

1 Introduction

1.1 Background

1.1.1 Pencloe Wind Energy Limited (henceforth referred to as PWEL) is seeking to develop a windfarm (henceforth referred to as the proposed development) located wholly within the East Ayrshire Council area and immediately to the north of the Dumfries & Galloway Council border. The proposed development will be known as Pencloe Windfarm. The site location is shown in **Figure 1.1 Volume III** and lies within part of an extensive area of forestry plantation known as Carsphairn Forest. New Cumnock is the closest settlement to the site, lying some 2.5 km to the north at its nearest point with Dalmellington located some 11 km to the west. Afton Reservoir can be found about 1.5 km to the southeast.

1.1.2 The proposed development comprises 21 wind turbines and associated ancillary infrastructure. The turbines are each expected to have a maximum generating capacity of 3.3 megawatts (MW) resulting in a total generating capacity of approximately 70 MW. This will be dependent on the final choice of turbine best matching site conditions and following a competitive tender process.

1.1.3 With an indicative capacity of 70 MW, PWEL is applying under Section 36 of the Electricity Act 1989 ("the Act") to seek the consent of the Scottish Ministers to construct and operate a wind-powered electricity generating station and also gain their direction under section 57 (2) of the Town and Country Planning (Scotland) Act 1997.

1.1.4 Jacobs has been commissioned by PWEL to lead the Environmental Impact Assessment (EIA) process and to produce this Environmental Statement (ES) and report the findings of the EIA undertaken for the proposed development to accompany the planning application. Jacobs has provided some of the required technical input to the EIA and co-ordinated other specialist consultants (see **Table 1.1**) in the production of this ES.

1.1.5 This introductory chapter provides information on PWEL as applicant for the proposed development (**Section 1.2**), the nature of the proposed development (**Section 1.3**), the EIA process (**Section 1.4**) and how comments on this application may be submitted (**Section 1.5**).

1.2 PWEL

1.2.1 PWEL is an independent private Scottish Company established to develop, build, own and operate the windfarm.

1.3 The Proposed Development

1.3.1 The boundary of the Section 36 application site (referred to hereafter as the application site) is shown **Figure 4.1 Volume III**. The application site will accommodate the following windfarm components:

- 21 wind turbines each with an anticipated maximum rated capacity of up to 3.3 MW and a height of up to 125 m to blade tip;
- Permanent foundations supporting the wind turbines and associated crane hardstandings (used during construction, operational repair and decommissioning);
- Transformers (one per turbine) which may be housed externally next to the base of the turbine;
- One new access bell mouth arrangement from the unclassified road along Glen Afton;

- 17.8 km of permanent access tracks into the application site from the public highway and between turbines, including 5.2 km of upgrade to existing forestry tracks;
- Six water crossings to accommodate the access tracks;
- A control building and substation compound (including electrical metering, stores, office and welfare facilities);
- Underground cabling between the turbines and substation, running alongside access tracks where possible;
- High voltage export cable or overhead line to the nearest Scottish Power Energy Networks (SPEN) substation (a new facility is planned adjacent to the application site (see **Figure 4.1 Volume III**);
- Four borrow pits (in total circa 1.0 ha, in area);
- Three permanent free-standing anemometry masts (up to 85 m) with associated foundations and hardstanding and
- Two temporary construction compounds and a temporary security office.

1.3.1 The proposed development will have an operational lifespan of 25 years.

1.3.2 The proposed development does not include associated works such as highway modifications for site access as there is no regulatory requirement to include them in an application for development consent. Any associated works will require planning consent from Local Planning Authorities (LPAs) under the Town and Country Planning (Scotland) Act 1997.

1.3.3 It is proposed the Pencloe Windfarm will connect into a new local 132 kV 'collector' substation (developed by SPEN), located immediately south of the application site, where electricity generated from the windfarm will enter the transmission network via the South West Scotland Connections Project.

1.3.4 Further details of the proposed development are provided in **Chapter 4: Project Description**.

1.4 The Environmental Impact Assessment

1.4.1 The EIA of the proposed development has been led by Jacobs and contributed to by the team shown in **Table 1.1**. This ES has been prepared by Jacobs on behalf of PWEL to provide information to the Energy Consents and Deployment Unit (ECDU) of the Scottish Government, the local planning authority (East Ayrshire Council), statutory consultees, local residents and other interested parties about the proposed development and its likely environmental impacts. The purpose of the ES is to inform the decision as to whether planning permission should be granted for the proposed development.

Table 1.1 Contributors to the EIA

Discipline	Author	Company and Team Qualifications
Lead EIA Consultant	Jacobs	EIA Quality Mark Registrant
Planning and Policy Context	Jacobs	BSc Member of the Royal Town Planning Institute
Landscape & Visual	Jacobs	BA (Hons) Landscape Architecture, MA Landscape Architect, Member of the Landscape Institute

Discipline	Author	Company and Team Qualifications
Non-Avian Ecology	Lawrence Environmental Consultants / Jacobs	Phd (Ecology) BSc (Hons) Ecological Science Chartered Environmentalist Member of the Chartered Institute of Ecology and Environmental Management (CIEEM)
Ornithology	Lawrence Environmental Consultants / Jacobs	BSc Biological Sciences, PhD Behavioral ecology of birds, CIEEM / CEnv MCIEEM
Hydrology, Hydrogeology and Geology	Jacobs	BSc (Hons) Geography MSc Environmental Water Management Member of the Chartered Institution of Water and Environmental Management Chartered Environmentalist Chartered Water and Environmental Manager
Archaeology and Cultural Heritage	Headland Archaeology	BA (Hons) Medieval History, MA Archaeology, PhD Archaeology, Fellow of the Society of Antiquities of Scotland, Member of the Institute for Archaeologists
Noise and Vibration	Jacobs	Member of the Institute of Acoustics (MIOA) BSc (Hons) Acoustics with Music
Traffic and Transport	Jacobs	BEng (Hons) Civil Engineering MSc Transport Engineering & Planning Member of the Chartered Institute of Logistics and Transport (MCLT) Member of the Chartered Institution of Highways & Transportation (MI)
Telecommunications, Aviation & Defence	Aviatica	MA (Hons) Politics, MSc Rural and Regional Resources Planning
Socio-Economics	Jacobs	BSc (Hons) Environmental Management
Climate Change	Jacobs	BVMS Veterinary Medicine & Surgery, MSc Environmental Studies
Peat Slide Risk Assessment, Borrow Pit Assessment and Peat Management Plan	Jacobs	BSc (Hons) Environmental Management, Fellow member of Geolsoc BSc (Hons), AIEMA

- 1.4.2 The ES has been prepared in accordance with the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2000 (as amended in 2008) hereafter referred to as 'the EIA Regulations'. The EIA Regulations list applicable thresholds and criteria that are applied to certain types of development which are described in Schedule 1 and Schedule 2 to the EIA Regulations. Developments within the definition of '*Schedule 1 development*' (being developments which are listed in Schedule 1 and are not exempt development) require an EIA and this is mandatory. '*Schedule 2 development*' is development which is not exempt development and which is listed in Column 1 of Schedule 2 where either any part of the development is to be carried out in a sensitive area or the applicable threshold or criterion for that type of development has been respectively exceeded or met.
- 1.4.3 A Schedule 2 development will require an EIA if the development may have significant effects on the environment as a result of factors such as the nature of development, size or location. Windfarms are a Schedule 2 development and based on the noted factors and PWEL's experience of previous windfarm development, PWEL recognised at an early stage that EIA would be required.

- 1.4.4 The EIA was conducted in accordance with Schedule 4 of the EIA Regulations which defines the information to be included in an ES and which has been summarised as follows:
- A description of the development;
 - An outline of the main alternatives considered and reasons for choice;
 - A description of the aspects of the environment likely to be significantly affected;
 - A description of the likely significant effects of the development;
 - A Non-Technical Summary; and
 - An indication of residual areas of uncertainty.
- 1.4.5 The ES for the proposed development comprises:
- Volume I: Non-Technical Summary;
 - Volume II: Main Text;
 - Volume III: Figures and
 - Volume IV: Technical Appendices.
- 1.4.6 A confidential figure (**Figure 9.11** Bird Nests and Indicative Territories) has also been produced, however, this is only to be made available to the relevant nature conservation organisations.
- 1.4.7 The main volume of the ES contains 17 chapters in total, with 9 specific topic chapters covering the potential impacts associated with the proposed development (in accordance with the scoping opinion received from ECDU – see **Chapter 5**) and grouped under the following headings:
- Landscape and Visual Assessment (Chapter 7);
 - Non-Avian Ecology (Chapter 8);
 - Ornithology (Chapter 9);
 - Hydrology, Hydrogeology and Geology (Chapter 10);
 - Archaeology and Cultural Heritage (Chapter 11);
 - Noise and Vibration (Chapter 12);
 - Traffic and Transport (Chapter 13);
 - Socio-Economics (Chapter 14);
 - Telecommunications, Aviation and Air Defence (Chapter 15) and
 - Climate Change (Chapter 16).
- 1.4.8 In terms of format, each topic chapter describes the existing background/baseline environment, relevant consultation, the aspects of the environment likely to be significantly affected by the development, the methodologies used to assess the magnitude and significance of those effects (including associated guidance), a description of the proposed measures to reduce or mitigate (where appropriate) any significant effects and any likely residual effects.
- 1.4.9 Cumulative effects are of particular interest for the proposed development and all potential cumulative effects with other operational, permitted and “in-planning” windfarm developments have been assessed, for example for potential noise, landscape, traffic and ecological effects. The EIA has included consideration of the

potential cumulative effects with the windfarm developments shown in **Tables 2.1** and **2.2** of **Chapter 2: Environmental Impact Assessment Process**.

- 1.4.10 Introductory chapters are provided to outline the EIA process (**Chapter 2**), the processes associated with site selection and consideration of alternatives (**Chapter 3**), a description of the proposed development (**Chapter 4**), the scoping and consultation that has been undertaken throughout the EIA process (**Chapter 5**) and the planning and policy context (**Chapter 6**).
- 1.4.11 The Non-technical Summary (NTS) has been produced to provide a summary of the proposed development and the potential environmental impacts that may result using non-technical language and which can be read independently of the ES. A summary of mitigation has been provided in **Chapter 17** and a glossary of terms is also provided.

1.5 Commenting on the Planning Application

- 1.5.1 The planning application and supporting documentation, including this ES, will be available to view at the following locations during normal opening hours:

East Ayrshire Council
Planning and Economic Development
The Johnnie Walker Bond
15 Strand Street
Kilmarnock
KA1 1HU

Cumnock Community Library
1 Greenholm Road
Cumnock
KA18 1LH

The New Cumnock Community Centre
Castle
New Cumnock
Cumnock
KA18 4AH

- 1.5.2 Hard copies of the ES may be purchased from Graham Irwin of PWEL, and are available for a charge of £400 or £25 on CD (including VAT). Copies of the NTS are available free of charge. All documents can be obtained by writing to:

Pencloe Wind Energy Limited
13 Lennox Street
Edinburgh
EH4 1QB

- 1.5.3 The ES will also be available to view on East Ayrshire Council's e-planning website: <http://eplanning.east-ayrshire.gov.uk/online/>

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2 Environmental Impact Assessment Process

2.1 Introduction

2.1.1 This chapter describes the EIA process and the key stages involved in producing the ES for the proposed development.

2.1.2 The process, as applied to the EIA for the proposed development, is sequential and involves the following key stages:

- **Stage 1 - Screening:** preliminary consultations to understand and confirm if an EIA is likely to be required for a specific proposal. It was recognised by PWEL at an early stage that an EIA would be required for the proposed development and therefore this stage was not deemed necessary;
- **Stage 2 - Scoping:** consultation with the determining authority and other relevant statutory consultees and stakeholders to obtain their views on the proposal, identify potential impacts, identify existing environmental information and agree methods for the assessment of these impacts. The scoping process undertaken for the Pencloe Windfarm is described in Chapter 5: Scoping and Consultation;
- **Stage 3 - Baseline Studies:** identification of existing environmental conditions through review of existing information and monitoring and field studies as required;
- **Stage 4 - Assessment of Significant Impacts:** assessment and prediction of potential effects on the environment, quantification of impacts where possible including:
 - **Assessment of Significance of Impacts:** an assessment of the significance at local, regional, national and international scales of potential impacts.
 - **Mitigation:** the identification of measures to reduce these impacts.
 - **Residual Effects:** identification of residual effects which cannot be avoided through mitigation.
- **Stage 5 - Environmental Reporting:** preparation of the ES and supporting documentation; and
- **Stage 6 – Submission of Section 36 Application and Determination.**

2.1.3 Throughout the EIA and in particular in Stages 2, 3 and 4, there is an opportunity to use the interim findings to inform the final design of the project. There is normally a significant design iteration following completion of the baseline studies, where the constraints that apply to the development in question are confirmed and evaluated. **Chapter 3: Site Selection and Design Evolution** describes how the optimisation process has worked for the proposed development. The project description (layout, scale and extent) is then fixed to allow the full impact assessment to occur. The following sections expand on the above synthesis of the process in the context of the proposed development. In addition, subsequent **Chapters 7 – 16** expand on the methodologies used for specific topic assessments.

2.2 Regulatory Context

2.2.1 The requirements for EIA in Scotland in connection with planning applications under Section 36 of the Electricity Act 1989 are set out in the EIA Regulations (as referred to in **Chapter 1**).

2.3 EIA Process

2.3.1 EIA is a process that identifies the likely significant environmental effects (both beneficial and adverse) of a proposed development and the methods by which significant adverse environmental effects, where identified, may be mitigated (e.g. through prevention, reduction or offsetting). The EIA process has a number of key characteristics; these are that it should be:

- **Systematic:** comprising a sequence of tasks defined both by regulation and by good practice;
- **Consultative:** providing the opportunity of obtaining feedback from interested parties including statutory consultees and stakeholders;
- **Current:** reliant on the most up to date information to form a baseline of the local environment;
- **Predictive:** using techniques and professional judgement to assess the potential nature, size and significance of environmental change;
- **Transparent:** the information and assumptions upon which the assessment are made are set out clearly, as are limits to knowledge and the capability of the predictive tools employed in the assessment process; and
- **Iterative:** allowing opportunities for environmental concerns to be addressed during the planning and design of a project.

