.9	7.1
Turbines	0.2	1.4	2.0	3.2
Balance of Plant	2.7	3.7	9.5	9.8
Grid Connection	1.1	1.2	3.2	3.2
Total	**4.8**	**7.4**	**18.6**	**23.4**

14.7.11 Following a similar approach, appropriate sectoral turnover per job ratios were applied to the spending occurring across each study area to estimate the direct employment supported by the Proposed Development. In this way it was estimated that the Proposed Development could support a total of 69 direct years of employment in Dumfries and Galloway, 107 direct years of employment in the South West of Scotland, 267 direct years of employment across Scotland and 332 years of employment in the UK.

Table 14-17 Development and construction, direct employment (years of employment)

Contract Type	Dumfries and Galloway	South West of Scotland	Scotland	UK
Development and Planning	12	14	54	99
Turbines	2	22	32	52
Balance of Plant	39	53	134	139
Grid Connection	16	18	46	46
Total	**69**	**107**	**267**	**336**

14.7.12 The majority of this employment would be in the construction sector and related services. The construction sector employs around 3,500 people in Dumfries and Galloway therefore the employment supported by the Proposed Development would be equivalent to 2% of the total construction employment in the area and is therefore may be a noticeable change within the sector.

14.7.13 Alongside the direct impact on economic activity from construction and development spending, expenditure across the supply chain (indirect impacts) and by those working on construction and development contracts (induced impacts) will generate economic benefits.

14.7.14 Indirect impacts were estimated by applying Scottish Type 1 employment and GVA multipliers, as sourced from the Scottish Input-Output Tables[34]. Since these multipliers refer to sectoral interactions at the level of the Scottish economy, it was necessary to consider a share of those when estimating impacts at the level of the Dumfries and Galloway and South West of Scotland economies. In particular, for the purposes of this assessment, it was assumed that indirect impacts for Dumfries and Galloway and the South West of Scotland are respectively 33% and 40% of those for Scotland.

14.7.15 In this way, it was estimated that the construction and development of the Proposed Development could result in indirect impacts of £0.8 million GVA and 11 years of employment in Dumfries and Galloway, £1.4 million GVA and 20 years of employment in the South West of Scotland, £8.2 million GVA and 114 years of employment across Scotland and £15.4 million GVA and 228 years of employment in the UK.

[32] Office for National Statistics (2009), *UK Standard Industrial Classification of Economic Activities 2007 (SIC 2007).*

[33] Scottish Government (2020), *Scottish Annual Business Statistics 2018*.

[34] Scottish Government (2020), *Supply, Use and Input-Output Tables*.

Table 14-18 Development and construction, indirect impact

	Dumfries and Galloway	South West of Scotland	Scotland	UK
Indirect Impact (£m)	0.8	1.4	8.2	15.4
Indirect Impact (years of employment)	11	20	114	228

14.7.16 In a similar way, it was possible to estimate the economic impacts associated with the spending by those working on the construction and development of the Proposed Development. These were estimated by applying the relevant sectoral Scottish Type 2 GVA and employment multipliers to the direct GVA and employment supported. Based on internal analysis of the geographical spread of household spending patterns, it was estimated that induced multipliers in Dumfries and Galloway and in the South West of Scotland could account respectively for 70% and 75% of Scottish multipliers.

14.7.17 In this way, it was estimated that the spending by those working at the Proposed Development could generate £1.2 million GVA and support 11 years of employment in Dumfries and Galloway, £1.9 million GVA and 20 years of employment across the South West of Scotland, £6.1 million GVA and 63 years of employment across Scotland and £17.5 million GVA and 257 years of employment in the UK.

Table 14-19 Development and construction, induced impact

	Dumfries and Galloway	South West of Scotland	Scotland	UK
Induced Impact (£m)	1.2	1.9	6.1	17.5
Induced Impact (years of employment)	11	20	63	257

14.7.18 Adding direct, indirect and induced impacts, it was estimated that the construction and development of the Proposed Development could support £6.8 million GVA and 92 years of employment in Dumfries and Galloway, £10.7 million GVA and 147 years of employment in the South West of Scotland, £32.9 million GVA and 445 years of employment across Scotland and £56.3 million GVA and 802 years of employment in the UK.

Table 14-20 Economic impact during development and construction

	Dumfries and Galloway	South West of Scotland	Scotland	UK
Economic Impact (£m)	6.8	10.7	32.9	56.3
Economic Impact (years of employment)	92	147	445	820

14.7.19 The temporary employment supported by the construction and development of the Proposed Development may be a noticeable change in the Dumfries and Galloway economy, but not in any of the other study areas. Therefore the magnitude of this impact was assessed as **low** in Dumfries and Galloway and **negligible** everywhere else**.**

14.7.20 On this basis, the effect of spending on construction and development contracts was assessed as **minor (beneficial)** for Dumfries and Galloway and **negligible** (beneficial) for the other areas.

Operations and Maintenance

14.7.21 The Proposed Development will generate economic benefits throughout its operations. In order to estimate the economic impact associated with this spending, it was first necessary to consider how much would be spent each year on operations and maintenance contracts and where would this spending take place.

14.7.22 Based on the generating capacity of the Proposed Development, it was estimated that each year £2.3 million could be spent on operations and maintenance (Opex) contracts. Dumfries and Galloway is expected to receive 32% of this spending, with businesses across Scotland benefitting from 81% of total Opex spending and business across the UK securing 91% of contracts.

Table 14-21 Annual operations and maintenance by study area

	Dumfries and Galloway		South West of Scotland		Scotland		UK	
	%	£m	%	£m	%	£m	%	£m
Operations and Maintenance	32%	0.7	36%	0.8	81%	1.9	91%	2.1

14.7.23 In a similar way as it was done with spending on construction and development contracts, operational spending was allocated to those sectors where it will likely take place. Expenditure was then divided by the appropriate turnover per job and turnover per GVA ratios, to estimate the direct employment and direct GVA supported. In this way, it was estimated that operations and maintenance spending could generate £0.4 million direct GVA and support six direct jobs in Dumfries and Galloway, £0.5 million direct GVA and six direct jobs in the South West of Scotland, £0.8 million direct GVA and 13 direct jobs across Scotland and £0.9 and 15 jobs in the UK.

Table 14-22 Annual operations and maintenance, direct impact

	Dumfries and Galloway	South West of Scotland	Scotland	UK
Direct Economic Impact (£m)	0.4	0.5	0.8	0.9
Direct Economic Impact (jobs)	6	6	13	15

14.7.24 Indirect and induced impacts were estimated in a similar way as for the construction and development phase by applying sectoral GVA and employment Type 1 and Type 2 multipliers.

14.7.25 By adding together direct, indirect and induced impacts, it was estimated that throughout its operations the Proposed Development could generate each year £0.5 million GVA and support seven jobs in Dumfries and Galloway, £0.6 million GVA and eight jobs in the South West of Scotland, £1.3 million GVA and 22 jobs across Scotland and £2.0 million GVA and 31 jobs in the UK.

Table 14-23 Annual economic impact during operations and maintenance

	Dumfries and Galloway	South West of Scotland	Scotland	UK
Economic Impact (£m)	0.5	0.6	1.3	2.0
Economic Impact (jobs)	7	8	22	31

14.7.26 The magnitude of these impacts was assessed as **low** with respect to the economies of Dumfries and Galloway, the South West of Scotland and Scotland as a whole.

14.7.27 In this way, the effect of expenditure on operations and maintenance contracts was assessed as **negligible** (beneficial) with respects to the Dumfries and Galloway economy, **negligible** (beneficial) with reference to the economy of the South West of Scotland and **negligible** (beneficial) with reference to the Scottish economy.