2.3.2 The process and outcomes of the assessment are presented in the ES, which is submitted to support an application for planning permission for the development in question (in this case a Section 36 application). It is intended to provide the decision-making authority, the statutory consultees and the wider community with sufficient information to make an objective judgement as to the development's acceptability within the context of national, regional and local planning and environmental policy.

2.4 Impact Assessment Methodology

2.4.1 Good practice in EIA is defined through a number of sources, ranging from the overarching EU Directive, (European Commission, 1985), through to guidance related to individual environmental issues. The methodologies used in this ES follow best practice guidance to ensure a robust assessment.

2.4.2 This EIA has been conducted in accordance with the EIA Regulations and current Scottish Government advice on good practice comprising:

- The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2000 (as amended in 2008);
- Guidance on the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2000; and
- Planning Advice Note (PAN) 58: Environmental Impact Assessment.

2.4.3 In addition, the EIA has been carried out taking due consideration of non-statutory guidance such as that contained within the 'Guidelines for Environmental Impact Assessment' (IEMA, 2004), along with various guidance documents relating to the assessment of individual aspects of the environment (see individual assessment chapters).

2.4.4 Good practice advises that EIA should be treated as an iterative process rather than as a one-off, post-design environmental appraisal, and that interested parties be consulted at an early stage in order to identify key impacts and design appropriate mitigation. In this way, the findings from the EIA can be fed into the design process,

leading to the production of a project which achieves a 'best fit' within the environment. This approach was used throughout the EIA of the proposed development.

- 2.4.5 Where likely significant adverse impacts were predicted or sensitive environments were identified, the interim results of the EIA were used to influence the number, size, type, construction details and location of the wind turbines and associated infrastructure (see **Chapter 3: Site Selection, Design and Alternatives**). Where it was not possible to eliminate a likely significant impact through sensitive design alone, the EIA process has been used to identify further appropriate mitigation measures to reduce such impacts.
- 2.4.6 The significant mitigation that PWEL applied to the proposed development design process has produced a layout which:
- Minimises landscape impacts while maximising the production of renewable energy;
 - Minimises and where possible avoids the loss of priority habitats and species, and creates opportunity for habitat enhancement;
 - Protects watercourses from the potential impacts of constructing the project;
 - Can be accommodated within the Forestry Design Plan for the area; and
 - Can be engineered safely and cost effectively.
- 2.4.7 The use of various mitigation measures identified in **Chapter 17** will help to reduce or remove potential impacts that have been identified as part of the individual environmental assessments.
- 2.4.8 The EIA has been conducted in accordance with Schedule 4 of the EIA Regulations which defines the information to be included in an ES and which has been summarised as follows:
- A description of the development (**Chapter 4: Project Description**);
 - An outline of the main alternatives considered and reasons for their selection (**Chapter 3: Site Selection, Design and Alternatives**);
 - A description of the aspects of the environment likely to be significantly affected (each of the specific topic **Chapters 7 - 16**);
 - A description of the inter-relationship between the likely significant effects on the environmental, for example where noise effects may impact on a socioeconomic receptor (see each topic chapter, where relevant);
 - A description of the likely significant effects of the development (see each topic chapter);
 - A description of mitigation measures (**Chapter 17: Summary of Mitigation Measures**);
 - A Non-Technical Summary (NTS); and
 - An indication of residual areas of uncertainty (see each topic chapter where appropriate).
- 2.4.9 The individual EIA topic assessments have been undertaken using the recognised best practice impact assessment methodologies for each specialist in the relevant topic. Full magnitude, sensitivity and significance criteria are provided in **Chapters 7 - 16** or in the associated appendices.

- 2.4.10 The majority of assessments employ the approach set out below, or similar, in order to quantify the significance of environmental effects associated with the development.
- 2.4.11 Effects are initially assessed in terms of:
- **the magnitude of the impact** - the degree of alteration (both beneficial and adverse) from the baseline state (e.g. the nature and duration of the effect); and
 - **the sensitivity of the receptor(s) subjected to the impact** – this may relate to the value of a resource and the reversibility of impacts. Magnitude and sensitivity assessments are then combined to determine the significance of effects.
- 2.4.12 Recognising guidance given in Section 11.2 of the IEMA guidelines referenced above on terminology, the EIA has considered the use of the terms “*impact*” and “*effect*”. The IEMA guidelines suggest that it may be helpful to distinguish between the two “*in order to demonstrate the difference between the 'characteristics' of the impact and the 'significance' of the effect*”. The Guidance also highlights that “*The distinction between impact and effect is helpful but may not necessarily be appreciated by the public...*”.
- 2.4.13 It is acknowledged that the individual EIA topic assessment methodologies in this ES vary in their use of the two terms. However, as advised in the IEMA guidelines, “*Provided it is clear that the assessment of significance is based on the scale of the nature of the impact / effect and the sensitivity of the receptor there would be little loss of understanding if impact and effect were to be interchanged within the text of the ES*”. It can be confirmed that this approach to assessment of significance has been adopted in this ES.
- 2.4.14 Where environmental impacts are considered to be significant in terms of the EIA Regulations, and where these are adverse, mitigation measures have been proposed, where possible, in order to avoid, reduce, remedy or compensate those significant environmental impacts. This hierarchical strategy is an iterative one which seeks to avoid potential impacts, reduce those that remain and, where no other measures are possible, put forward compensation or offset measures through each stage of the proposed development’s evolution. The project team has considered the mitigation of significant effects as an integral part of the overall project design process throughout the EIA and the project’s development, whereby the design of the proposed development has been amended with the primary aim of minimising environmental effects through avoidance or reduction.
- 2.4.15 Magnitude, sensitivity and significance have then been re-assessed to determine the residual environmental impacts of the proposed development allowing for the proposed mitigation measures.

Cumulative Impacts

- 2.4.16 Cumulative impacts are those that arise from (i) the combination of activities or impacts at a particular site, for example noise, dust and visual impacts resulting together from construction, or (ii) the recurrence of the same impact at different locations, for example combined traffic or visual impacts from two or more (proposed) developments in a wider area. They are considered to some degree through strategic planning documents (for example land allocation in development plans) but increasingly as part of an EIA. Cumulative impacts are sometimes difficult to assess quantitatively; their assessment relies heavily on assumptions about other possible development and it is not always possible to predict other development impacts with confidence. Where appropriate the EIA has addressed the potential cumulative effects of the proposed development with other wind farms

(built, consented but not yet built and those for which planning applications have been submitted but not yet determined), in particular under the topic headings of landscape (**Chapter 7**), ornithology (**Chapter 10**) and noise (**Chapter 12**).

- 2.4.17 Each potential cumulative impact has been assessed at a scale appropriate for that particular impact. For example the landscape assessment has considered the cumulative effects of the proposed development with windfarms and other developments up to and beyond 35 km radius. The noise assessment has considered the cumulative effects with consented and in planning sites in the vicinity of the proposed development where cumulative effects could conceivably occur.
- 2.4.18 At the time of writing, there are currently a number of operational or consented/under construction or in planning commercial scale windfarm developments within a 35 km radius of the application site (**Tables 2.1 and 2.2**). The location of these windfarms in relation to the application site is shown on **Figures 7.4.1 and 7.4.2 Volume III**.

Table 2.1 Built and Consented Windfarms within the 35 km Study Area

Windfarm	Developer	Stage	Distance / Direction from Pencloe Windfarm	Number of Wind turbines	Blade Tip Height
Operational and Consented Wind Energy Developments					
Afton	E.ON	Consented	0.1 km SE	27	120 m
Windy Standard Extension	RWE npower renewables	Consented	0.8 km S	30	120 m
Windy Standard	RWE npower renewables	Operational	1.8 km S	36	56.5 m
Hare Hill	Scottish Power Renewables	Operational	2.1 km NE	20	63.5 m
Hare Hill Extension	Scottish Power Renewables	Consented	2.5 km NE	39	91m
Sanquhar Community	Community Windpower	Consented	5.5 km E	12	126.5 m
Whiteside Hill	SSE Renewables	Consented	8.1 km E	13	121 m
Wether Hill	Scottish Power Renewables	Operational	13.4 km SE	14	91 m
Sunnyside	EDF Energy Renewables	Consented	14.3 km E	2	101 m
Penbreck and Carmacoup	ARSU	Consented	14.9 km NE	9	125 m
Dersalloch	Scottish Power Renewables	Consented	15.5 km W	23	115 m
Torrs Hill	Fred Olsen Renewables	Under Construction	17.1 km SW	2	100 m
Linburn Farm	Andrew Woodburn	Consented	24 km NE	2	15 m
Knockman Hill	Natural Power	Consented	21.9 km SSE	5	81 m
Blackcraig Hill	SSE Renewables	Consented	22.9 km SE	23	110 m
Bankend Rig	I & H Brown	Consented	23.0 km N	11	84.5 m
Galawhistle	Infinis	Consented	24.1 km NE	22	110.2 m - 121.2 m

Windfarm	Developer	Stage	Distance / Direction from Pencloe Windfarm	Number of Wind turbines	Blade Tip Height
Dungavel Hill	E.ON	Consented	26.0 km N	13	100 m
Hagshaw Hill	Scottish Power Renewables	Operational	26.1 km NE	26	91 m
Andershaw	Force 9 Energy	Consented	26.6 km NE	14	125 m
Nutberry	Falck Renewables	Consented	27.0 km NE	6	115 m
Hagshaw Hill Extension	Scottish Power Renewables	Operational	27.5 km NE	20	91 m
Kype Muir	Banks Renewables	Consented	29.1 km NE	26	132 m
Hadyard Hill	SSE Renewables	Operational	29.7 km W	52	110 m
Auchrobert	Falck Renewables & Coriolis Energy	Consented	29.8 km NE	12	132 m
Calder Water	Community Windpower	Operational	30.5 km N	13	144.5 m
Whitelee Ext Phase 2	Scottish Power Renewables	Operational	31.4 km NNW	39	110 m
West Browncastle	Falck Renewables	Consented	31.8 km N	9	136.5 m
Whitelee	Scottish Power Renewables	Operational	32.2 km N	140	110 m
Whitelee Ext Phase 1	Scottish Power Renewables	Operational	32.4 km N	36	110 m
Sneddon Law	Community Windpower	Consented	32.7 km NNW	15	130 m
Clyde and Extension	SSE Renewables	Operational	34.3 km E	152	125 m – 142 m
Dalswinton	Infinis	Operational	35.9 km SE	15	121 m
High Park Single Turbine	High Park Farm	Operational	4.59km NE	1	75m

Table 2.2 Proposed Windfarms within the 35 km Study Area

Windfarm	Developer	Stage	Distance / Direction from Pencloe Windfarm	Number of Wind turbines	Blade Tip Height
Ashmark Hill	RWE Innogy	Application submitted	0.4 km NW	7	116 m
South Kyle	Vattenfall	Application submitted	1.4 km W	50	149.5 m
Land at Burnfoot	Iberdrola	Application submitted	4 km S	1	67 m
High Cumnock	Banks Renewables	Application submitted	6.4 km N	8	132 m

Windfarm	Developer	Stage	Distance / Direction from Pencloe Windfarm	Number of Wind turbines	Blade Tip Height
Garleffan	Peel Energy	Application submitted	7.1 km N	9	135 m
Quantans Hill	E.ON	Application submitted	9.6 km S	19	130 m
High Glenmuir Farm- ST	VG Energy	Application submitted	9.8 km N	1	80 m
Ulzieside	North British Wind Power	Application submitted	11.0 km E	12	120 m
Longburn	Burcote Wind Renewables	Application submitted	11.5 km SSE	20	135 m
Glenmount	RWE npower renewables	Application submitted	13.3 km SW	19	130 m
Keirs Hill (Scienteuch)	RES	Application submitted	15.4 km W	17	149.5 m
Twentysilling Hill	Element Power	Application submitted	15.6 km E	9	125 m
Kennoxhead	PNE Wind UK	Application submitted	18.8 km NE	26	126.5 m
Margree	North British Wind Power	Application submitted	19.0 km SE	17	125 m
Linfairn	Willowind Energy	Application submitted	20.5 km W	25	126.5 m
Leadhills	Leadhills Estate	Application submitted	23.5 km NE	14	137.5 m
Glentaggart	Infinis	Application submitted	26.7 km NE	5	132 m
Middle Muir	Banks Renewables	Application submitted	27.4 km NE	15	130 m
Mochrum Fell	Falck Renewables	Application submitted	30.9 km SE	11	126.5 m
High Dyke Farm- ST	e-Gen	Application submitted	31.8 km NE	1	84 m
Poniel Hill	SRG Renewables Ltd	Application submitted	31.9 km NE	3	100 m
Crookedstane Farm	Crookedstane Wind Farm Ltd	Application submitted	33.1 km E	5	126.5 m
Lion Hill	Lion Hill Wind Farm Ltd	Application submitted	34.3 km E	4	126.5 m
Balunton	North British Wind Energy Ltd	Application submitted	34.4 km SW	9	126 m
Auchencairn Forest	Acciona Energy	Application submitted	34.7 km SE	16	121 m
Blackwood	Force 9 Energy	Application submitted	35.4 km SE	5	130 m

Assumptions and Limitations

2.4.19 Assumptions specifically relevant to each topic have been set out in each chapter. The principal assumptions and limitations that have been identified in undertaking this EIA are:

- The assessments contained within each of the **Chapters 7 - 16** have assessed the proposed development as detailed on the application figures submitted as part of this Section 36 application;
- Baseline conditions have been established from a variety of data sources, including historical data. Due to the dynamic nature of certain aspects of the environment, conditions may change prior to and during the construction and operation of the proposed development;
- All of the land uses adjoining the application site will remain substantially unaltered once the project is implemented. Where it is foreseeable that changes may occur these have been taken account of in the assessment; and
- Potential windfarm proposals at an early stage in the planning process, for example those at screening or scoping, are excluded where there is insufficient information upon which to base the cumulative assessment, for example details of size, location and number of turbines, are not publicly available.

2.5 References

- IEMA (2004) - Institute of Environmental Management and Assessment (IEMA) (2004). Guidelines for Environmental Impact Assessment
- European Commission (1985). Environmental Impact Assessment Directive (85/337/EEC).

3. Site Selection, Design & Alternatives

3.1 Introduction

3.1.1 The assessment and selection of an appropriate site for a windfarm development is integral to the delivery of a sustainable project which employs suitable environmental mitigation. This chapter outlines the criteria used in the initial assessment to determine the suitability of the application site for the proposed Pencloe Windfarm and then describes the subsequent design process, including alternatives considered and layout evolution.

3.1.2 The EIA process involves continuous review of environmental and technical constraints. With respect to the proposed development, this process resulted in a design which is considered to be appropriate in terms of turbine specification, number and layout. The additional infrastructure which will form part of that layout is also considered to have been sited in a sympathetic and appropriate manner.

3.1.3 This chapter draws on the outcomes of the scoping and consultation reported on in **Chapter 5** and findings of the baseline assessments included in **Chapters 7 to 16**.

3.2 Site Selection Process and Alternatives Considered

3.2.1 PWEL conducted a survey of over 200 potential sites throughout Scotland starting in 2002, with sites being evaluated against the following criteria:

- Indicative wind speeds in excess of 8 m/s as estimated by the ETSU NOABL UK wind speed database;
- Environmental Sensitivity;
- Feasibility of grid connection;
- Local Plan and Structure Plan Policy;
- Area topography, including gradients, exposure, watercourses and land use;
- Landscape character;
- Distance from dwellings;
- Access feasibility;
- Cumulative impact of other windfarm developments and
- Proximity to civil and military airspace, including MOD test facilities.

3.2.2 This process led to a short-list of highly rated sites that included Pencloe. In selecting the short-list, a large number of sites were assessed and rejected on the basis of desk study findings and/or physical inspection.

3.2.3 From the short-list, a sifting process involving more detailed work on each site was used to rank the sites. The Pencloe site was identified as an optimal site for development. In addition, the land owners responded favourably to the idea of development. PWEL agreed on a suitable area to site the Pencloe Windfarm.

3.3 Consideration of Alternative Sites

3.3.1 The EIA Regulations (Schedule 4) require an ES to include:

'An outline of the main alternatives studied by the applicant or appellant and an indication of the main reasons for his choice, taking into account the environmental effects'

- 3.3.2 This is not a requirement to consider alternatives, but rather a requirement to indicate why a particular choice is being made in cases where alternatives have been considered.
- 3.3.3 There is an expectation from the Scottish Government expressed in the SPP that both strategic and local development authorities, working together where required, should identify where there is strategic capacity from windfarms and areas with the greatest potential for wind development. Paragraph 163 (of the SPP) states that “assessment should follow the approach to spatial framework preparation set out in the SPP to ensure consistency nationally and additional constraints should not be applied at this stage”. The onus will therefore remain on any windfarm developer to demonstrate that the site that they have selected is suitable for that development, rather than that there is an absence of more suitable sites. Therefore this chapter does not consider alternative sites in any further detail.

3.4 Technical and Locational Feasibility Assessment

Wind Resource

- 3.4.1 The available wind data indicates that wind speeds at the application site are sufficient to make the proposed development viable. The DECC Wind Speed Database for the UK indicates a wind speed range of 6.7m/s (close to Turbine 1), through to 8.9m/s (close to Turbine 15) at 45m above ground level. A wind speed of 6.0m/s at 45m is generally considered to be the minimum for a commercial wind energy development. A temporary anemometry mast was erected on the application site in September 2004 to confirm wind speeds and to provide site specific input into the design of the proposed development and monitoring has continued since then.

Internationally/Nationally Designated Nature Conservation and Landscape Sites

- 3.4.2 Seven statutory designated sites were found within the 10 km search zone (20 km for Special Protection Areas and Ramsar wetlands), of which one carries dual designations (as Muirkirk Uplands Site of Special Scientific Interest (SSSI) and as Muirkirk and North Lowther Uplands SPA). The designated interests at Fountainhead SSSI, Nith Bridge SSSI, Benbeoch SSSI, Lagrae Burn SSSI and Polhote and Polneul Burns SSSIs relate entirely to geological features.
- 3.4.3 The nearest nationally / internationally designated site is 5.9 km away at Muirkirk Uplands SSSI/Muirkirk and North Lowther Uplands SPA. Designated species in the North Lowther Uplands SPA, notably hen harrier, peregrine falcon and merlin, could be present at Pencloe, although the distance between Pencloe and the SPA might mean that individuals are unlikely to be part of the SPA population. Similarly the Arctic charr designated interest in Loch Door SSSI, c.10 km southwest of Pencloe, will not be impacted by the proposed development because it lies within a separate watershed.
- 3.4.4 At the feasibility study stage, PWEL anticipated that while a detailed ecological impact assessment would be necessary, good site management practices could be employed to ensure no significant impacts on the designated sites in the area. This has been confirmed through the ecological impact assessment (**Chapter 8: Non-Avian Ecology**).
- 3.4.5 One of the key considerations in a feasibility assessment for any windfarm development is its impact on landscape resources and visual amenity. PWEL identified at an early stage of the site selection process that the Pencloe site did not lie within any nationally designated landscapes (such as National Scenic Areas) and therefore would not result in any direct impacts on these.

Regionally and Locally Designated Nature Conservation and Landscape Sites

- 3.4.6 Three ancient woodlands lie within 2 km of the application site with 2 of these (Carcow and Boltwood) being adjacent to the site boundary.
- 3.4.7 Subsequently, at the time of the feasibility study in 2010, the application site was designated as Sensitive Landscape Character Areas within the East Ayrshire Local Plan (2010).

Landscape - Planning Policy and Planning Guidance

- 3.4.8 The need for local landscape protection is defined in the Ayrshire Structure Plan 2007 to cover those “*landscape areas that make a particularly important contribution to landscape quality.*” This has been adopted in the East Ayrshire Local Plan under Policy ENV3 through the designation of Sensitive Landscape Character Areas (SLCA) “*to ensure that the landscape quality of Sensitive Landscape Character Areas is maintained for the benefit of local communities.*” The policy states that the council in considering development proposals within SLCA will ensure that they respect “*the local landscape characteristics of the particular area in which they are proposed.*”
- 3.4.9 In respect of the local landscape designations, the Ayrshire Supplementary Planning Guidance (SPG): Wind Farm Development, February 2009, provides “*developers with greater clarity regarding those areas where the principle of development is likely to be acceptable - and likewise where it is not - and to provide further explanation regarding the criteria against which new development will be assessed.*” “*This Guidance is divided into two sections: Spatial Framework and Visual and Landscape considerations.*” (Paragraph 8).
- 3.4.10 The Spatial Framework defines the area identified for the proposed Pencloe Windfarm as being within an area of Potential Constraint since it falls within a Sensitive Landscape Area and is designated as Forestry Commission Access Land. The SPG does, however, qualify the nature of the constraint imposed: “*The existence of a constraint does not necessarily preclude development but should be taken as a signal to the developer that a clear understanding of the nature of the constraint, the factors that must be satisfactorily addressed and any mitigation required to produce an acceptable level of impact will need to be fully demonstrated and agreed.*”
- 3.4.11 With regard to ‘*Visual and Landscape Considerations*’ the SPG identifies management and planning guidelines for each Landscape Character Type. The proposed development falls within the Southern Uplands with Forestry Landscape Type which is assessed as having a low sensitivity to Large, Medium and Small Windfarm Developments and is given the following management recommendation in respect of windfarm development:
- “The aim of the development strategy is to conserve, and where appropriate, restore the character of the southern uplands landscape, promoting more natural patterns of land cover and reducing the visual impact of extensive areas of forestry. Large parts of the southern uplands have potential for wind power development. Wind farm development will be steered to those parts of the southern uplands already affected by forestry or other developments. More sensitive sites should be avoided. Medium scale wind power development may be suitable in areas where landform can minimise intrusion. The siting of turbines should use adjacent forested landscapes to aid screening and back clothing. Development should be located away from key skylines and valleys.”*
- 3.4.12 More recent spatial guidance for the identification of windfarm sites is contained within the East Ayrshire Landscape Windfarm Capacity Study, Carol Anderson

Landscape Associates, (July 2013). The study considers the sensitivity of key landscape and visual criteria within each defined landscape character type/area to different scales of wind turbine. The study recommended that landscapes with a combined sensitivity of medium and lower offer greatest scope to accommodate large (i.e. turbines greater than 70 m tall) and medium developments (i.e. turbines between 50 m and 70 m tall) whilst minimising significant impact on key landscape and visual sensitivities. The application site located within the Southern Uplands with Forestry (20c) LCA where the *'large scale and relatively simple land cover of this character type reduces sensitivity to larger wind turbine typologies'* however, due to the sensitivity of the nearby Doon Valley, overall the LCA is identified with an overall Medium-high landscape sensitivity to large turbines (>70 m). The SPG provides useful guidance with respect to cumulative issues and constraints which should be considered when siting development in this landscape. In this regard the following specific issues identified in the SPG have been addressed through the design optimisation process and will fully satisfy the guidance given for development of large-scale turbines in this LCA.

- 3.4.13 In summary the turbines will be set well back from the more sensitive western edges of the Southern Uplands with Forestry LCA and will avoid significant impact on the setting of Loch Doon and the upper Doon valley with no effect on the settlement of Dalmellington. The proposed development will have limited, not significant effects on the setting of Glen Afton and the Upland Basin centred on New Cumnock. The appearance of the proposed development will be compatible with the existing views to Hare Hill and Windy Standard I and II Windfarms when seen in views from the north. The following table sets out the issues raised in the SPG and confirms how they have been addressed through the design optimisation of the proposed development:

Design Compatibility with the findings of the East Ayrshire Landscape Windfarm Capacity Study, 2013 for development proposals within the Southern Uplands with Forestry LCA	
Potential Cumulative Issue	Design Response
Potential 'encirclement' of the settled Upland Basin (15) where the operational Hare Hill windfarm and any other larger turbines sited in this character type and also in the Foothills with Forestry and Opencast Mining (17a) and East Ayrshire Plateau Moorland (18a) would be seen in close proximity on containing skylines.	The proposed development will be seen in views to the south as a cluster of new development seen as a coherent part of the existing cluster of development. The character of views from the settled Upland Basin will be maintained.
Dominant effects on the small scale, settled Glen Afton incurred by any turbines sited on the eastern edge of this landscape seen in combination with the operational Hare Hill windfarm which already significantly intrudes on this scenic glen.	The proposed development is substantially sheltered by topographic from Glen Afton by Yarnallows Knowe, Craigdarroch Rig and Boltcraig Hill, with the development lying set back from Glen Afton to the west of the Lochingerroch Burn.
Constraints	How Addressed
The prominent western slopes and hills of this landscape which form the containing edges to the settled Upland River Valley (10) of the Doon Water.	The proposed development is set well back from the western slopes of the LCA, with visibility restricted to distant partial blade visibility from the higher sides of the western Doon Valley.

<p>The backdrop provided by the steep-sided rounded western hills of this character type to Dalmellington, particularly apparent in views from the A713 on the approach to the settlement from the north-west.</p>	<p>There will be no influence on the western slopes and no visibility from either Dalmellington or the approach to the settlement on the A713.</p>
<p>A complex landform of steep-sided narrow interlocking ridges found in some areas where operational and consented wind turbines (Windy Standard I and II) adopt a linear arrangement, increasing the extent of windfarm development seen in the Loch Doon area and contrasting with the more clustered layout of the Hare Hill windfarm on the nearby more rounded hills of the East Ayrshire Southern Uplands (20a).</p>	<p>The proposed development will be visible in the distance from the arc of hills to the west of Loch Doon. Where visible the proposed development will be seen in oblique views adjacent to or in overlap with Windy Standard I and II and Hare Hill respectively. There will be no visibility from the lower lying areas around Loch Doon, Loch Muck and Ness Glen.</p>
<p>Impacts on views from the public road and shores of west Loch Doon including potential cumulative effects with the operational Windy Standard I and much larger and closer turbines of the consented extension to this windfarm in these views. The setting of the scenic Loch Doon area would be compromised by larger turbines sited on prominent containing skylines.</p>	<p>There will be no visibility from the public road and shores to the west of Loch Doon.</p>
<p>Potential cumulative effects with the existing Hare Hill and Windy Standard I and II windfarms experienced from the Upland Basin (15) character type.</p>	<p>The proposed development will be seen as a coherent addition to the existing pattern of development and will appear as a similar scale of development when viewed in elevation from the north.</p>

- 3.4.14 More recently, the Scottish Government has set out, in their Scottish Planning Policy (SPP) (Scottish Government, 2014), the recommended approach that local planning authorities, such as EAC, should adopt in planning for renewable energy, particularly for onshore windfarms (paragraphs 161 – 166). This approach involves identifying areas which should be protected, areas which pose significant constraint and areas of search for windfarms. This is designed to encourage windfarm developers to explore the potential of the least constrained areas, where a development would have minimum impact. It is appropriate for the proposed development application to be determined by the *'detailed and exacting development management process where the merits of an individual proposal will be carefully considered against the full range of environmental, community, and cumulative impacts'*, as set out in the SPP.
- 3.4.15 SNH's Strategic Locational Guidance (SLG) (SNH, updated March 2009iii) identifies three zones of relative sensitivity for natural heritage interests. The application site lies within the 'Zone 2' area of 'medium heritage sensitivity' which encompasses areas subject to very different levels of planning policy guidance. Thus SNH considers that, while there is often scope for windfarm development within Zone 2 it may be restricted in scale and energy output and will require both careful choice of location and care in design to avoid natural heritage impacts.
- 3.4.16 Initial landscape assessment indicated that the proposed development would slightly increase the influence of wind turbines within a localised area within the Glenmuir and Afton SLCA but overall would not result in a change to the local landscape characteristics of the particular area in which they are proposed. The impact of the proposed development on the Glenmuir and Afton SLCA and the

Southern Uplands with Forestry Landscape Character Area has been assessed in detail in **Chapter 7: Landscape and Visual**.