Community Benefits

14.7.28 In its publication outlining good practice principles for community benefits arising from onshore wind developments (source - Scottish Government (2019), Scottish Government Good Practice Principles for Community Benefits from Onshore Renewable Energy Developments) the Scottish Government discusses the approach that developers should take when developing community benefit proposals with the local community. The ultimate aim of a community benefits package should be to achieve a lasting legacy for communities

14.7.29 The Applicant is also committing in supporting the long-term ambitions of local communities through local community benefits worth an estimated £15 million over up to 35 years. The effect that a community benefit fund could have on the economies of Dumfries and Galloway, South West Scotland and Scotland as a whole will depend on the projects that this funding supports and the ability of the funding to leverage in wider support.

14.7.30 The Applicant is actively engaging with local community groups to ensure that this funding has the maximum socio-economic benefit to local communities and is identifying investment priorities through a Community Development Strategy. This process is ongoing.

Non-Domestic Rates

14.7.31 The Proposed Development, once operational, is also expected to make a contribution towards non-domestic rates. These annual payments will support public finances and contribute to the provision of local public services.

14.7.32 Existing guidance on which assessments of a property's rateable value are carried out is based on onshore wind developments receiving subsidies and will not be updated until 2023. In addition, at the moment there is no evidence on actual non-domestic rates paid by operational onshore wind farm developments that are not supported by subsidies.

14.7.33 Based on conversations with onshore wind developers, a conservative rate of £7,000 of non-domestic rates per MW was assumed. This is an estimate based on information available at present and it is acknowledged that the rates paid will depend by a range of factors, including the Proposed Development's load factor.

14.7.34 On this basis, it was estimated that during each year of operation the Proposed Development could contribute around £0.6 million towards non-domestic rates and, in this way, support the revenue of Dumfries and Galloway Council. The effect of non-domestic rates payments was assessed as **negligible** (beneficial).

Tourism and Recreation

Literature Review

14.7.35 The most comprehensive study of the potential effects of wind farms on tourism was undertaken by the Moffat Centre at Glasgow Caledonian University in 2008[35]. The study was based on effects that could happen and found that, although there may be minor effects on tourism providers and a small number of visitors may not visit Scotland in the future, the overall effect on tourism expenditure and employment would be very limited.

14.7.36 Since this study, wind farms have become a more common feature in Scotland and any negative effects on the tourism economy as a result of their existence would now be apparent.

14.7.37 In 2021, BiGGAR Economics produced a report analysing the relationship between the construction of onshore wind farms and tourism employment at the national, regional and local level. [36]

14.7.38 Nationally, the report found that, while Scotland had experienced a significant increase in onshore wind energy (with the number of turbines increasing from 1,082 in 2009 to 3,772 in 2019) whilst employment in tourism-related sectors had increased by 20%. At the local authority level, those which had seen the largest increase on onshore wind energy also experienced increases in tourism employment equal to, or greater than other areas across Scotland.

14.7.39 The report included case studies of 44 onshore wind farms constructed between 2009 and 2019. This included an updated analysis of 28 wind farms included in a previous report[37] constructed prior to 2015, and 16 additional wind farms constructed between 2015 and 2019. The study reported on changes in tourism-related employment in the small areas within 15km of each wind farm. Of the 28 wind farms previously analysed, the surrounding local areas of 18 experienced an increase in tourism employment above the Scottish average in the years following the construction. Of the 16 local areas surrounding the additional 16 onshore wind farms, 11 experienced increases in tourism employment which outperformed the Scottish average. These results suggested that tourism employment in local areas across Scotland changed independently of wind farms located in the area.

14.7.40 The report concluded that, there was no pattern or evidence suggesting that the development of onshore wind farms in Scotland had any negative effects on the tourism economies of the country as a whole, local authority areas or the immediate areas surrounding wind farms.

14.7.41 The findings of this research are in accordance with those of the Scottish Parliaments Economy, Energy and Tourism Committee in 2012[38], when they concluded that there is no robust, empirical evidence of a negative link between wind farm development and tourism.

14.7.42 Overall, there is no research evidence that shows an adverse effect on Scotland's tourism economy as a result of wind farm developments.

Local Attractions

14.7.43 The main visitor attraction within 15 km of the Proposed Development is the Galloway Forest Park. 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 facilities within 15 km, 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**.

14.7.44 The village of Carsphairn has a small heritage centre and a community garden. These are not understood to have substantial numbers of visitors and therefore are 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**.

14.7.45 The Forrest Estate, which offers various country sporting activities, is considered to be regionally important, attracting people to the area and has therefore been assessed as medium sensitivity. Given that the main attraction is the sports on offer and the seclusion and it is considered unlikely that these would be affected (negligible magnitude). Therefore, the effect has been assessed as **negligible**.

14.7.46 The Galloway Tourist Route from Gretna to Ayr passes through St Johns of Dalry and Carsphairn, it is considered to be of regional importance (medium sensitivity). A small portion of the route may be affected by the Proposed Development, but it is unlikely that this will lead to a change in tourism behaviour or reduce the spending associated with tourists in Dumfries and Galloway or in the area within 15 km of the Proposed Development (low magnitude). Therefore, the effect has been assessed as **minor**.

Accommodation

14.7.47 There are three accommodation providers in and around Carsphairn, which suggest mainly local economic importance (low sensitivity). The quality of the service, rural location and proximity to attractions, such as the former Dark Skies Observatory and walking routes, are considered key features. It is not expected that these will be significantly affected, and therefore the magnitude has been assessed as low. The effect has been assessed as **negligible**.

14.7.48 Similarly, the accommodation providers off the B729, including the small Hawkrigg Camping and Caravan Site (10 tent pitches and 5 hardstandings) are likely to be of mainly local economic importance (low sensitivity). The views

[35] Moffat Centre (2008). *The Economic Impacts of Wind Farms on Scottish Tourism.*

[36] BiGGAR Economics (2021), Wind Farms and Tourism Trends in Scotland: Evidence from 44 Wind Farms

[37] BiGGAR Economics (2017), Wind Farms and Tourism Trends in Scotland

[38] Scottish Parliament Economy, Energy and Tourism Committee (2012). *Report on the achievability of the Scottish Government's renewable energy targets.*

are a key feature, as is the location and proximity to an abandoned settlement (Polmaddy) and Galloway Forest Park. The magnitude has therefore been assessed as medium. Therefore, the effect has been assessed as **minor**.

14.7.49 Further south, there are two accommodation providers off the B7000, which are assessed as local importance (low sensitivity). Among other features, such as the proximity to the Galloway Forest Park, the views and landscape are considered key features. Therefore, the magnitude has been assessed as medium. On this basis, the effect is assessed as **minor**.

14.7.50 There is a cluster of six accommodation providers in St Johns of Dalry, including the Clachan Inn and Lochinvar Hotel. This cluster is likely to be of local/regional importance and therefore the sensitivity has been assessed as medium. However, given the distance from the Proposed Development it is not anticipated that there would be any impact (negligible magnitude). Therefore, the effect has been assessed as **negligible**.

14.7.51 There are two hotels in Dalmellington. The cluster is mainly of local importance (low sensitivity) and is a substantial distance from the Proposed Development so impacts are unlikely (negligible magnitude). The effect has therefore been assessed as **negligible**.

14.7.52 There is a cluster of around 6 self-catered accommodation providers at the Auchenbrack Estate, which is likely to be of mainly local importance (low sensitivity). Given the distance from the Proposed Development impacts are considered unlikely (negligible magnitude). Therefore, the effect has been assessed as **negligible**.

14.7.53 There are two hotels in New Galloway, suggesting that this cluster is mainly of local importance (low sensitivity) and given the distance from the Proposed Development any impact is considered unlikely (negligible magnitude). Therefore, the effect has been assessed as **negligible**. Similarly, the cluster around nearby Balmaclellan is likely to be locally important (low sensitivity) with negligible magnitude. Therefore, the effect would be **negligible**.

14.7.54 There are three accommodation providers near New Cumnock, including the Glen Afton Caravan Park. They are likely to be of local importance (low sensitivity) and given the distance from the Proposed Development it is unlikely that they would experience adverse impacts (negligible magnitude). On this basis, the effect has been assessed as **negligible**.