Proximity to Residential Properties

- 3.4.17 There are no residential properties within the application site. The distance from the nearest properties to the closest turbine is as follows; Lynn View (1.30 km), Craig Braneoch (1.60 km), Corbyhill (1.60 km), Craigdarrock Farm (1.76 km), Craig an Dhu (1.87 km) and The Craigs (1.87 km). A review of available land following the inclusion of appropriate buffers around these properties indicated to PWEL that sufficient space would potentially be available to enable the construction and operation of a viable wind turbine development while meeting anticipated noise limits and without detrimentally affecting residential amenity. It was recognised however that cumulative effects with adjacent proposed windfarm developments would need to be addressed within the ES to confirm that this was the case.

Cultural Heritage

- 3.4.18 Following an initial review, it was concluded that there were few recorded cultural heritage assets in the vicinity of the proposed windfarm. The only designated assets in the surrounding area (all listed buildings), were found to be located in and immediately around New Cumnock.
- 3.4.19 There are also no Scheduled Monuments, Category A listed buildings, Inventory Gardens and Designed Landscapes, Inventory Battlefields or Conservation Areas within 5 km of the application site.
- 3.4.20 No un-designated cultural heritage assets were noted within the application site and in the immediate surrounding area the majority of recorded assets are related to post-medieval agriculture, in particular sheepfolds.

Road Access

- 3.4.21 The application site has good access to the road network, being located close to the A76 trunk road. The initial feasibility studies identified the need for a detailed Abnormal Load Route Assessment which has now been completed and demonstrates that access for the delivery of turbines and associated infrastructure is possible without major offsite works (**Appendix 13.1 Volume IV**).

Grid Connection

- 3.4.22 The Pencloe Windfarm project will connect into a new local 132 kV 'collector' substation being developed by SP Energy Networks, located immediately south of the Pencloe Windfarm site, where generation from the windfarm will enter the transmission network via the South West Scotland Connections Project.

Aviation and Defence Interests

- 3.4.23 The proximity of the site to Glasgow Prestwick International Airport and its location within a MOD Low Flying Area were recognised at an early stage in the site feasibility assessment. PWEL were confident that impacts on the Low Flying Area would not be significant and that mitigation would be available to maintain the performance of the Glasgow Prestwick International Airport radar (see **Chapter 15: Telecommunications, Aviation and Defence**).

Land Availability

- 3.4.24 PWEL has obtained landowner agreement with Forestry Commission Scotland over an area of sufficient size to support a viable wind energy development, subject to the outcome of necessary environmental studies.

Feasibility Assessment Conclusions

- 3.4.25 On completion of the initial feasibility assessment, the application site was considered to provide a viable development site. It was acknowledged that liaison with Prestwick and NATS would be required to agree and implement mitigation measures with respect to impacts upon aviation and radar and that the site layout would need to consider the potential cumulative impact due to the presence of a number of windfarms within its vicinity.
- 3.4.26 The application site was considered to have the following advantages for the development of a windfarm:
- Exposed location with good wind speeds;
 - Location that naturally reduces views of the windfarm from the local and regional area;
 - Proximity to the new grid connection hub that is under construction and
 - Availability of land to accommodate a commercial scale windfarm with a generating capacity that will make a meaningful contribution to the UK and Scottish Governments' renewable energy targets.
- 3.4.27 The decision was therefore made by PWEL to progress to the scheme design and planning application stages and to undertake any necessary detailed studies which included the commissioning of further baseline surveys and an EIA.

3.5 Site Design and Layout Evolution

- 3.5.1 An iterative and constraints based approach was adopted and this has produced a sequence of layouts with changes made to reflect the increasing database of knowledge being collected about the application site and its surroundings during the EIA process. These changes and the three principal layout iterations produced are summarised below to illustrate the approach adopted by PWEL to the design of the proposed development.

Design Strategy

- 3.5.2 Throughout the evolution of the proposed development, from initial site selection through to detailed site design, the design strategy utilised by PWEL has been one of minimising the potential environmental impacts through an environmental constraints based approach, incorporating and considering the responses and advice from the statutory consultees such as those detailed during the scoping phase.
- 3.5.3 The principles of the design strategy were threefold in order to develop a layout that:
- responds to the particular landform and topography of the application site;
 - maximises the wind yield onsite with due consideration of the known environmental constraints and
 - is buildable and realistic given the application site constraints.
- 3.5.4 Environmental constraints have been identified as the different EIA technical assessments have progressed; those constraints that have had the most significant effect on the windfarm layout have arisen under the headings of landscape, noise, sensitive habitats and watercourses and the layout has been amended to take account of these. Aviation constraints have also influenced the layout. This approach to site design identifies and avoids potential significant environmental risks and impacts from the proposed development and allows PWEL to focus on areas of the application site which are more suited to the construction and operation of a commercial windfarm.

The Initial Scoping Layout (December 2011)

- 3.5.5 The initial Scoping Layout (See **Figure 2.1 Volume III**) was based on development over two landholdings, the larger Carsphairn Forest (i.e. part of the FCS landholding) and a smaller parcel of land to the east owned by the Lochingerroch Estate. The layout was produced by the Jacobs landscape team, utilising much of the available development area.
- 3.5.6 The Scoping Layout was based upon an evaluation of the application site against technical, commercial and environmental criteria. These included site topography, gradient, wind speed, land requirement, proximity to residential properties/roads/power lines, grid connection feasibility, proximity to designated sites, planning policies, the existing forestry tracks onsite and areas that, from site knowledge and a map based review, looked suitable for turbines and associated infrastructure. Based on these criteria, the application site was identified as being appropriate for a wind turbine development.
- 3.5.7 Up to this point, limited baseline survey work had been undertaken at the application site (aside from a number of ornithological studies which had been undertaken since 2006) and therefore no detailed environmental or engineering constraints had been applied to the layout.
- 3.5.8 At this stage the windfarm layout (in its draft configuration) consisted of 33 turbines with a height of up to 130m to blade tip (85m to hub) and a total capacity of up to 99 MW. The turbine layout was designed to follow the four ridges with turbines located broadly in four adjacent arrays at a height of approximately 400m AOD to 500m AOD, these being Milray Hill, Auchincally Hill, Meikle Hill and Yarnallows Knowe, a sequence of rolling hills which increase in height towards the southwest of the application area and extend to the north as tapering ridges.

First Iteration Layout, Early Optimisation (December 2012 to October 2013)

- 3.5.9 The First Iteration Layout comprised 33 turbines with a maximum tip height of 130 m (see **Figure 2.1 Volume III**). This layout was produced subsequent to scoping and also a preliminary design exercise which took account of site specific work undertaken under the following headings:
- hydrological / hydrogeological baseline assessment;
 - peat depth survey;
 - civil engineering appraisal and slope gradient analysis and
 - landscape evaluation and cumulative assessment.
- 3.5.10 The identified constraints are summarised below. The cultural heritage features identified during site surveys were not located close to the proposed turbine locations and were not therefore considered to constrain the site layout.

Hydrology and Hydrogeology

- 3.5.11 The results of a desk study, site survey and a review of consultation responses were used to inform hydrological and hydrogeological constraints. A 50m buffer was applied to watercourses. Flood risk and geology were considered to have local/low sensitivity from the proposed development, with further information regarding the location and type of private water supplies yet to be confirmed at this stage. Initial information on ground water dependent terrestrial ecosystems was also considered.

Peat Depth

- 3.5.12 The main outcomes from the peat survey were:
- significant peat cover (i.e. >1.0m) was generally absent across the majority of the application site, with peat depths being lower in the northern half;
 - localised areas of deeper peat (up to a maximum depth of 2.85m) were encountered, predominantly in the eastern and southern sections of the application site and
 - visible indications of potential minor peat slide activity were limited to an area of open moorland located within the south eastern part of the site.
- 3.5.13 The findings of the survey were utilised to assist the civil engineering design for the turbine layout and enable the development of a preliminary infrastructure layout for the proposed windfarm. The layout has, therefore, been designed to avoid, as far as practicable, potential risks from the identified peat constraints.
- 3.5.14 Based upon the findings of the preliminary peat depth survey, it was considered that Peat Slide Hazard and Risk Assessment (PSHRA) works were required prior to the final design freeze in order to assess the proposed turbine (including crane hardstandings), access tracks and the substation locations, focussing further investigation works within the areas of proposed infrastructure.

Civil Engineering Constraints

- 3.5.15 The main focus of the civil engineering design centred upon the turbine locations, the access tracks and the crane platforms required for construction, installation and maintenance. The initial design work was undertaken based upon typical design parameters. Given the location of the application site and the anticipated ongoing FCS activities, FCS design requirements were also considered in terms of forestry management. The design requirements for commercial forestry access tracks are similar in nature to typical windfarm tracks although there will be a need for additional cross-drainage below tracks as part of the detailed design and construction.
- 3.5.16 The preliminary design parameters set out in the table below were utilised for the track design.

Parameter	
Maximum track gradient	10% (uphill approach)
	14% (downhill approach)
Track width	6m wide running surface
Horizontal curve radii	typically 50m as a minimum
Vertical curve radii	minimum of 500m (sag and hog)

Landscape Evaluation and Cumulative Assessment

- 3.5.17 A preliminary design review was carried out using the principles of the design strategy set out above. It was decided to prepare a layout that took account of the site survey work for hydrology, peat and civil engineering constraints, which then could also be reviewed specifically from a landscape and visual perspective, before proceeding to a final design optimisation.
- 3.5.18 The preliminary landscape and visual design optimisation worked through a sequence of design iteration, reducing effects on a range of sensitive receptors, reducing unsatisfactory combinations of turbines from key viewpoints, positioning turbines so they did not appear to be dominating, avoiding extensive intrusion into

Glen Afton and seeking to create a simple layout which complemented the underlying pattern of topography. The following eight design viewpoints were used as a basis for the optimisation work, selected to represent a range of different receptors close to the application site.

- Viewpoint 1, Near entrance to Pencloe, Glen Afton;
- Viewpoint 2, Glen Afton Road, immediately to north of Lochingarroch Plantation;
- Viewpoint 3, Connel View, southern edge of New Cumnock;
- Viewpoint 4, Burnfoot Road, Burnside (B741);
- Viewpoint 5, A76 north of New Cumnock;
- Viewpoint 6, Blackcraig Hill;
- Viewpoint 7, Benbrack on the Southern Upland Way and
- Viewpoint 8, Cairnsmore of Carsphairn.

3.5.19 Cumulative windfarm considerations were also an important influence on the formation and extent of the proposed development to fit with the existing layouts and tie in with the strongly aligned arrays of the adjacent proposals. In the context of this emerging pattern of development it is considered that the landscape has capacity for the addition of the proposed Pencloe Windfarm to the emerging cluster of Windy Standard, Afton and Ashmark Hill. The cluster was designed to achieve a compact footprint and importantly it is discretely sited in the landscape, in particular from more sensitive receptors to the south. The design was considered in the light of the existing and emerging pattern of windfarm development to form an acceptable scale of development conforming to the concept of cluster and space.

3.5.20 The 33 turbine First Iteration Layout that resulted from this Preliminary Design exercise was taken forward to public consultation in 2013.

Second Iteration Layout (November 2013 - May 2014)

3.5.21 Later in 2013 a re-evaluation of the layout was undertaken following clarification of the grid capacity available at Pencloe and this applied the design principles that had been used in the first design iteration.

3.5.22 At this time some detailed modelling with respect to Aviation constraints and the visibility to NATS radar in particular, was also undertaken.

3.5.23 The Second Iteration Layout comprised 21 turbines up to 130 m to blade tip and is shown in **Figure 1.2 Volume III**.

3.5.24 While the larger 33 turbine layout had been considered a viable and acceptable scheme, the reduction in turbine numbers had the following environmental benefits:

- Further reducing the visibility of the proposed windfarm in views from New Cumnock and other settlements the north;
- Preventing any significant visibility of turbines from residential and other receptors to the west and from Glen Afton in particular;
- Reducing the potential for cumulative noise impacts (with the consented Afton Windfarm to the immediate south east) on residences to the east of the application site in Glen Afton and
- Eliminating any visibility of turbines to NATS radar.

3.5.25 The track layout and location of the remaining infrastructure was then optimised to avoid areas of groundwater dependent terrestrial ecosystems (following more

detailed survey work) to minimise felling and to safely accommodate the necessary vehicle manoeuvres.

- 3.5.26 A final optimisation exercise was undertaken based on a larger turbine blade of 49 m, as opposed to the 45 m blade that had been used in the earlier iterations. This design change greatly increases the wind capture and potential output of the proposed development and due to a lowering of hub height reduced overall tip height to 125 m.
- 3.5.27 The larger blade size also increases the individual capacity of each turbine from 3.0 MW to about 3.3 MW.
- 3.5.28 Following a request for a detailed specification from the candidate turbine supplier the design parameters being utilised with regards to the design and location of the access tracks and crane hardstandings were altered in order to ensure that the design was appropriate.
- 3.5.29 This final iteration has resulted in the proposed layout taken forward for the Section 36 Application to the Scottish Government.