14.7.55 There were two further accommodation providers: Polskeoch Bothy and the self-catered River Ken Cottage. The bothy, on the Southern Upland Way, is free to use and has thus been assessed as low sensitivity and negligible magnitude (**negligible** effect). The cottage has been assessed as low sensitivity. The views are considered a key feature, as is the rural location, position by the river and proximity to trails and amenities. The magnitude has therefore been assessed as low, and the effect has been assessed as **negligible**.

Recreational Paths and Trails

Construction

14.7.56 The Cairnsmore to Carsphairn walk is a circular trail beginning at the Green Well off the B729 that includes the Cairnsmore of Carsphairn Corbett and a core path. It also includes the Black Shoulder summit. It is not waymarked. According to Walkhighlands members, of the 222 Corbetts (a mountain between 2,500 and 3,000 feet high) Cairnsmore is the 39th most visited[39]. This suggests that the walk is of regional importance and likely to be a walking attraction for current visitors. The sensitivity of this path has therefore been assessed as **medium**.

14.7.57 The walk passes through the Proposed Development Area and passes close to Turbine 1. As such, it is anticipated that without mitigation there would be disruption during the construction phase as the path would not be safe to use at all times. The magnitude of the effect has been assessed as **high**. Therefore, the nominal effect during the construction period would be **major**, temporary and significant.

14.7.58 Core path 182 that begins at the B729 east of Carsphairn. It follows a road upwards and is an alternative route up the Cairnsmore, though it is not waymarked. It is likely to be of mainly local importance and has therefore been assessed as **low** sensitivity.

14.7.59 It passes through the Proposed Development Area and therefore some disruption is expected during the construction phase, though it is likely that the road will still be accessible. On this basis, the effect has been assessed as medium. Therefore, the effect has been assessed as **minor** and temporary.

Operation

14.7.60 The Southern Upland Way passes to the east of the site. Given the number of visitors, it is considered regionally important (medium sensitivity). The Proposed Development will be visible at certain sections of the route, in particular to the East of Glen Lorg. 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**.

14.7.61 The Cairnsmore to Carsphairn path has been assessed as medium sensitivity and passes through the Site. the significance of the Landscape and Visual Impact impacts on this path route have been assessed as major and significant. The Developer is proposing to invest in improving the accessibility of the paths within the Proposed Development Area which may also include improved car parking access and increased signage. This is likely to increase the usage of the paths, and thus increasing the overall amenity value of the path. Determining the residual effect therefore must consider both potential positive and negative effects that the Proposed Development could have on this route. General EIA guidance requires the assessment to consider the worst-cases scenario, which in this instance would mean that the negative effects on amenity to the site outweigh the positive. Therefore, the magnitude has been assessed as medium, and the effect as **minor**.

14.7.62 Similarly, core path 182 passes through the Site and is considered to be of local importance (low sensitivity). The magnitude of impact is likely to be medium and the effect **minor**.

14.7.63 The Striding Arches is a short trail off the Southern Upland Way to the north-east of the Proposed Development. It is considered to be of local importance (low sensitivity). It passes through a small glen and is a substantial distance from the Proposed Development and is therefore considered unlikely to be adversely affected (negligible magnitude). Therefore, the effect has been assessed as **negligible**.

14.7.64 The Dundeugh Forest trail is a small circular route which is considered to be mainly of local importance (low sensitivity) and its key features, passing through a forest along the banks of a burn and small loch, would not be affected by the Proposed Development (low magnitude). Therefore, the effect has been assessed as **negligible**.

14.7.65 The Craiglea Trail and the Ness Glen trail to so the east of the Proposed Development are both considered low sensitivity, due to their local importance. In both cases, the main attraction is likely to be the proximity of Loch Doon, which is unlikely to be affected by the Proposed Development (negligible magnitude). Therefore, the effect has been assessed as **negligible**.

14.7.66 There are also a number of core paths, which are likely to mainly be used locally (low sensitivity). The Proposed Development is not expected to reduce the overall amenity of the area (low magnitude). Therefore, the effect has been assessed as **negligible**.

[39] Walkhighlands (2021), The Corbetts by popularity. [Online] Available from https://www.walkhighlands.co.uk/corbetts/most-climbed [Accessed 29th September]

Mitigation and Enhancement

Mitigation

14.7.67 There are no standard mitigation requirements for economic impacts during construction and development and operations and maintenance.

14.7.68 To mitigate against recreational path access disruption during the construction phase, in particular the paths on the Proposed Development Area, the Applicant will develop an Access Management Plan. This shall be distributed to stakeholder groups and designed to maximise access to all recreational paths during the construction phase when it Is safe to do so.

Enhancement

14.7.69 The Applicant is committed to maximise economic benefits within Dumfries and Galloway and South West of Scotland. To support this, it has commissioned BiGGAR Economics to carry out a supply chain analysis of South Kyle Wind Farm, an onshore wind development under construction, which spans across East Ayrshire and Dumfries and Galloway, The assessment will support the Applicant's efforts to maximise local economic benefits in future developments in the area, such as the Proposed Development.

14.7.70 This will include learning from experience in encouraging local suppliers to diversify into the onshore wind market and cataloguing the capacity that is available locally so that these firms can be included in suitable invitations to tender for the Development. More details of this work is available:

14.7.71 The Applicant is working to maximise the recreational opportunities of the paths and trails on the Site. This will include:

- retaining construction car parking facilities next to existing paths and new tracks that will improve the accessibility of those paths;
- construct two new dedicated paths as part of the Proposed Development. One will directly link the village of Carsphairn to the Site and the other path will led from the Site to the location of a cashed bomber; and
- increase signage in the area to make the Proposed Development and its environment an attraction in its own right.

14.7.72 The enhanced recreational access will be designed to meet the demographic needs of the local community. As discussed in Table 14-6, the population of Dumfries and Galloway is older than that of Scotland as a whole and the share of older people is expected to continue. The enhancement of the recreational facilities proposed is in line with the guidance provided by the Scottish Government[40]. This guidance advocates those recreational interventions should provide transport access to outdoor spaces for older people, accommodate different levels of difficulty and provide rest spaces. It also notes that condition of many recreational paths, such as uneven ground, tree roots and mud, act as a deterrent for older people to participate in outdoor activities.

Residual Effects

14.7.73 As a result of these enhancement and mitigation measures the residual effect on the recreational trails will be negligible.

14.7.74 The disruption to the access for paths on the Site will be minimised through the Access management Plan. This will reduce the magnitude of the effect to Low and therefore the significance of the effect to Minor.

14.7.75 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 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.

[40] Scottish Government (2016) Access to outdoor recreation by older people in Scotland

14.8 CUMULATIVE EFFECTS

14.8.1 The Proposed Development is within 20 km of 37 wind farm developments, at various project stages. This includes:

- 13 operational wind farms, namely;
  - Afton;
  - Blackcraig;
  - Dersalloch;
  - Hare Hill I;
  - Hare Hill II;
  - Sanquhar;
  - South Kyle;
  - Twentyshiling Hill;
  - Wether Hill;
  - Whiteside Hill;
  - Windy Rig;
  - Windy Standard I; and
  - Windy Standard II.
- 14 consented wind farms, namely;
  - Benbrack;
  - Enoch Hill;
  - Glenshimmeroch;
  - Knockman Hill;
  - Lorg;
  - Margree
  - North Kyle
  - Overhill;
  - Pencloe;
  - Sandy Knowe;
  - Sanquhar Six;
  - Torrs Hill;
  - Troston Loch; and
  - Windy Standard III.
- 11 wind farms that have submitted applications for consent namely;
  - Cornharrow;
  - Euchanhead;
  - Fell;
  - Greenburn;
  - Knockippen

- Knockcronal
- North Kyle;
- Sanquhar II;
- Sclenteuch;
- Shepherd's Rig; and
- Windy Standard I Repower

- 4 projects currently in Scoping, namely;
  - Appin;
  - Cloud Hill
  - Divot Hill;
  - Knockkippen;
  - Manquhil; and
  - South Kyle II

14.8.2 These sites at various stages of their development represent a positive economic opportunity for the local supply chain in Dumfries and Galloway and the South West of Scotland. Given the existing operational developments and developments that have already received approval in the proximity of the Proposed Development, the Proposed Development has the potential to generate beneficial cumulative impacts. This will be the case if it were to further encourage the development of a local renewable energy supply chain. The presence of an existing supply chain in the local area and a pipeline of projects may also lead to new businesses engaging with the sector.