3.6 Site Selection and Project Design Conclusions

3.6.1 PWEL considered a range of environmental, technical, legislative and economic factors when investigating opportunities for onshore windfarm developments. Following a site selection and feasibility process, underpinned by the results of the EIA, the application site was considered to have the following advantages for the development of a windfarm:

- An excellent wind resource suitable for a commercial windfarm that would be deliverable within national time scales;
- A potentially large area that could provide significant benefits in terms of generating electricity and displacing greenhouse gas emissions;
- Limited visual impact on built-up areas owing to the nature of the terrain;
- A sparse settlement pattern to the east and north of the application site. This offers a substantial distance between the turbines and any residential properties to enable the proposed development to satisfy stringent noise requirements;
- Absence of statutory designated sites/features on the application site;
- Good connectivity to the national electricity grid infrastructure and
- Opportunities for beneficial habitat management across a commercial forest.

3.6.2 The final design of the layout of the proposed development has followed an iterative process that has taken into consideration technical and environmental constraints, including reducing the visibility of the proposed windfarm from New Cumnock and from Glen Afton in particular; reducing the potential for cumulative noise impacts (with the consented Afton Windfarm to the immediate south east) on residences to the west of the application site in Glen Afton and eliminating any visibility of turbines to NATS radar.

3.7 References

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- SNH, 2009a Siting and Designing Windfarms in the Landscape, December 2009
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- Ayrshire Joint Structure Plan 2007
- Ayrshire Supplementary Planning Guidance: Wind Farm Development, February 2009
- Wind Farms: Addendum to Ayrshire Joint Structure Plan Technical Report TR03/2006
- East Ayrshire Local Plan 2010
- Carol Anderson Landscape Associates, East Ayrshire Landscape Wind Capacity Study, July 2013.

4 Project Description

4.1 Introduction

4.1.1 This chapter describes the layout and associated infrastructure of the proposed development (see **Figure 4.1 Volume III**). It also outlines the construction programme, the proposals for operation and the approach to decommissioning.

4.2 The Application Site

4.2.1 The application site is wholly located within the East Ayrshire Council area, immediately to the north of the Dumfries & Galloway Council border. The boundary of the application site is shown in **Figure 4.1 Volume III**. The application site lies within part of an extensive area of forestry plantation known as Carsphairn Forest. New Cumnock is the closest settlement to the application site, lying some 2.5 km to the north at its nearest point with Dalmellington located some 11 km to the west. Afton Reservoir lies about 1.5 km to the southeast. The grid reference of the centre of the application site is NS 60507 06671.

4.2.2 The land cover across the majority of the application site area almost exclusively comprises mature commercial forestry plantation only broken in a number of discreet areas. All of the application site is managed by Forestry Commission Scotland (FCS). The northernmost end of the site comprises farmland (sheep grazing) adjacent to Pencloe Farm. The land rises to a series of ridges between 400 m and 526 m Above Ordnance Datum (AOD) and these are separated by relatively steep sided stream valleys. The site drains to the north via the Carcow, Glenhastel, Glenshalloch, Lochingerroch and Bolt Burns, which in turn feed into the Afton Water.

4.2.3 The application site occupies an area of about 871 hectares (approximately 2,152 acres). The site is surrounded by further conifer plantations to the south and southwest and open agricultural grazing moorland to the north, east and west. Afton Road, which roughly follows the course of Afton Water, runs to the east of the site. The application site is remote and the nearest properties to it are listed in **Table 4.1**.

Table 4.1 Nearest Properties

Property	Distance and direction to nearest turbine (km)	Distance to application boundary (km)
Lynn View	1.30 km north west	1.06 km
Craig Braneoch	1.59 km west	1.47 km
Corbyhill	1.60 km west	1.47 km
Craigdarrock Farm	1.76 km west	1.64 km
Craig an Dhu	1.87 km west	1.74 km
The Craigs	1.87 km west	1.75 km

4.3 General Description

Wind farm components

4.3.1 The principal components of the proposed windfarm are shown on **Figure 4.1 Volume III**, and comprise:

- 21 wind turbines each with an anticipated maximum rated capacity of up to 3.3 MW and up to 125 m to tip;
- Permanent foundations supporting the wind turbines and associated crane hardstandings (used during construction, operational repair and decommissioning);
- Transformers (one per turbine) which will be housed externally next to the base of the turbine;
- One new access bell mouth arrangement from the unclassified road along Glen Afton;
- 17.8 km of permanent access tracks into the application site from the public highway and between turbines, including 5.2 km of upgrade to existing forestry tracks;
- Six water crossings to accommodate the access tracks;
- A control building and substation compound (including electrical metering, stores, office and welfare facilities);
- Underground cabling between the turbines and control building and substation compound, running alongside access tracks where possible;
- High voltage export cable or overhead line to the nearest Scottish Power Energy Networks (SPEN) substation (a new facility planned adjacent to the application site);
- Four borrow pits (in total circa 1.0 ha in area);
- Three permanent free-standing anemometry masts (up to 85m) with associated foundations and hardstanding and
- Two temporary construction compounds and a temporary security office.

Layout

4.3.2 **Table 4.2** details the locations of the principal components of the proposed development. Each component is considered in more detail below. A layout plan is shown in **Figure 4.1 Volume III**.

Table 4.2 Locations of Windfarm Components

Component	NGR	Easting (NGR)	Northing (NGR)
Wind Turbines (T)			
T1	NS	61284	07224
T2	NS	61240	06828
T3	NS	61219	06412
T4	NS	61572	06326
T5	NS	61365	05944
T6	NS	61377	05579
T7	NS	60977	05598
T8	NS	61100	05193
T9	NS	60686	05784
T10	NS	60515	06055
T11	NS	60253	06260
T12	NS	60182	06617

Component	NGR	Easting (NGR)	Northing (NGR)
T13	NS	60008	06898
T14	NS	60382	07050
T15	NS	60276	05686
T16	NS	59717	05357
T17	NS	59215	05384
T18	NS	59090	05686
T19	NS	59134	06033
T20	NS	59463	05922
T21	NS	59740	05785
<i>Anemometry Mast A</i>	NS	61287	07431
<i>Anemometry Mast B</i>	NS	59306	05638
<i>Anemometry Mast C</i>	NS	60185	06822
<i>Northern Temporary Construction Compound</i>	NS	61512	08646
<i>Southern Temporary Construction Compound</i>	NS	60319	05583
<i>Control Building & Substation Compound</i>	NS	60937	05367
<i>Site Access Point</i>	NS	61975	09801
<i>Temporary Security Office</i>	NS	61938	09796
<i>Borrow Pit 1</i>	NS	61024	08432
<i>Borrow Pit 2</i>	NS	61020	07353
<i>Borrow Pit 3</i>	NS	59802	06707
<i>Borrow Pit 4</i>	NS	61523	08540

Detailed Design and Micrositing

- 4.3.3 Where possible, identified environmental constraints have been avoided, including areas of deeper peat, particularly sensitive habitats, locations occupied by protected species, watercourses and cultural heritage features. Where avoidance has not been possible, mitigation measures have been proposed to prevent significant effects, as described in the relevant ES chapters. The evolution of the design of the project layout and the consideration of these constraints is described in **Chapter 3: Site Selection and Design Evolution**.
- 4.3.4 In the event of Section 36 Consent being granted for the proposed development, intrusive site investigations will be undertaken to inform the detailed design of the windfarm layout. This will include, for example, orientation of crane hardstandings and detailed track construction methods. It is possible that unforeseen ground conditions will require the route of the access tracks and positions of individual turbines and other windfarm components to be microsited to facilitate construction and /or reduce potential environmental impacts. It is proposed that micrositing within 50m from a stated location be permitted. Such micrositing will be overseen by the Ecological Clerk of Works (ECoW) and will be in accordance with the identified environmental constraints such as the 50 m standoff from mapped watercourses (see **Chapter 3: Site Selection and Design Evolution**).

4.4 Wind Turbines

Wind Turbine Generators

- 4.4.1 Each of the proposed wind turbines will be a 3-bladed modern design, with an anticipated maximum capacity of around 3.3 MW. The nacelle (which houses the power generation equipment) will be supported by a tapering cylindrical steel tower. The maximum height of the blade tip from ground level will be 125 m. There are a number of candidate turbines that would be suitable for the application site. For the purposes of the ES, each environmental assessment topic has considered the largest blade tip height of 125 m with a hub height of 74.5 m and rotor diameter of 101 m. The final selection of turbine model will be subject to competitive tendering.
- 4.4.2 The proposed wind turbines will be erected using two large mobile cranes. The main lifting crane will have a lifting capacity of up to 900 tonnes while the second (or tail) crane will have a lifting capacity of circa 500 tonnes. The two cranes will lift turbine tower sections and blades from the delivery vehicles and into their assembly position. The larger crane will be used to lift the tower sections, turbine nacelle and the hub and blade assembly into position. The tail crane will help to align and position the components whilst being installed. Once each turbine is assembled and installed, the two cranes will be moved to the next turbine position.
- 4.4.3 The turbines will then undergo a series of commissioning tests, after which they will be ready to generate electricity under normal operation.
- 4.4.4 A typical turbine, with maximum dimensions of 125 m to blade tip is included in **Figure 4.2 Volume III**. It is proposed that the turbines will be of a pale-grey colour with a non-reflective semi-matt finish coating.

Wind Turbine Foundations

- 4.4.5 The wind turbines will be supported on concrete foundations, measuring approximately 20 m by 20 m and 3.5 m in depth, dependent on ground conditions (see **Figure 4.3 Volume III**). Each foundation will have a 5 m diameter central pedestal where it meets the turbine tower.
- 4.4.6 Construction of the turbine foundations will involve the excavation of soil / peat, prior to the *in situ* casting of the steel-reinforced concrete slab. Surplus soil / peat will be stored separately and used to create a batter on the edges of the tracks and hardstandings or to reinstate areas local to each turbine. Any turf with vegetation removed will be carefully stacked on the surrounding ground to preserve vegetation, until required for re-turfing.
- 4.4.7 The depth of the excavation will depend on the need to reach suitable substrate but will typically be 3.5 m. The sides will be 'battered' back to ensure that they remain stable during construction. Therefore the excavation for each foundation could extend to 24 m across. It is estimated each foundation will require approximately 1430 m³ of concrete and up to 200 tonnes of steel reinforcing.
- 4.4.8 The concrete pedestal will be cast on top of the main slab of the individual turbine foundations, to which the turbine tower will later be bolted, and the excavated area will be back-filled with compacted layers of graded material from the original excavation. This will be capped with approximately 150 mm of soil or peat, which will either be flush with the existing ground surface or will form a raised mound between 300 and 500mm above the existing ground level, depending on the depth of the foundation at each specific turbine location. The turbine foundations will be

covered and reinstated as appropriate, leaving only a narrow area of concrete at the base of each turbine tower and a stoned access path around the base. The turbine foundation area will be allowed to re-vegetate and will permit the natural infiltration of surface water.

4.4.9 Turbine foundations will be constructed using concrete appropriate to the chemical conditions encountered in the turbine locations. This will ensure that the concrete will not degrade when in contact with acidic water.

4.4.10 The turbines and their foundations will be designed with containment systems to prevent accidental releases of, for example, lubricating oil, from leaving the turbine tower.

Crane Hardstandings

4.4.11 Hardstanding areas will be required adjacent to each turbine base to accommodate cranes and their outriggers. These will be of similar construction to the tracks (see below), but covering a triangular area adjacent to the turbine foundation, approximately 55 m x 41 m x 68.6 m (the hypotenuse along track edge) and covering an area of 1128 m². Two additional 'tail crane' hardstandings (each 12 m x 3 m) may also be required, depending on the local topography and the type of crane ultimately used for construction. A typical hardstanding layout is presented in **Figure 4.4 Volume III**. The actual design and layout will be determined by the turbine supplier according to their specification.

4.4.12 The crane hardstandings will be excavated and backfilled with stone to a suitable depth. Surplus soil and peat will be used to batter the edges of the tracks and hardstandings or landscaped local to each turbine.

4.4.13 The orientation of the crane hardstandings will be optimised to make best use of the existing topography, prevailing wind conditions (to enable safe lifting) and the erection procedure. The locations of the hardstandings shown in **Figure 4.1 Volume III** are indicative only. Where ecological or other constraints are identified during the construction phase, the crane hardstanding will be re-orientated where possible.

4.4.14 The crane hardstanding will remain *in situ* throughout the operational phase.

Wind Turbine Transformers

4.4.15 An electrical transformer will be located within a housing outside and adjacent to the turbine base. The transformer housing will not exceed 4 m x 6 m x 3 m (high). The external finishes will typically be rendered masonry or moulded plastic, the colour of which will be agreed with East Ayrshire Council. An example of the transformer housing is included in **Figure 4.5 Volume III**.

4.5 Access Tracks

Site Access

4.5.1 A new access bell mouth arrangement is proposed from the Afton Road into the application site for use by construction vehicles, including abnormal load vehicles and also for use throughout the operational and decommissioning phases of the proposed development.

4.5.2 The location and form of the application site access junction have been agreed in principle with Transport Scotland. Visibility splays of 2.5 m x 100 m and 2.5 m x 90 m to the north and south respectively can be achieved as shown on Figure 0002 in **Appendix 13.1 Volume IV**. Given the nature of Afton Road, where traffic speeds are likely to be low due to its width and alignment, the achievable visibility splays are deemed to be sufficient. The first 7.5m of the bell mouth apron will be metalled and finished with a blacktop (macadam) surface and tied into the existing carriageway. Behind the bell mouth the track will be finished with a compacted granular surface. If required new stock-proof fencing will be installed adjacent to the new access track in the northern part of the application site.

Internal Access Tracks

4.5.3 The layout of internal access tracks is shown on **Figure 4.1 Volume III**. Approximately 17.8 km of access tracks will be required to access and link the turbines. It is currently estimated that 12.6 km will be new track and 5.2 km will be upgrade to the existing forestry tracks. Tracks will have a minimum running width of 5 m with widening on bends as necessary. Local widening will be required on corners, with the amount of land required depending upon the angle of slope and the severity of the bend on plan. Passing places will be required along the length of the track. Where the existing track is used it will require some upgrades including widening, re-alignment and re-grading to make it suitable for the construction and delivery traffic.