14.8.3 The development of a strong local supply chain would help to increase the economic benefits of the Proposed Development and similar projects in Dumfries and Galloway and the South West of Scotland, which could help to increase the magnitude of the beneficial economic effects considered in this chapter. To this end the Applicant has commissioned BiGGAR Economics to conduct a supply chain analysis of South Kyle Wind Farm. The findings from the assessment will inform the Applicant's engagement with local businesses.

14.8.4 Efforts to attract new entrants into the onshore wind market could also potentially help to address potential issues associated with the capacity of the local market to meet the demands of the onshore wind energy sector in this area. This will be of relevance to the specialised contractors within the Development, Turbine and Grid Connection contracts. The employment supported by the Balance of Plant contracts is less likely to be affected by capacity issues due to lower levels of specialisation.

14.8.5 Similarly, the majority of the sites considered in the cumulative assessment would also provide community benefit funding to support economic development and the investment priorities of local communities. The larger funds that would be available would also allow these communities to undertake more strategic level project investments which could have a larger economic impact.

Tourism and Recreation

14.8.6 There are not expected to be any significant effects on tourism or recreation assets in the surrounding area. Overall, though there may be some cumulative effects due to the addition of the Proposed Development, it is not expected that these would be significant.

14.9 CONCLUSIONS

14.9.1 Dumfries and Galloway has an older population that the Scottish average, which is set to decline in the future. The area also a less dynamic labour market, with agriculture, the tourism sector and health care being relatively important employers.

14.9.2 The Proposed Development will generate economic benefits both during its development and construction and during its operation and maintenance. In particular, its development and construction are expected to generate:

- £56 million GVA and 820 years of employment in the UK; including
- £33 million GVA and 440 years of employment in Scotland as a whole; including
- £11 million GVA and 150 years of employment in the South West of Scotland; including
- £7 million Gross Value Added (GVA) and 90 years of employment in Dumfries and Galloway.

14.9.3 The expenditure for the operation and maintenance of the Proposed Development could deliver up to:

- £1.9 million GVA and 31 jobs in the UK; including
- £1.3 million GVA and 22 jobs across Scotland; including
- £0.6 million GVA and support 8 jobs in the South West of Scotland; including
- £0.5 million GVA and support 7 jobs in Dumfries and Galloway.

14.9.4 The Proposed Development will also contribute to the revenue of local government by paying each year around £0.6 million in non-domestic rates. This revenue will then be available for spending on public services.

14.9.5 The Applicant will also contribute to the long-term economic development of the area surrounding the Proposed Development through the annual payment of community benefits.

14.9.6 Within the context of Environmental Impact Assessment legislation, none of the economic impacts considered is significant.

14.9.7 The analysis in this chapter has also considered whether the Proposed Development may affect the local tourism economy. This has been based both on a literature review of the evidence surrounding the relationship between onshore wind developments and the Scottish tourism economy and on an assessment of the potential impact on tourism assets located within 15 km from the Proposed Development.

VATTENFALL

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Chapter 15

Synergistic Effects, Summary of Mitigation and Residual Effects

Contents

Glossary

Term	Description
Environmental Impact Assessment	Environmental Impact Assessment (EIA) is a means of carrying out, in a systematic way, an assessment of the likely significant environmental effects from a development.
Environmental Impact Assessment Regulations	The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (EIA Regulations)
The Proposed Development	The Quantans Hill Wind Farm development
The Proposed Development Area	The area within the 'Site boundary' as illustrated on Figure 1.1 which the Proposed Development will be located

List of Abbreviations

Abbreviation	Description
ACoW	Archaeological Clerk of Works
Applicant	Vattenfall Wind Power Ltd, the Applicant
CAA	Civil Aviation Authority
CEMP	Construction Environmental Management Plan
CoWRP	The Scottish Government's 'Control of Woodland Removal Policy'
CP	Compensatory Planting
DGAS	Dumfries and Galloway Archaeology Service
DGC	Dumfries & Galloway Council
DGCAS	Dumfries and Galloway Council Archaeological Service
DWPA	Drinking Water Protected Area
ECoW	Environmental/Ecological Clerk of Works
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
FLS	Forestry and Land Scotland
FMS	Fisheries Management Scotland
GDL	Gardens and Designed Landscapes
HER	Historic Environment Scotland
HES	Historic Environment Scotland
HGV	Heavy Goods Vehicles
HMP	Habitat Management Plan
IEF	Important Ecological Feature
IOF	Important Ornithological Feature
JRC	Joint Radio Company
LCS	Landscape Capacity Study
LCT	Landscape Character Type
LDSFB	Local District Salmon Fisheries Board
LFA	Low Flying Area
MOD	Ministry of Defence
MSS	Marine Scotland Science
NATS	National Air Traffic Services Ltd.
NERL	NATS En Route Ltd
NSA	National Scenic Areas
NVIS	Night Vision Imaging Systems
PMO	Planning Monitoring Officer
PMRA 1986	Protection of Military Remains Act 1986
PPIP	Pollution Prevention Incident Plan
PWS	Private Water Supply
RSA	Regional Scenic Area
RSPB	Royal Society for Protection of Birds
SEPA	Scottish Environment Protection Agency
SF	Scottish Forestry
SLA	Scenic Landscape Area
SPP	Species Protection Plan
SPEN	Scottish Power Energy Network
SUW	Southern Upland Way
SW	Scottish Water
TS	Transport Scotland
TMP	Traffic Management Plan
WoSAS	West of Scotland Archaeology Service
WSI	Written Scheme of Investigation

15.1 INTRODUCTION

15.1.1 This chapter of the EIAR presents a summary of the topics scoped for the EIA, the consultees which were consulted/responded during the EIA, where in the EIAR these responses have been addressed if applicable, the EIA results where these are potentially significant, the mitigation proposed and the residual effects. Synergistic effects are potential effects which may be caused through a combination of effects from different topics and these are assessed in section 15.1 below.