4.5.4 The overall track length has been kept to a minimum to reduce environmental effects, construction time and material quantities. The following issues have been carefully considered and avoided where practicable:

- archaeological and hydrological features;
- Ground Water Dependent Terrestrial Ecosystems (GWDTEs);
- deeper areas of peat; and
- protected species and habitats.

4.5.5 Gradients have been kept to less than the recommended gradients from the turbine supplier, generally shallower than 1 vertical: 10 horizontal to facilitate access by the large specialist vehicles for both construction and transport of the turbine components and also to allow construction plant to move safely round the site; and the layout has been optimised to align with appropriate orientation of crane pads/hardstandings.

4.5.6 Tracks will be constructed on the cut track principle where soil (including turves), and peat, or other sub-soils are excavated down to the underlying strata. The excavated track is then backfilled with approximately 0.75 m depth of compacted stone and stripped turves and excavated peat or top-soil/sub-soil is used appropriately to dress and landscape the side slopes and verges. Typical track cross sections for excavated track are shown in **Figure 4.6 Volume III**.

4.5.7 At bends, the tracks will widen as appropriate depending on bend radius required. The edges of the tracks will be encouraged to re-vegetate after construction, while maintaining a suitable width of approximately 4.5 m for maintenance vehicles throughout the operational period. All new tracks will be unpaved and constructed from material sourced from the onsite borrow pits. Temporary passing places (up to 60 m x 5 m) would also be provided at intervals to facilitate traffic movements. It is currently anticipated that 5 passing places will be required, as shown on **Figure 4.1, Volume III**.

Drainage Management around Access Tracks

- 4.5.8 The need for drainage will be established onsite during construction by observation. Tracks will be designed with a slight camber to encourage runoff to adjacent trackside drains. Trackside drains will be provided to control runoff from construction areas especially during heavy rainfall. Trackside drainage will comprise infiltration trenches with check dams which will be unlined to allow the standing water to infiltrate back into the ground (see **Section 10.7 Hydrology, Hydrogeology and Geology**).
- 4.5.9 Maintenance of existing drainage is important, therefore identified existing drainage routes including, if present, 'peat pipes' which have formed naturally will be maintained and, where necessary, channelled below the proposed track construction. Upslope side drainage ditches to the track will be required on side-long ground; the ditches would be constructed with small dams and cross drains where necessary so that:
- Water can pass below the track at regular intervals; and
 - Scour and erosion is avoided in the side ditches due the limited volume and velocity. Concentrated discharges to the peat on the down slope side of the track are avoided.
- 4.5.10 The track drainage design will ensure that runoff rates are not increased and will be sized to be able to accommodate runoff flows for the life of the proposed development. The final drainage design will take into account predicted increases in rainfall intensity due to climate change and will be subject to approval by East Ayrshire Council and SEPA. Drainage provisions beneath access tracks that run perpendicular to slopes will ensure continuity of surface water flows to downslope catchments. **Chapter 10 Hydrology, Hydrogeology and Geology** includes further information regarding the management of surface water drainage.

Water crossings (access tracks)

- 4.5.11 There will be a requirement for permanent crossings of a number of watercourses or drainage channels to accommodate the new access tracks. The location of each of the crossings is provided in **Table 4.3** and also shown on **Figure 4.1 Volume III**.

Table 4.3 Access Track Crossings

Name	Reference	Easting (NGR)	Northing (NGR)	Description
Unnamed tributary of Glenshalloch Burn	Crossing 1	260954	608279	Existing crossing, needs upgrading
Glenshalloch Burn	Crossing 2	260859	607363	Existing crossing, needs upgrading
West Strand, tributary of Water of Deugh	Crossing 3	259560	605546	New crossing, will be a minor crossing (probably culvert)
Unnamed tributary of Afton River	Crossing 4	261811	609623	Existing crossing, needs upgrading
Unnamed tributary of Afton River (likely ephemeral flow)	Crossing 5	261909	609726	Existing crossing, needs upgrading
Unnamed tributary of Afton River (likely ephemeral flow)	Crossing 6	261943	609764	Existing crossing, needs upgrading

- 4.5.12 The crossings will be constructed in accordance with the SEPA and CIRIA good practice guidance and will be agreed in advance with SEPA. It is proposed that the crossings are made by pre-cast circular or semi-circular piped culverts, and these will be generally adopted with culvert sizes based on ensuring conveyance of the 0.5% Annual Exceedance Probability (AEP) flow, including an allowance for climate change on future rainfall intensities. Design of these crossings will take into consideration overland flow routing in the event of a blockage and crossings will be designed to direct flow back into the watercourse downstream of any obstruction. Culverts will be embedded so that the base is at grade with the streambed, or lower to maintain bed form processes and minimise disruption to wildlife migration. The need for ledges to enable the movement of mammals through the pipe will be assessed at the design stage and incorporated if necessary. An indicative drawing of a typical culvert is shown in **Figure 4.7 Volume III**.
- 4.5.13 The construction of all watercourse crossings will be bound by the protocols of a Construction Environmental Management Plan (CEMP) (see **Section 4.14** of this chapter and also **Chapter 17: Summary of Mitigation Measures**) to avoid polluting watercourses with soil or sediment.

4.6 Anemometry Masts

Permanent Masts

- 4.6.1 Three permanent self-supporting anemometry masts, up to 85 m tall, will be installed to inform the operation of the proposed development and performance monitoring, see **Figure 4.8 Volume III**. The proposed mast locations are shown on **Figure 4.1 Volume III**. A temporary 60 m anemometry mast is currently located onsite and is currently subject to an application for extension of use.
- 4.6.2 Each mast will require a concrete foundation, measuring approximately 6 m x 6 m and 2.5 m deep and a crane hardstanding measuring approximately 20 m x 20 m. The masts will be erected using a small crane.
- 4.6.3 Access to the masts will be along a 4 m wide track connected to the main network of access tracks.

Temporary Mast

- 4.6.4 It may be necessary to erect a temporary anemometry mast during the construction period in order to allow calibration between wind conditions at the location of the permanent anemometry masts and the positions of the turbine locations. This will be the same height as the permanent anemometry masts (up to 85 m) and will be moved from turbine location to turbine location as construction progresses. The temporary mast will be removed prior to the final turbine being erected.

4.7 Control Building and Substation Compound

- 4.7.1 The cables from each of the turbines will be collected at the control building and substation compound. The location of the compound has been selected due to the grid connection being routed to the south of the site and is shown on **Figure 4.1 Volume III**.
- 4.7.2 The indicative layout of the compound is shown in **Figure 4.9 Volume III**. The control building will comprise a single storey control building measuring approximately 23 m x 10 m with a pitched roof and an external compound (anticipated to be 9 m x 9 m) for electrical equipment. The building will contain

transformers and switch-gear, stores, site communications (i.e. SCADA), an office and welfare facilities. An indicative design of is shown in **Figure 4.10 Volume III**.

- 4.7.3 The compound will measure approximately 50 m x 100 m and will contain car parking facilities and a storage yard. The compound will be surrounded by fencing.
- 4.7.4 It is expected that the small quantity of sewage arising from the infrequent visits of maintenance staff will be removed from site by a licensed operator. A rainwater collection system will be installed to provide water for flushing which, if necessary, will be topped up with water brought to site by tanker delivery in dry periods. Excess rainwater falling on the roof of the building will be discharged to an infiltration drain or other Sustainable Drainage System (SUDS) around the compound.
- 4.7.5 The building will be constructed in keeping with the local built environment. The final designs for the building and compound will incorporate sustainable design features and will be agreed with East Ayrshire Council.

4.8 Cabling

- 4.8.1 The wind turbines will be linked together with underground cabling, three 33kV, single-phase cable circuits will be required to export electricity from the wind turbines to the control building and substation compound.
- 4.8.2 The construction of the cable route will minimise disturbance to drainage by taking the route alongside the access track and around the turbines adjacent to the access tracks shown in **Figure 4.1 Volume III**. All cables will be laid in trenches approximately 0.6 m wide by 1.2 m deep, as shown in **Figure 4.11 Volume III**. The cables will be laid directly into the trench and a sand surround applied prior to the overburden being replaced in the trench. To prevent water tracking along trenches, clay plugs or similar plugging material will replace the backfill in short (typically 1m) sections, with the distance between plugs dependent on the track slope.
- 4.8.3 The position of trenches will be marked out and the line stripped of turfs and soils and set aside for reinstatement. If the cable route is on rock this may require excavation of rock or alternatively laying cable in a mounded strip to minimise excavation of rock.
- 4.8.4 In areas of trenching, the vegetation layer and peat/soil will be removed and segregated from the removed subsoil for use in reinstatement. If necessary where depth allows, further segregation of the vegetation layer and peat/soil will be undertaken to prevent burying of the upper vegetation layers in deeper soil upon replacement. To mark the location of cable, markers will be placed at regular intervals along the track edge.

4.9 Grid Connection

- 4.9.1 The proposed development is one of several windfarm projects that would be enabled by Scottish Power's South West Scotland Connections project for which Stage 1 (Coylton Substation to New Cumnock Substation and associated overhead line) was granted consent in December 2012. Construction work on this stage has subsequently commenced. The Pencloe Windfarm project will connect into a new local 132kV 'collector' substation (developed by SPEN), located immediately south of the application site (as shown in **Figure 4.1 Volume III**), where generation from the windfarm will enter the transmission network.

- 4.9.2 The connection to this new substation will be subject to a separate planning application by SPEN (if not permitted under general development rights), and if required, an appropriate environmental assessment will be undertaken.

4.10 Temporary Works

Construction Compounds

- 4.10.1 During the construction phase, two temporary construction compounds will be required, one close to the site entrance, where the existing access track enters the forest and a second in the vicinity of turbine 15. Grid coordinates for these compounds are presented in **Table 4.2** of this chapter, and their locations are shown on **Figure 4.1 Volume III**.
- 4.10.2 An indicative layout for the construction compounds is shown in **Figure 4.12 Volume III**. The dimensions will be approximately 100 m x 50 m. The areas will be prepared by stripping peat/soil, laying down a geotextile material and then a working surface of stone. The stripped material will be stored adjacent to the working area for subsequent use in reinstatement and screening. It is anticipated that the construction compounds will include:
- Temporary portacabin type structures to be used for the security and site offices;
 - Welfare facilities, including portacabin toilet with provision for sealed waste storage and removal;
 - Parking for construction staff, visitors and construction vehicles;
 - Laydown areas for the storage of large items;
 - Secure storage for tools, small parts and oils;
 - Waste storage facilities;
 - A receiving area for incoming vehicles; and
 - A concrete batching facility (if required).
- 4.10.3 In addition, a temporary wheel-wash facility will be located close to the access from the public road to reduce the amount of mud deposited on local roads before vehicles exit the application site.

Borrow Pits

- 4.10.4 To minimise the volume of imported material brought to site and any consequent environmental impact, it is preferred that borrow pits located within the application site will be used to source the necessary aggregate required for track upgrade and construction, turbine base backfill, crane hardstandings, compounds and other hardstanding areas. A borrow pit assessment (see **Appendix 10.6 Volume IV**) has been undertaken to identify the optimal locations within the application site, such that suitable controls and methodologies can be implemented during the design and construction phases.
- 4.10.5 Four borrow pits are proposed which PWEL aim to use to source around 63,100 m³ of aggregate for construction of the proposed development. The four identified areas, as shown on **Figure 4.1 Volume III**, have all previously been used for the excavation of stone and are estimated to have reserves sufficient to supply in excess of the required amount of aggregate. The proposed locations have been selected because of their morphology, accessibility from existing or new access tracks, orientation and their previous use.

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- 4.10.6 The rock would be extracted using standard quarrying techniques and crushed to provide the required road stone properties. Rock from the borrow pits would be checked to ensure it is compatible with its intended place of use.
- 4.10.7 Prior to the excavation and where required, soil/peat will be removed and stockpiled for use in reinstatement. The majority of the rock will be ripped using an excavator, however it is anticipated that some blasting may be required in certain instances.
- 4.10.8 The borrow pits would be restored following extraction of stone, and indicative plans for each pit are shown in **Appendix 10.6 Volume IV**. It is currently anticipated that the floor of the pits will be built up with surplus soil/ peat excavated during the construction of the windfarm. The side slopes of the borrow pits will be graded to a safe angle to prevent collapse and to provide a landform shape that integrates the feature, as far as practicable, with the adjacent landscape. The soil/peat will be replaced and prepared to create suitable ground conditions for seeding or re-turfing. Any seeding would be carried out in accordance with techniques and seed mixes approved by East Ayrshire Council. Detailed methodologies regarding removal of topsoil and reinstatement methods and approaches would also be agreed with the Council.

Security Office

- 4.10.9 During the construction period, a temporary security office will be located on the access track, close to the access from Afton Road.

4.11 Felling and Forestry Management

- 4.11.1 Given the predominant commercial forestry cover over the application site, a plan has been prepared to address the implications for forestry management in the event of the proposed development being approved and constructed, and is provided within **Appendix 4.1 Volume IV**. The key information from that plan is summarised below.

Existing Woodland

- 4.11.2 Pencloe Forest extends to 825.89 ha and was planted in the early 1970s. The forest consists of commercial conifer plantations. Species diversity is low and the principal species is Sitka spruce, which accounts for over 80% of the crops. Other than these crops, the remaining land consists of open ground. The woodlands have been managed and maintained by Forestry Commission Scotland since planting. They have been managed on non-thin basis and no thinning, felling or replanting has been carried out to date. The woodlands have suffered extensive windblow in recent years.
- 4.11.3 Pencloe Forest is adjacent to existing forests on the west, east and southern boundaries, which form part of the extensive Carsphairn Forest Complex. There is no felling proposed in any of the coupes adjacent to Pencloe within the next 10 years.

Current Management

- 4.11.4 The woodlands onsite are now into the production phase and are managed under an approved Forest Design Plan. Felling was due to commence in 2012 but has been delayed for management reasons.

Felling for the Wind Farm Development

4.11.5 A Felling Design Plan for the wind farm development is included in **Appendix 4.1 Volume IV**.

4.11.6 ***Restocking Plans for the Wind Farm Development***

4.11.7 Following commissioning of the wind turbines, the forest will be restocked to incorporate the proposed development into the forest structure. The majority of the areas felled will be replanted except for areas required for the proposed development infrastructure. The species composition of the forest will change. In particular, species diversity will increase and the areas of conifer crops and open ground decrease, balanced by an increase in broadleaf woodland and woodland fringe. Overall there will be a net increase in the area of stocked woodland of 15.69 ha.

4.12 Construction

Construction Process

4.12.1 Construction of the windfarm will comprise the following main tasks. These are listed below in sequence, however some will overlap and some activities undertaken in parallel:

- Removal of forestry where required within the application site (see **Section 4.11**);
- Construct the bell mouth access from the Afton Road;
- Establish temporary construction compound at entrance to forest and install the application site accommodation;
- Erect temporary anemometry mast for calibration;
- Construct approximately 17.8 km of access tracks (of which 5.2 km is an upgrade to existing forestry track), water crossings and crane hardstandings;
- Excavate the wind turbine foundations and construct the turbine bases;
- Construct control building and substation compound;
- Excavate cable trenches and lay the power and instrumentation cables;
- Install the grid connection (subject to separate consent process);
- Erect and commission the permanent anemometry masts;
- Erect and commission the wind turbines;
- Carry out reinstatement works; and
- Remove temporary accommodation and compounds and clear the application site.

Programme

4.12.2 The construction period for the Proposed Development is expected to be approximately 18 months and will follow completion of the felling phase.

4.12.3 An indicative programme for construction is provided in **Table 4.4**. Note the construction programme does not include any provision for potential winter down time due to adverse weather.

Table 4.4 Indicative Construction Programme

Activity	Month																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Site Establishment																		
1	Install Site Entrance	█	█															
2	Plant offices delivery/removal																	█
3	Construct first compound	█	█	█														
4	Install Welfare Services	█	█															
Access Tracks																		
5	Construct Access Tracks/ second Compound	█	█	█	█	█	█	█	█	█	█	█						
6	Water crossings			█	█	█	█	█	█	█	█	█	█	█	█	█	█	█
Turbine Foundations /Crane Hardstandings																		
8	Construct Turbine Foundations								█	█	█	█	█	█	█	█	█	█
9	Construct Hardstandings				█	█	█	█	█	█	█	█	█	█	█	█	█	█
Substation																		
10	Construct Building								█	█	█	█	█	█	█	█	█	█
11	Internal Fit												█	█	█	█	█	█
Electrical																		
12	Install Wind Farm Cabling				█	█	█	█	█	█	█	█	█	█	█	█	█	█
Wind Turbine Generators (WTGs)																		
13	Erect WTGs										█	█	█	█	█	█	█	█
14	Commission WTGs												█	█	█	█	█	█
15	WTG/Wind Farm Reliability Run and Final Works																█	█

Personnel

- 4.12.4 It is estimated that over the 18 month period the onsite construction workforce will average 40 individuals (with a likely maximum of approximately 90 individuals) to undertake the various activities, split between civil engineering, turbine installation, electrical and commissioning contractors. The levels of manning will vary according to the phase of the project, with the highest levels at the point where civil works are nearing completion and turbines and electrical systems are being installed, followed by the initial testing of turbines for commissioning.
- 4.12.5 Where feasible and subject to procurement rules, local contractors or sub-contractors will be invited to tender. Prior to construction, PWEL will hold a meeting in the local area to introduce and discuss any aspects of the proposal to local contractors.

Materials

- 4.12.6 The wind turbines will all be delivered to site in component form and will require up to 9 loads per turbine (consisting of tower sections, blades, hub and nacelle).
- 4.12.7 The majority of the aggregate required for the construction of the access tracks, crane hardstandings and other construction activities (including temporary construction compounds and substation) will be won from the identified on site borrow pits. However of this total, about 5400 m³ of aggregate will be required to be brought to site in order to construct the first 1.4 km of access track needed to reach the most northerly borrow pit (assuming that no material is won along the way) and also to provide the higher grade aggregate needed for the production of concrete for the turbine foundations.
- 4.12.8 It is estimated that 63,100 m³ of aggregate will be required for use in access roads, crane hardstandings and other construction activities (including temporary construction compound and control building construction).
- 4.12.9 Concrete will most likely be batched onsite. It is estimated that 210 deliveries of concrete will be required for turbine foundations.
- 4.12.10 Steel reinforcement for the turbine foundations will be imported to application site and will number 3-4 deliveries per foundation.
- 4.12.11 Sand for the cable trenches will be imported to the application site. Up to 5200 m³ will be required.
- 4.12.12 Cables will be imported to the application site in ready cut lengths. Typically up to four cable drums can be loaded onto one delivery vehicle; and therefore it is estimated that up to 15 deliveries will be required. This will include the delivery of optical cable.
- 4.12.13 Transformers, switch gear, panels, batteries, steelwork, main building and other ancillaries will be required for the substation, as well as concrete and steel re-bar for the footings. It is estimated that approximately 50 deliveries associated with the substation will be required.
- 4.12.14 The construction delivery programme is discussed in more detail in **Chapter 12 Traffic and Transport**.

Construction Traffic Routes

4.12.15 It is anticipated that the Turbine Delivery Vehicles (TDVs) will be transported by road from the Port of Ayr, which is the closest port in the region capable of handling wind turbine equipment. The Port of Ayr has been used regularly for the delivery of wind turbine components for wind farm developments in this region and is the selected port of entry for turbine components for the consented Afton Wind Farm and the proposed Ashmark Hill Wind Farm, both of which are located adjacent to the proposed development. The proposed TDV access route from Port of Ayr to the proposed development access is as follows, as shown on **Figure 13.1 Volume III**:

- Exit Griffen Dock in Port of Ayr;
- East on Waggon Road;
- South on A79 Allison Street;
- East on A719;
- Northeast on the A77;
- Southeast on A76;
- Southwest on B741 Mossmark;
- South on Afton Road; and
- Proposed site access off Afton Road, approximately 3.5km south of the B741 Mossmark / Afton Road priority junction.

4.12.16 The delivery route of all other imported materials will depend on the location of the supplier, which will not be finalised until the tender process has been completed. An Assessment of the traffic impacts are considered in more detail in the **Chapter 13: Traffic and Transport**.

Construction Hours

4.12.17 Hours of construction will be from 7am to 7pm on weekdays and 7am to 1pm on Saturdays unless otherwise agreed with East Ayrshire Council. This restriction will also apply to the delivery of the majority of materials to application site. Delivery of the towers, nacelles and blades will require the use of abnormal sized and slow moving loads, and may require to be escorted. It is possible that abnormal deliveries will be made at night to avoid disruption to road users but this will be done in agreement with the council. The erection of the wind turbines may also be necessary outside of these core hours.

4.12.18 Twenty four hour security may be required onsite during the construction phase.

Reinstatement

4.12.19 After each element of the proposed development is constructed there will be a requirement to reinstate the ground surface. Details of reinstatement methods will be provided in the detailed CEMP, (see outline CEMP, **Appendix 10.7 Volume IV**).

Waste

4.12.20 The construction phase is likely to generate waste from the following activities:

- felling (see **Section 4.11**);
- site clearance;
- site preparation;
- earthworks (including soil/peat removal);

- establishment of the site and construction compounds, and access tracks; and
 - construction and erection of the wind turbines, control building and substation compound, and underground cables.
- 4.12.21 There are currently no buildings on the application site, so no demolition waste is anticipated.
- 4.12.22 The main waste types anticipated to be generated from materials imported onto the application site would be inert and metal related.
- 4.12.23 The size of the borrow pits have been determined on the basis of the estimated requirements for construction materials together with additional allowances for overburden and processing waste. Excavated materials from the borrow pits are assumed to have 0% wastage rate, as any excess materials will be used onsite. It is envisaged that overburden/soils would be carefully stored adjacent to the excavation void for eventual use in the restoration process. Therefore it has been assumed that there would be no aggregate wastage due to the predicted volumes of aggregate required and that there are a number of reuse outlets onsite for the aggregate.
- 4.12.24 It is estimated that peat excavated for the proposed development will total approximately 66,434 m³, primarily as a result of preparation for track, hardstanding and foundation areas. Where peat is excavated this will be managed in accordance with the PMP (**Appendix 10.5 Volume IV**) which will be developed further prior to construction commencing. The PMP proposes prevention and reuse as the primary means of managing peat excavated during construction. The PMP demonstrates any peat that is excavated onsite will be reused onsite.
- 4.12.25 Material such as steel will be used in the building of the wind farm and cement and aggregates will be used in the foundations of the wind turbines. There is the possibility for waste to be generated during construction from material brought onsite and the wastage that occurs from this.
- 4.12.26 It is acknowledged that not all waste arising during the construction phase may be suitable for management and/or reuse onsite. Any waste removed from the application site will be taken to permitted facilities for recovery or disposal and any hazardous waste that is generated will also be appropriately managed.
- 4.12.27 A Site Waste Management Plan (SWMP) will be developed for the construction phase which will help confirm the types and quantities of wastes arising and how best to manage them. An outline SWMP for the construction phase has been prepared and included as **Appendix 4.1 Volume IV**.
- 4.12.28 The objective of the SWMP will be to ensure that there is the safe management of waste during the construction process from production to final disposal, thus minimising any potential impacts. During the construction phase every attempt will be made to implement best practice with respect to waste management and construction management practises.
- 4.12.29 With the design and construction methods and mitigations proposed (and in particular the PMP) the amount of waste that will require removal from the application site will be minimised. Given the relatively low tonnages arising during the construction and operational phases of the development, this will have a negligible effect on the existing waste treatment capacity in East Ayrshire and the associated environmental effects.

4.13 Operation

- 4.13.1 The proposed development has a planned operational life of up to 25 years. On a day to day basis the wind turbines will operate automatically, responding by means of anemometry equipment and control systems to changes in wind speed and direction. The operation of the turbines will be remotely monitored.
- 4.13.2 When operating, the rotational speed of the turbine blades will be geared up through the gearbox, which drives the generator. This produces an output which is transferred from the generator to the transformer. Buried inter-array cables then transmit the power output to the substation at 33kv where it is then exported offsite to the transmission network.
- 4.13.3 The proposed development will support some limited direct employment during the operational phase. In comparison to the temporary jobs created during the construction phase the level of employment is expected to be relatively small but permanent and is estimated to be around 2 permanent staff (based on experience of similar developments). There will be a further requirement for temporary contractors and remote support staff probably resulting in 3 to 7 local jobs in total (this calculation is explained in more detail in **Chapter 14 Socioeconomics**).

Traffic

- 4.13.4 The predicted levels of traffic associated with the operation and maintenance of the proposed development are unknown at this point. However, previous experience allows the following assumptions to be made:
- standard turbine servicing approximately 10 times annually;
 - unscheduled servicing approximately 10 times annually;
 - repairs to turbines approximately 30 times annually;
 - access track maintenance approximately 4 visits annually;
 - substation maintenance approximately 1 visit annually; and
 - routine site inspections once a fortnight.

Shadow flicker

- 4.13.5 Under certain combinations of geographical position and time of day, the sun may pass behind the rotors of a wind turbine and cast a shadow over neighbouring properties. When the blades rotate, the shadow flicks on and off resulting in an effect known as 'shadow flicker'. This effect only occurs inside buildings and under a limited set of circumstances, e.g. when meteorological conditions are clear, the sun is low in the sky and the moving shadow of a turbine is cast onto a narrow window.
- 4.13.6 The impact of shadow flicker on the local community is discussed in the Scottish Government's web based renewable advice note on onshore wind turbines (which replaces the relevant aspects of Planning Advice Note 45). The renewable advice note states that "*In most cases, where separation is provided between wind turbines and nearby dwellings (as a general rule 10 rotor diameters), "shadow flicker" should not be a problem.*" In the case of this development, this would be a radius of up to 1010 m, depending on turbine/rotor size. As shown in **Table 4.1**, the nearest property to a turbine is 1300 m away and therefore it can be concluded that shadow flicker will not occur as a result of the Proposed Development. An assessment of the effects of shadow flicker has therefore been scoped out (see Section 5.3 of **Chapter 5: Scoping and Consultation**).

Waste

- 4.13.7 The proposed development will not be manned during the operational phase and, therefore, waste generation will be minimal and restricted to waste from maintenance works in the main. It will be disposed of in line with normal waste disposal practices and the SWMP (outline provided in **Appendix 4.1 Volume IV**).
- 4.13.8 Based on the existing waste disposal capacity in the region the additional waste would have no significant effects.

4.14 Decommissioning

- 4.14.1 At the end of the operational life, either planning permission will be sought to re-power the development or the development will be decommissioned. It is assumed for the purposes of the EIA that the proposed development will be decommissioned at the end of its operational life. The decommissioning process will comprise the following:
- Wind turbines will be dismantled, removed from the application site and disposed of appropriately;
 - Foundations will be left *in situ* although the top metre of the base will be removed and disposed of appropriately. The area will be re-surfaced with soil or peat and restored;
 - Underground cabling will be left *in situ* or removed for recycling;
 - Access tracks and hard standings will be left *in situ* to be used by the landowner or will be removed should these no longer be required;
 - The anemometry masts will be dismantled, removed from the application site and disposed of appropriately. The foundations will remain *in situ*. The top metre of the base will be removed, disposed of appropriately, then covered with topsoil or peat and restored;
 - The site access (i.e. the bell mouth) will be left *in situ* and
 - The equipment will be removed from the substation and disposed of appropriately. The buildings will be demolished and the material removed from the application site. The top one metre of the foundations will be removed then covered over with topsoil or peat and reinstated appropriately.