Table 15.1: Summary of Effects, Mitigation and Residual Effects

Topic	Consultees	EIAR reference	Potential Significant Effects	Proposed Mitigation	Residual Effects
Landscape & Visual	Scottish Government Dumfries and Galloway Council Mountaineering Scotland	Chapter 5	The Proposed Development would be located within two LCTs (160 and 177). The construction and decommissioning stages of the Proposed Development would result in ground disturbance operations, track upgrades and new track/crane pad/hardstanding construction and decommissioning removal, construction of wind turbines and removal during decommissioning and general reinstatement works, together with vehicular/personnel movements on site. Such operations would result in direct effects on the landscape fabric of the Proposed Development Area. It is considered the magnitude of change on the landscape resource of the site would be **Substantial**, resulting from a large geographical extent and major size and scale of proposed changes but these are temporary and over a limited area (within 8km of Proposed Development). This results in a **Major (significant)** effect on the landscape resource of the Proposed Development Area during the construction and decommissioning stages of the Proposed Development. Following reinstatement post construction, the site area would enter the operational stage. The magnitude of change on the landscape resource of the site would remain **Substantial**, resulting from the large geographical extent of the site area affected, the size and scale of proposed changes including the introduction of 14 vertical elements into the landscape and the long term, theoretical reversible nature of the changes. This is considered to result in a **Major (significant)** effect on the Proposed Development Area during the operational stage of the Proposed Development. Within the wider study area, four LCTs are predicted to receive significant effects as a result of the Proposed Development. LCT 165, 176, 177, 178 and 180 which are predicted to receive localised **Major (significant)** effects. This is due to the small part of the overall LCT that would be affected within 8 km from the Proposed Development. This would result in a locally **Substantial** or **Moderate** magnitude of change for **High-medium** sensitivity receptors. Thereafter, potential effects would reduce as a result of distance, and screening from landform, woodland and forestry. The Proposed Development would be located within the Galloway Hills RSA and it is predicted that the special qualities would be affected both directly and indirectly within the proposed site extending out to around 5 km Magnitude of change would be **Substantial** for a **High** sensitivity receptor resulting in a **Major (significant)** effect. Of the 25 selected viewpoints that were identified to represent the general visual amenity throughout the study area, 13 were identified as being significant on	The Proposed Development has been through an iterative design process which aimed to mitigate significant effects through careful siting and design of developments. The design process aimed to reduce environmental effects whilst achieving suitable technical and commercial objectives, resulting in the removal of seven proposed turbines and the reduction in proposed tip height from 250 m to 200 m. Turbine layout was thought out carefully to provide a layout with simple form and one that relates to the landscape character of the site and its surroundings. Furthermore, suitable separation between operational/consented wind farms and the Proposed Development prevented amalgamation with other nearby cumulative sites. A reduced lighting scheme has been developed for the project to minimise the visual effects of aviation lighting on receptors. New tracks have been designed, amongst other environmental criteria to avoid prominent slopes and summits to reduce the requirement for cut and fill. The proposed internal tracks are aligned so as to take advantage of the screening effect of intervening topography or vegetation. Wind farm collector cables would be underground within the site to avoid potential visibility. Substation, Control Building, Energy Storage and Permanent Compound would be constructed on site and situated away from residential properties and the Southern Upland Way as well as close to the main turbine access track to avoid the requirement for further access tracks. Screening would also be used to minimise impact further. Throughout all phases of the Proposed Development, ground disturbance on site would be confined, as far as practicable, to access tracks, turbine base areas, lay-down areas, crane pads and underground sections of the grid connection cables. The assessment also identified designated landscape with potential to experience significant effects. A total of three National Scenic Areas (NSA), 21 Gardens and Designed Landscape (GDL) and 12 local designations (Special Landscape Areas/Regional Scenic Areas were identified within the study area. The assessment of visual effects of the Proposed Development considers the effect on visual receptors or viewers throughout the study area.	Chapter 5 of the LVIA should be referred to for full detailed assessment of each receptor. It concludes that there would be **several significant effects to both landscape and visual receptors but these would affect a relatively small number of landscape and visual receptors located within Upper Glenkens and the immediate hillsides. Within the wider area, it is not predicted that significant effects would occur to landscape and visual receptors due to a combination of screening from landform and woodland.** The potential significant effects identified are restricted to landscape and visual effects upon a limited number of receptors within close proximity of the Proposed Development.

Topic	Consultees	EIAR reference	Potential Significant Effects	Proposed Mitigation	Residual Effects
			account of the close views obtained of the Proposed Development from a variety of lowland and upland landscapes. Of the 10 route receptors assessed including Core Paths within 5 km of the Proposed Development, ten were assessed as potentially receiving a significant effect as a result of close views of the Proposed Development. This would cover short sections of each route where open views are available and within close proximity to the proposed site. Thereafter, effect levels would reduce to non-significant levels as distance and screening from vegetation increases. Cumulative Scenario 2 sites would be located further back within the uplands reducing their prominence from Upper Glenkens and potential to lead to significant cumulative effects. Where significant cumulative effects do occur for the Scenario 2 baseline, it is as a result of consented sites to the north east at Lorg, and to the east at Troston Loch and Glenshimmerroch. Scenario 3 sites are similar with the exception of Shepherds Rig which would be viewed alongside the Proposed Development. For some landscape and visual receptors this would lead to an increase in horizonal extent of turbines and would appear as one large wind farm. For other receptors, the Proposed Development would be viewed within the footprint of Shepherd Rig and would have limited cumulative effect. Seventeen of the eighteen residential receptors assessed are predicted to receive a significant effect. This would be due to the openness of the view obtained from each property within 2km of the proposed turbines. None were identified as receiving an effect to the extent that the Proposed Development would be overbearing and result in it being an unattractive place to live. One settlement is predicted to receive significant effects, Carsphairn. This would mainly occur in the eastern part of the settlement where views towards the proposed site can be obtained. Elsewhere, a combination of adjacent properties and garden vegetation would reduce effects to non-significant levels.		
Ecology	NatureScot Scottish Environment Protection Agency Dumfries and Galloway Council Marine Scotland	Chapter 6	This assessment has systematically considered the potentially significant effects of the Proposed Development on important ecological features (i.e. sensitive habitats and protected species) and any potential cumulative effects that could occur in combination with other relevant projects. The assessment has analysed the effects on various habitats types including marshy grassland, semi-improved acid grassland wet, wet modified bog, wet dwarf shrub heath, blanket bog, scattered bracken, semi-improved neutral grassland, acid/neutral flush and mature conifer plantation woodland in which all habitat effects were considered as **Not Significant.** Without consideration of further mitigation, the effects of construction and operation effects on badger, otter and reptile habitats and risk of injury would be Negligible, resulting in a Negligible adverse impact which is **Not Significant.**	Ecological constraints (i.e. sensitive habitats and important locations for protected / notable species) have been carefully considered during the design process. The potential effects from the construction and operation of the Proposed Development on several ecological features have therefore been avoided, or reduced, through siting infrastructure away from the more sensitive locations. However, it is not possible to avoid all potentially significant effects through the layout design alone. A Bat Protection Plan for the operational phase of the Proposed Development is also proposed. This Plan includes various elements, based on current best practice guidance. A Fish Monitoring Plan is to be developed, in advance of works commencing on the Site, which would set out in detail the approach to the protection and monitoring of fish populations (with a focus on	Residual assessment has concluded, assuming that the proposed mitigation measures are implemented effectively, that all potentially significant adverse effects from the Proposed Development (including cumulative) are avoidable for each ecological feature. **No significant effect.**

Topic	Consultees	EIAR reference	Potential Significant Effects	Proposed Mitigation	Residual Effects
			The assessment has identified potentially **Significant** effects on watercourses and salmonid fish (associated with the Water of Deugh catchment) due to the possibility of pollution to surface waters from operational phase effects. Potentially **Significant** effects on bat populations have also been identified for the operational phase of the Proposed Development due to mortality from collision with the turbine blades.	salmonid species) prior to, during and following the construction of the Proposed Development. This Plan will also include water quality monitoring at various locations on watercourses draining the Site and at suitable control sites. Extensive habitat creation and enhancement measures are proposed to be developed and implemented, under a proposed HMP, to address the potential effects of the Proposed Development on habitats of nature conservation importance such as blanket bog and wet heath. Native woodland establishment is proposed along several riparian corridors within the site. The proposed HMP has the potential to result in a net-positive contribution regional objectives for blanket bog restoration and native woodland creation in the long-term. An alternative proposal to focus conservation efforts elsewhere offsite within the broader region is also proposed in lieu of onsite HMP.	
Ornithology	NatureScot RSPB	Chapter 7	The assessment considered the various potential impacts arising from the construction, operation and decommissioning of the Proposed Development, and evaluated the significance of these impacts on the identified key species of interest in the context of their conservation value, sensitivity to wind farm development and the scale of the potential effects. During construction of the wind farm, adverse effects on birds may arise from loss of habitat and from disturbance associated with construction activities. **No significant** habitat loss is predicted for any species, taking into consideration the scale of the proposal, the extent of direct habitat loss in comparison to the abundance of similar habitats unaffected in the wider area. During wind farm operation, impacts may arise from collision with turbines and other structures resulting in injury or death, displacement/disturbance from areas where turbines are operating and disturbance by maintenance activities and pedestrian access via newly created site roads. Collision risk has been assessed using data systematically gathered during flight activity surveys and a standard model used in wind farm EIA. Due to the low levels of flight activity for most species considered in the assessment the effect of wind turbine collision is considered to be **Not Significant** at the regional population scale. The modelled collision risk for red kite is comparatively high, reflecting the levels of activity recorded during the baseline surveys and the relatively high susceptibility of this species to wind turbine strike risk. However, due to the favourable conservation status of the red kite population in Dumfries & Galloway the predicted losses and effects are anticipated to result as **Not Significant** on this regional population. The potential for cumulative impacts on red kite, as a result of interactions with the Proposed Development and existing/proposed wind farms in the wider region, has also been considered in this assessment. Based on the available information	The layout of the Proposed Development has been informed by a constraints assessment related to certain key species, primarily breeding red kite and curlew. Regularly used breeding locations have been mapped as constraints on the wind farm design and protected by set-back zones. A habitat management plan is proposed to be developed and implemented to improve the quality of blanket bog and heath vegetation within the Proposed Development (in locations separated from the proposed wind turbines) and to establish native woodland along corridors adjacent to the main watercourses. These measures are primarily proposed to offset the effects of the construction of the proposed wind farm on sensitive habitats of conservation importance but would also increase habitat quality and extent for black grouse, and breeding moorland waders, helping to address potential long-term effects from the operation of the Proposed Development on these IOFs. An alternative proposal to focus conservation efforts elsewhere offsite within the broader region is also proposed in lieu of onsite HMP. Disturbance effects will be mitigated through careful management of construction works and through pre-construction surveys, to avoid disturbance to birds during the breeding season. See Technical Appendix 7.3: Outline Bird Protection Plan for details.	**No significant effect**

Topic	Consultees	EIAR reference	Potential Significant Effects	Proposed Mitigation	Residual Effects
			obtained from the published impact assessments of these proposals and taking into consideration the current favourable conservation status of the regional population**, No Significant** cumulative impacts are indicated.		
Hydrology, Geology & Hydrogeology	Galloway Fisheries Trust (GFT) Marine Scotland Science (MSS) Scottish Water (SW) Scottish Environment Protection Agency (SEPA)	Chapter 8	The potential effects on the hydrological, geological and hydrogeological environment have considered pollution incidents, erosion and sedimentation, changes in water quality, changes to water resources i.e. Benloch Burn DWPA and private water supplies, modification of surface water and groundwater flows, modification of natural drainage patters, impediments to flow and flood risk, peat instability and compaction of soils. Following the identification and assessment of the key receptors, taking into account the potential effects listed above, a comprehensive suite of mitigation and good practice measures has been incorporated into the design, including extensive buffer areas. In addition, a PPIP and a site-specific CEMP as well as detailed design of infrastructure and associated mitigation will be implemented to protect the groundwater and surface water resources from pollution and minimise changes to the hydrological environment. The impact assessment has taken into account the hydrological regime, highlighting that the principal effects will occur during the construction phase. Following the successful design and implementation of mitigation measures the significance of construction effects on all identified receptors are not defined as significant. The assessment of predicted operational effects has determined that the significance of effects on all receptors to be of **no significance**.	To facilitate the reduction of potential impacts on the hydrological environment, a series of set-back distances have been adopted and designed proportionately to allow greater protection in more sensitive areas. All watercourses shown on a 1:10,000 and 1:50,000 scale OS map with the Benloch Burn (DWPA only) were allocated 100 m buffers along with the remainder of the Proposed Development Area watercourses which were allocated a 50m buffer. Borrow pits, layout of new tracks, watercourse crossings and use of infrastructure have been designed to minimise impacts on hydrological environment. The design of linear infrastructure elements will be done so as to avoid modifying surface water and groundwater flow pathways. Infrastructure has been minimised within the Benloch Burn catchment along with proposals for Natural Flood Management will minimise effects on negatively modifying downstream flood risk. Furthermore, a PPIP has been prepared to protect and monitor water quality during the construction phase of the Proposed Development specifically for prevention within the Benloch Burn DWPA. As a result of above mitigation and successful design and implementation of these measures the significance of construction effects be of **no significance**.	**No significant effect**
Cultural Heritage	Historic Environment Scotland (HES) Dumfries and Galloway Council Archaeology Service (DGAS)	Chapter 9	Eighty-nine known heritage assets are within the Proposed Development Area. **No significant** impacts are expected upon these as the iterative design process has largely allowed for mitigation through avoidance. Three potential **Negligible effects** upon Assets 3 to 5 are expected. The potential for hitherto unknown archaeological remains to survive within the Proposed Development Area has been considered and mitigation measures have been suggested to ensure identification, assessment and avoidance or recording of any such assets as required. There is one designated asset within the Proposed Development Area, the crash site of a Blenheim Bomber Mk IV bomber which crashed on 8 November 1939 and under the PMRA Act 1986[1] all aircraft, whether civilian or military are Protected Places if on military service, irrespective of whether any loss of life occurred or whether it was during wartime. Within the 1 km Study Area, there is one Scheduled Monument, one Listed Building of Category B status, one Listed Building of Category C status and one Landscape Park designated as being of	The Proposed Development has been designed, where possible, to avoid direct impacts on known heritage assets. The only direct effects on known heritage assets would be on non-designated assets of Low importance with a negligible to medium sensitivity and the magnitude of impact would not exceed **Low** in each case. It is recommended that all known heritage assets within 50 m of the Proposed Development (working areas) should be fenced off with a visible buffer under archaeological supervision prior to the start of the construction phase in order to avoid accidental damage by heavy plant movement. An Archaeological Watching Brief would be maintained on ground breaking works which are predicted to cross or be located immediately adjacent to archaeological remains. The aim of the Watching Brief would be to identify any archaeological remains threatened by the Proposed Development, to assess their	**No significant effect**

[1] UNITED KINGDOM. Protection of Military Remains Act 1986: Elizabeth II. Chapter 35 (1986) London: Her Majesty's Stationary Office.

Topic	Consultees	EIAR reference	Potential Significant Effects	Proposed Mitigation	Residual Effects
			Regional Significance in the HER. Within the 5 km Study Area, there are an additional nine Scheduled Monuments, six Listed Buildings of Category B status, four Listed Buildings of Category C status, four assets deemed to be of 'National Significance' in the HER and two Archaeologically Sensitive Areas. Within the 10 km Study Area, there are an additional six Scheduled Monuments, one Listed Building of Category A status and one Archaeologically Sensitive Area. One asset, the former Scottish Dark Skies Observatory within the nationally designated Garden and Designed Landscape at Craigengillan (Asset 217, List No. GDL00111) is out with the 10 km Study Area and has been included within this assessment following consultation with HES. **No significant** effects are anticipated on the settings of designated assets within the defined Study Areas. **No significant** effects are anticipated on the settings of specified assets raised in consultation with DGAS. No significant operation effects or cumulative effects upon the setting of heritage assets has been predicted.	significance and to mitigate any impact upon them either through avoidance or, if preservation in situ is not warranted, through preservation by record. The Applicant has initiated discussions with Carsphairn Heritage Initiative with a view to increasing understanding, appreciations and experience of heritage assets in the area. Although, these discussions are in the early phases it has been suggested that specific trails could be established within the Proposed Development Area with interpretation provided at features of note, , including at the location of the Blenheim bomber crash site.	
Noise	Dumfries and Galloway Council	Chapter 10	Operational noise levels from the Proposed Development, including the effects of cumulative noise, have been assessed against noise limits derived in accordance with national guidance, and agreed with Dumfries and Galloway Council. The results of the operational noise impacts assessment indicate that predicted noise levels at the nearest noise sensitive receptors would meet the relevant criteria. Noise from construction and decommissioning activities have been assessed with reference to a fixed noise limit as suggested by BS 5228:2009+A1:2014, *Noise and Vibration Control on Construction and Open Sites*. Detailed predictions have not been undertaken given the separation distances between construction activities and noise sensitive receptor locations. A commitment will be made to ensure that the relevant construction noise limits will not be exceeded during the construction phase. The results of the assessment show that **No Significant** effects are anticipated, and therefore no specific mitigation is required.	No specific operational mitigation is required as the relevant noise limits are met. It should be noted that noise reduced modes of operation are generally available for wind turbines of the scale proposed here that allow noise levels to be reduced by restricting the rotational speed of the machines. This mitigation could be employed if any noise issues arise that would require mitigation to be implemented. Good practice construction techniques will be employed to minimise noise effects. In addition to proposed good practice measures, a noise control plan, as part of the CEMP.	**No significant** residual noise effects are predicted as the relevant noise limits have been shown to be met.
Traffic and Transport	Transport Scotland Dumfries and Galloway Council	Chapter 11	The traffic and transport assessment has assessed the traffic impacts associated with the Proposed Development. The assessment considered a worst-case scenario and assumes all stone would need to be imported onto site and all foundation concrete would need to be brought to site in ready mix lorries. In addition, the traffic impacts associated with the abnormal load deliveries were also assessed. An Abnormal Load Access Assessment, including swept path analysis at particular pinch points was also prepared demonstrating the viability of the proposed abnormal load route.	Embedded mitigation is delivered through a preliminary TMP. The assessment has been based on a number of conservative assumptions around the construction programme/sequencing, source of stone and concrete deliveries. These assumptions can only be clarified post consent. Hence it is expected a Planning Condition will be applied to the development for a final construction TMP to be prepared and approved by Dumfries and Galloway Council post consent and prior to construction works commencing.	**No significant effect**

Topic	Consultees	EIAR reference	Potential Significant Effects	Proposed Mitigation	Residual Effects
			The assessment concludes that, with the incorporation of suitable mitigation measures secured through a construction Traffic Management Plan, there will be **No Significant** traffic effects associated with the Proposed Development. The assessment considered the operational and decommissioning phases and concludes that there will be **No Significant** traffic effects associated with the Proposed Development. In relation to potential cumulative impacts, these are predicted to be '**Negligible / Low'** depending on if other developments are constructed concurrently. If the construction of the Proposed Development coincided with another, using the same transport routes, then communication with the other developers would take place with the aim to mitigate effects to a non-significant level. This would be delivered through the construction Traffic Management Plan. The assessment considered the operational and decommissioning phases and concludes that there will be **No Significant** traffic effects associated with the Proposed Development.	The preliminary TMP includes, amongst others, temporary pedestrian crossings, temporary signage to inform both drivers and pedestrians, temporary railings along footpaths and temporary speed restrictions.	
Forestry	Scottish Forestry	Chapter 12	The total forestry study area extends to 363.34 ha of newly planted woodland under different private ownership. 2.54 ha of shelterbelt woodlands are present within the Proposed Development Area. Permanent woodland removal of 13.91 ha would be required to construct the Proposed Development. The species composition would remain materially unaltered as a result of the Proposed Development as most infrastructure lies within spruce compartments. The layout, tracks and four turbine locations of the Proposed Development impact the two woodland creation schemes and one small shelterbelt. This permanent woodland loss of 13.81 ha of mainly newly planted woodland is required to facilitate the construction and operation of the Proposed Development and comprises mainly productive conifer, a loss of 6% to these two new woodlands. Broadleaf loss is 2% within these new woodlands.	Compensatory Planting (CP) would be required to mitigate the loss of woodland area. The extent, location and composition of such planting would be agreed with Scottish Forestry. It is noted that the proposed riparian planting arrangements presented in the draft Habitat Management Plan accompanying this EIAR will more than exceed the anticipated woodland removal. Long Term Forest Plans will be shaped by the access tracks and open ground associated with the turbines in the future when woodland felling and replanting proposals are considered in 30 to 40 years from planting. This is potentially around the years 2050 to 2060. This is around the end of the anticipated operational life of the Proposed Development. Infrastructure has been directed, where practical to utilise open ground and minimise the disruption of planted compartment.	**No significant effect**
Public Access		Chapter 13	There is a Public Right of Way that traverses the site but does not physically exist in The Proposed Development Area. Nonetheless, the Proposed Development has been designed to ensure a safe passage across the site is maintained. 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.	Furthermore, the Applicant is looking into the potential for a community heritage program; linking the recreational access benefits the project is seeking to provide, with sign posting and interpretation of some key historic features. See chapter 9: Cultural Heritage for details.	**No significant effect**

Topic	Consultees	EIAR reference	Potential Significant Effects	Proposed Mitigation	Residual Effects
Telecommunications	BT Openreach Joint Radio Company Limited Scottish Power Energy Network	Chapter 13	Openreach confirmed the Proposed Development should not cause interference to BT's current and presently planned radio network as well as the Joint Radio Company Limited line. The potential effect of the Proposed Development is considered to be **Not Significant** with respect to other radio communicated networks. Furthermore, EE confirmed the Proposed Development layout would not cause any interference to the EE telecommunications mast. The Proposed Development therefore does not directly affect microwave fixed links and the potential effect on microwave fixed links is **Not Significant.** The potential effect of the Proposed Development is considered to be **Not Significant** with respect to other radio communication networks. Scottish Power Energy Network is developing an overhead transmission grid line which dissects the Proposed Development. The Applicant has consulted with SPEN throughout EIA to establish suitable locations and buffers for several turbines.	No requirement for mitigation.	**No significant effect**
Public Water Supply	Scottish Water	Chapter 13	One public water supply was identified; the Scottish Water Carsphairn Water Supply, which confirmed the designation of the Benloch Burn catchment as a Drinking Water Protected Area. The Applicant consulted with Scottish Water during the EIA process to ensure this asset remains safeguarded. There should therefore be **No Significant** adverse effect upon the public water supply.	Specific mitigation will be outlined in the Construction Environmental Management Plan (CEMP) during detailed design for the sensitive locations. Additional mitigation specific to the Benloch Burn DWPA has also been outlined in Technical Appendix 8.6: Pollution Prevention and Incident Plan (PPIP) and is relevant to all proposed construction activities which will be undertaken within the Benloch Burn DWPA.	**No significant effect**
Private Water Supply	Dumfries and Galloway Council	Chapter 13	DGC provided information on private water abstractions, both domestic and commercial, within 3 km of the Proposed Development. In total, 91 private water supplies were identified. The private water supply risk assessment was undertaken using the Source-Pathway-Receptor model to establish the likelihood of a potential pollutant linkage existing between the Proposed Development and the supply of the identified PWS. Factors taken into consideration in the risk assessment include the proximity of the Proposed Development to the PWS source, layout of PWS infrastructure and pipework, the type of works being undertaken, the likely presence of pathways between the development and the source, the local topographic conditions and the underlying geology. The assessment concludes that following implementation of mitigation, there remains a low risk to Marbrack and Marbrack Cottage, with all other PWS demonstrating a combined risk rating of **Negligible**, including Knockgray Cottage and Stables Cottage as well as Knockgray and Knockgray Farm after mitigation.	Site specific mitigation will be undertaken at some of the private water supplies situated adjacent or within the Proposed Development Area. This will include, amongst other things, the provision of a permanent alternative water supply for Knockgray and Knockgray Farm PWS (see TA 8.4: PWSRA), which would be ready for use prior to the commencement of any works which could pose a risk to this PWS source, the implementation of mitigation or an alternative supply for Knockgray Cottage and Stables Cottage, and the implementation of a series of additional measures for the Marbrack PWS as well as appropriate design of standard good practice mitigation to avoid potential for impact through establishing a program of inspection and monitoring.	**No significant effect**
Shadow Flicker		Chapter 13	Sixteen properties may potentially experience shadow flicker from the Proposed Development, 4 of which have financial interest with the Proposed Development.	No requirement for mitigation.	**No significant effect**

Topic	Consultees	EIAR reference	Potential Significant Effects	Proposed Mitigation	Residual Effects
			These properties have been assessed to be within a deemed acceptable threshold for shadow flicker. It is therefore concluded that the Proposed Development has **No Significant** effect upon amenity due to shadow flicker.		
Aviation - Radar	National Air Traffic Services Glasgow Prestwick Airport MOD	Chapter 13	The Proposed Development Area is located within Low Flying Area (LFA) 16, where military aircraft are permitted to fly as low as 250 ft above ground level. It is also within Low Flying Area 20(T), the Borders Tactical Training Area, where fixed wing aircraft may be authorised to fly as low as 100 feet above ground level during daylight hours. This area is designated by the MoD as a "high priority military low flying area likely to raise considerable and significant concerns". There are no Meteorological Office radars within range and line of sight of turbines up to 200 m tip height on the Proposed Development Area. There are also no airfields, airstrips, gliding or other aviation sites within 20 km of the Proposed Development Area. The radars at Glasgow Prestwick Airport, Glasgow Airport, Cumbernauld, Kincardine, Edinburgh Airport, RAF Spadeadam and QinetiQ West Freugh have no line of sight to the Proposed Development due to intervening terrain. Consequently, the Proposed Development will have **No Significant** effects on those radars. The Proposed Development is likely to generate false plots on the Lowther Hill and Great Dun Fell radars. NERL has indicated that it will object to the Proposed Development. The Applicant is in discussions with NERL on technical mitigation measures to address the impacts on these radars	A Radar Mitigation Scheme will be agreed by the Applicant and NATS to address the effects of the Proposed Development on the Lowther Hill and Great Dun Fell radars. Following implementation of the Radar Mitigation Scheme the residual adverse effect will be a low magnitude of change to a receptor of medium sensitivity, resulting in a residual adverse effect of Moderate/Minor significance. The Proposed Development will be notified to the MOD and civil airspace users and marked on aeronautical charts and electronic aviation obstacle databases to enable aircrew to avoid the turbines horizontally and/or vertically.	**Not significant**
Aviation – Lighting	National Air Traffic Services Glasgow Prestwick Airport MOD	Chapter 13	Wind turbines with blade tip heights of 150 m or more are subject to the obstruction lighting provisions of Article 222 of the Air Navigation Order and the CAA Policy Statement: Lighting of Onshore Wind Turbine Generators in the United Kingdom with a maximum blade tip height at or in excess of 150m Above Ground Level (June 2017);. The MoD scoping response (5 August 2020) advised that the Proposed Development has the potential to compromise the safety of military low flying training and that it would be necessary for the Proposed Development to be fitted with aviation safety lighting in accordance with the requirements of the Air Navigation Order.	To mitigate potential effects on military low flying during daylight as well as at night, the MoD advised that it would request details of turbine positions and heights prior to construction, to ensure that all structures associated with the Proposed Development are marked on aeronautical charts. Infra-red lighting will be fitted to all turbines in the Proposed Development to enable aircrew using NVIS to see and avoid them at night. Medium intensity steady red lights will be fitted to 'corner' Turbines 1, 3, 10, 12 and 14 to assist non-NVIS-equipped aircraft to avoid the turbines at night. An aircraft proximity lighting system may be employed. This will switch the medium intensity lights on only when an aircraft passes at low level.	**Not significant**
Socioeconomics	British Horse Society Mountaineering Scotland	Chapter 14	The Proposed Development will generate economic benefits both during its development and construction and during its operation and maintenance.	There are no standard mitigation requirements for economic impacts during construction and development and operations and maintenance.	**No Significant Effects**

Topic	Consultees	EIAR reference	Potential Significant Effects	Proposed Mitigation	Residual Effects
			The Proposed Development will also contribute to the revenue of local government by paying each year around £800 k in non-domestic rates. This revenue will then be available for spending on public services. The Applicant will also contribute to the long-term economic development of the area surrounding the Proposed Development through the annual payment of community benefits. Within the context of Environmental Impact Assessment legislation, none of the economic impacts considered is significant. The analysis in this chapter has also considered whether the Proposed Development may affect the local tourism economy. This has been based both on a literature review of the evidence surrounding the relationship between onshore wind developments and the Scottish tourism economy and on an assessment of the potential impact on tourism assets located within 15 km from the Proposed Development.	To mitigate against recreational route access disruption during the construction phase, in particular the routes in the Proposed Development Area, the Applicant will develop an Access Management Plan. **Enhancement -** to maximise economic benefits within Dumfries and Galloway and South West of Scotland the Applicant commissioned BiGGAR Economics to carry out a supply chain analysis of South Kyle Wind Farm, an onshore wind development under construction, which spans across East Ayrshire and Dumfries and Galloway. The assessment will support the Applicant's efforts to maximise local economic benefits	

15.2 SYNERGYSTIC EFFECTS

15.2.1 An assessment of synergistic effects ensures that the assessments provided in the EIAR for each topic are not considered in isolation. Chapters 6 and 7 of the EIAR assess the biological environment (Ecology and Ornithology). Chapters 5, 8, 9, 12 assess the physical environment (LVIA, Hydrology, Cultural Heritage, Forestry) and Chapters 10, 11, 13 and 14 assess population and human health (Noise, Traffic, Infrastructure and Aviation and Socioeconomics). It is acknowledged that there are also some potential overlaps between the physical environment and population and human health.

15.2.2 This assessment considers the potential synergistic effect of related residual effects during construction, operation, and decommissioning of the Proposed Development. 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

15.2.3 During the construction 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, will be managed through a CEMP, PPIP, TMP and Decommissioning Plan and in isolation have been assessed in the EIAR as not significant. 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

15.2.4 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.

15.2.5 The EIAR predicts that there are no significant adverse effects in isolation for noise, visual effects of aviation warning lighting and shadow flicker. A relatively small number of landscape and visual receptors within 12 km of the Proposed Development. This is due to containment provided by the Southern Uplands and the Rhinns of Kells which reduces the visual envelope of the Proposed Development concentrating effect on the northern part of Upper Glenkens. 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.

15.2.6 A number of road receptors, long distance footpaths and local paths were identified within the 45 km study area. The assessment has predicted a small number of these including the A713, B729, Scottish Hill Tracks, Heritage Trails and Core Paths within 5 km of the Proposed Development would receive significant effects to short sections where views can be obtained. Overall, the routes would not receive a significant effect. As neither the potential visual effects or direct effects will prevent use of these in the long term, it is considered that the synergistic effects during construction and operation are not significant.

15.2.7 The inclusion of habitat management proposed by the Applicant, which will restore degraded peat habitat shall also improve natural flood drainage and habitat for some breeding bird species, thus have a positive synergistic effect in this regard. Alternatively, the Proposed Development may contribute funding in place of onsite interventions towards regional habitat management initiatives. Although it is not possible to directly identify the resulting expected benefits in the same way as can be done for onsite habitat management, the Applicant expects that equivalent funding could achieve similar or greater biodiversity improvements within the wider region through more strategic allocation of funding to initiatives with greater potential than can be achieved acting within onsite constraints and through the 'scaling up' effects of further funding sources being brought into the same regional fund (e.g. through other proposed developments or alternative funding sources).

15.3 SUMMARY

15.3.1 This chapter of the EIAR summarises the potential effects of the Proposed Development as well as potential synergistic effects which consider such effects in combination. Following the implementation of mitigation primarily in the form of embedded mitigation in the siting and design of the proposal, potential significant adverse effects are restricted to isolated landscape and visual effects upon limited receptors within close proximity of the Proposed Development. As noted in Table 15.1 these are effects which are commonly associated with wind farms and in this regard need to be balanced against the benefits.

15.3.2 The Applicant has proposed enhancements including habitat management which will restore degraded peat habitat, improve natural flood drainage and improve habitat for some breeding bird species. The Proposed Development will provide socioeconomic benefits through continuing employment opportunities it has already provided at the planning stage throughout the lifetime of the project following consent. The Proposed Development will contribute towards meeting national renewable energy targets and reducing carbon dioxide emissions to help reach the national carbon net zero target.

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