4.15 Environmental Management

- 4.15.1 In order to ensure that environmental considerations are addressed, construction, operation and decommissioning activities will be carried out in accordance with the management commitments made in this ES, plus any additional legislative and contractual requirements and updated good practice guidance in place at the time. These commitments include mitigation measures, management measures and/or monitoring requirements. Measures that will be taken to manage environmental issues during all three phases of the Proposed Development are presented in **Chapters 6 to 16** of this ES and summarised in **Chapter 17: Summary of Mitigation Measures**.
- 4.15.2 To facilitate this, Environmental Management Plans (EMPs) will be prepared for the construction, operation and decommissioning phases of the proposed development. The EMPs will describe the environmental risks and potential impacts of site activities and outline how the proposed mitigation measures and procedures will be implemented to manage these risks and impacts. A draft Construction EMP (CEMP) is included as **Appendix 10.7 Volume IV**.

- 4.15.3 If planning permission is granted, then prior to commencement of development, PWEL and/or its appointed Principal Contractor will finalise the CEMP and a detailed Construction Method Statement (CMS) outlining the methods and procedures which will be implemented during construction. It is anticipated that PWEL will present the CMS and CEMP to East Ayrshire Council for approval, in consultation with SNH and SEPA, at least two months prior to work commencing.
- 4.15.4 An Ecological / Environmental Clerk of Works (ECoW) will be appointed for the construction phase and will work, along with a nominated Environmental Manager to ensure that methods and good working practice detailed in the CEMP are adhered to and that any unforeseen risks to the environment encountered during construction are managed appropriately. The ECoW and Environmental Manager will be supported by specialists, for example with respect to water quality monitoring.
- 4.15.5 The EMPs for the operational and decommissioning phases will be prepared in advance of the start of each phase. It is anticipated that these will also be presented to East Ayrshire Council for approval, in consultation with SNH and SEPA.
- 4.15.6 In addition to the EMPs, the SWMP (as described in paragraph 4.12.27), and the PMP (as described in paragraph 4.12.24), a Habitat Management Plan (HMP) will also be prepared as outlined below.

Habitat Management Plan

- 4.15.7 Separate to the EMPs outlined above, a Habitat Management Plan (HMP) will be developed to compensate for the loss of habitats during the construction phase. The content of the HMP will be agreed with East Ayrshire Council, in consultation with SNH and SEPA at least two months prior to work commencing.
- 4.15.8 The HMP is discussed in more detail in **Chapter 8 Terrestrial Ecology** and an Outline HMP is included as **Appendix 8.5 Volume IV**. The broad aims and objectives of the Outline HMP are to compensate the permanent loss of 2.6 ha of habitats and the disturbance of an additional 9.7 ha, as follows:
- The greatest potential for compensation involves restoration of moorland habitat, notably heath and blanket bog, in drained and afforested areas of shallow (<50 cm) or deeper peats. There is no set rule on the scale of compensation being required, but it is acknowledged that habitat restoration is unlikely to provide equivalent value to intact habitat on a unit-for-unit basis, e.g. because the full range of soil microorganisms, higher and lower plants, associated fauna, and physical structure typical of intact habitat are unlikely to be restored in the short to medium term. The measures proposed provide compensation on a 2:1 basis.
 - Enhancement measures are included that comprise widening of river corridors and replacing sections of conifer plantation with mixed broadleaved woodland.
 - In addition to the value inherent in creating new areas of open habitat within the site, creating corridors of open habitat within the plantation and diversifying the woodland is predicted to benefit biodiversity by both providing a greater range of habitats on site and by facilitating the movement through the site of plants and animals, including species associated with moorland.

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5 Scoping and Consultation

5.1 Background

- 5.1.1 Good practice guidance recommends that the scope of the EIA is considered using the procedures set out in the relevant EIA Regulations. Although not directly relevant to a Section 36 Application, The Planning etc. (Scotland) Act 2006 and associated secondary legislation provide enhanced opportunities for people to get involved in the planning system. In addition to guidance in Circulars 1/2009 and 4/2009 and the advice provided in PAN 3/2010: Community Engagement, Scottish Planning Policy (SPP) recognises the importance of early community consultation and sets out the Scottish Government's policy on community engagement in the planning system. Further details on the requirement for consultation are provided within the Pre Application Consultation (PAC) report in **Appendix 5.1 Volume IV**.
- 5.1.2 The Scoping process enables the applicant to obtain an opinion from the Planning Authority on what information should be included in the ES and which specific areas should be addressed. This is known as a Scoping Opinion (see below). The purpose of scoping is to focus the EIA on the environmental issues and potential impacts which need assessment, identify those that are unlikely to need detailed study and to provide a means to present and agree the methodology of the assessment.
- 5.1.3 PWEL recognises that Scoping provides a mechanism to open the lines of communication with key consultees, interested third parties and the local community. It also gives an opportunity to provide information and initiate further consultation at appropriate points during the EIA process. Consultation undertaken after the request for a Scoping Opinion is set out below.

5.2 Scoping Opinion

- 5.2.1 In February 2012 a formal EIA Scoping Opinion was requested from the Scottish Ministers under the Regulations on the proposed Pencloe Windfarm at Carsphairn Forest, Dumfries and Galloway. A Scoping Report, prepared by the EIA Team, accompanied the request. The Scoping Report described the proposed development and the anticipated scope of the EIA and is included in **Appendix 5.2 Volume IV**. In response to this formal request the Scottish Ministers consulted the following statutory consultees and provided a Scoping Opinion, dated 16th January 2013:
- East Ayrshire Council (the local planning authority – LPA);
 - Dumfries and Galloway Council (the neighbouring planning authority – NPA);
 - Scottish Environment Protection Agency (SEPA); and
 - Scottish Natural Heritage (SNH).
- 5.2.2 The Scottish Ministers also consulted:
- Directorate for the Built Environment;
 - Forestry Commission;
 - Historic Scotland;
 - Marine Scotland;
 - Halcrow Group Ltd (on behalf of Transport Scotland);
 - Association of Salmon Fishery Boards;
 - Nith District Salmon Fishery Board;
 - BT;

- Civil Aviation Authority – Airspace;
- The Crown Estate;
- Defence Infrastructure Organisation (DIO);
- Joint Radio Company;
- NATS Safeguarding;
- RSPB Scotland;
- Ofcom;
- Mountaineering Council of Scotland;
- Scottish Water;
- Visit Scotland;
- John Muir Trust;
- Scottish Wildlife Trust;
- Prestwick Airport;
- Scottish Rights of Way and Access Society (ScotWays).

5.2.3 A copy of the formal scoping response received from the Scottish Ministers can be found in **Appendix 5.3 Volume IV**. Individual scoping feedback to the proposed extension has been summarised in **Appendix 5.4 Volume IV** and included in this appendix is scoping feedback received as a result of prior or subsequent meetings and correspondence. These tables contain details of which ES Chapters should be reviewed for further information.

5.3 Scoping out of EIA Topics

5.3.1 During the course of the EIA it has been possible to ‘scope out’ some assessment work;

- An air quality impact assessment was not necessary as no significant changes were identified to result from construction traffic and experience of other construction activities on other windfarm projects indicates that significant effects on air quality are very unlikely to occur; and
- A Shadow Flicker Assessment was not required as in accordance with the Scottish Government’s web based renewable advice note on onshore wind turbines (which replaces the relevant aspects of Planning Advice Note 45). The renewable advice note states that “*In most cases, where separation is provided between wind turbines and nearby dwellings (as a general rule 10 rotor diameters), “shadow flicker” should not be a problem.*” In the case of this development, this would be a radius of up to 1010 m, depending on turbine/rotor size. The nearest property to a proposed turbine location is 1.3 km away and therefore it can be concluded that shadow flicker will not occur as a result of the proposed development.

5.4 Further Consultation

5.4.1 Given the scale and nature of the development PWEL considered that, although the formal procedure did not apply to Section 36 Applications, the submission of a Proposal of Application Notice would assist in the communication of their proposals to the Scottish Government and other key stakeholders. The information provided to the Government is provided in **Appendix 5.5 Volume IV** and was submitted on 18th April 2013.

5.4.2 Following the request for a Scoping Opinion the Jacobs EIA Team and PWEL consulted regularly with specific consultees on EIA methodologies and findings, to discuss and agree potential mitigation and to keep consultees informed of design

modifications. These discussions were undertaken through a combination of face-to-face meetings, telephone, email and written communications.

5.4.3 The main additional consultation meetings (pre and post scoping) are listed in **Table 5.1** and a summary of the community consultation can be found below and also in the PAC Report.

Table 5.1 Additional Consultation

Stakeholder	Consultation Method and Reason	Outcome / Action Taken in ES
East Ayrshire Council – Planning Officer	Meeting (March 2012) - pre-scoping meeting to introduce and discuss project with EAC planning team. After scoping request, further telephone communication by Jacobs' Project Manager with David Wilson.	-
East Ayrshire Council – Roads Department	Email sent 14/01/13 to request details of mitigation proposed and Council requirements relating to abnormal load transportation on the B741 and C90.	EAC provided details of conditions and assessment requirements for Ashmark Hill Windfarm and Afton windfarm. EAC indicated same would apply to Pencloe.
East Ayrshire Council - Policy Department	Telephone call to Antony McGuinness (24/06/2014) regarding presence of Public Right of Way (PRoW) onsite.	It is proposed that the PRoW (which is not currently accessible due to forestry) be temporarily diverted during the construction phase and reinstated during operation. Health and safety of users during the operational phase should be considered with respect to proximity of the turbines and the route diverted if necessary. Opportunities for mitigation/enhancement may be possible through the Coalfield Environment Initiative and the New Cumnock Access Network.
East Ayrshire Council – Environmental Health Officer	Letter sent 29/01/13 to agree details of proposed survey and noise assessment, including agreement on noise monitoring locations. Follow up clarification phone calls and subsequent agreement of methodology and noise monitoring locations. Further correspondence on 06/03/13 in relation to the limited response from residents to request for use of their properties for noise monitoring.	The assessment will list all properties that were approached to accommodate noise monitoring equipment, in order to demonstrate the attempts that were made.
East Ayrshire Council - Regulatory Services (Environmental Health)	Letter requesting provision of available hydrological and hydrogeological data including private and public water supplies, details of abstractions and discharge consents, details of any contaminated land sites and details of any known flooding issues in the area.	EAC provided locations and details of known private water supplies within their jurisdiction. Supplies that were within the immediate catchments of the proposed development were included in the hydrology, hydrogeology and geology chapter.
ECDU, Scottish Government	Regular phone and email communication with relevant ECDU Case Officers since scoping request.	-

Stakeholder	Consultation Method and Reason	Outcome / Action Taken in ES
	Gatecheck Meeting to present the final draft of the application and the assessment to the Scottish Ministers and the statutory consultees for a final check prior to the application being submitted.	Gatecheck responses were received and consultees confirmed that their scoping responses had been actioned.
	Meeting to discuss the impacts upon Aviation from the proposed Pencloe Windfarm.	The issue regarding aviation is currently being addressed by Prestwick Airport and a mitigation solution is being sought for a number of windfarms proposed in the local area. Discussions on this will be ongoing throughout the planning process.
Forestry Commission Scotland -	Meeting with Conservator South Scotland 11th July 2013 to discuss proposed development felling and restocking plans and compensation planting requirements.	Draft felling and restocking plans to be reviewed taking into account the conservator's comments.
South Scotland Conservancy	The majority of the application site is located on FCS land. Regular contact with Forestry Liaison Officer regarding felling and restocking proposals.	Information in relation to application site and forestry operations supplied by FCS as and when required. Development felling and restocking plans discussed and reviewed with Forestry Liaison Officer and District Staff on regular basis.
West of Scotland Archaeology Service (archaeological advisors to East Ayrshire Council)	Email request (December 2012) from Linn Breslin to Martin O'Hare for historic environment record (HER) data for the site boundary and surrounding study area.	HER data incorporated into GIS, to form basis of site gazetteer and subsequent archaeology & cultural heritage assessment
West of Scotland Archaeology Service (archaeological advisors to East Ayrshire Council)	WoSAS was not approached by East Ayrshire Council to provide a formal scoping response. Informal discussions and review of information requirements were therefore undertaken between Linn Breslin and Martin O'Hare by email and phone in October 2013.	Commentary and advice has been incorporated into the ES chapter and proposed mitigation section.
Raptor Study Group – D&GRSG	Contacted email & phone Mr. C. Rollie (also contact for RSPB) 2006. Email sent 30/09/13 requesting ornithological data on important species within 5-6 km of the proposed development.	Acknowledged request & data supplied on 31/10/13.
RSPB	Contacted email & phone Mr. C. Rollie (also contact for Raptor Study Group) 2006. Black grouse officer contacted by telephone & email 12/03/2013 Doug Shapley, Black Grouse Project Officer-South and West Scotland, RSPB South	No leks known at Pencloe

Stakeholder	Consultation Method and Reason	Outcome / Action Taken in ES
	and West Scotland Regional Office	
SNH (ecology)	Telephone call made to Graham Walker on 06/11/2012 requesting clarification on scoping.	Indicated that Schedule 1 birds needed consideration in EIA since baseline data had shown some activity around the project (SNH did not know of Schedule 1 listed birds breeding in the Pencloe area) and advised that birds (even for a low risk closed-canopy conifer monoculture) in general couldn't be scoped out in the assessment. Reported from his site visit that pockets of blanket mire were present at Pencloe and that these should be one priority for retention/restoration via micro-siting and incorporated into a Habitat Management Plan (HMP) respectively.
County recorder	Bird County Recorder contacted 28/12/2010 via Paul Collin (ex. RSPB)	Responded with no known records for conservation species of note, e.g. no known black grouse leks.
Scottish Wildlife Trust	Lewis Pate Project Officer Saving Scotland's Red Squirrels - contacted Stephanie Johnstone Red Squirrel in Southern Scotland Project email & telephone 09/09/2010	Responded with no red squirrel records known from Pencloe/ upper Glen Afton
Forestry Commission	Alister Henderson FC; telephone Red squirrel sightings 09/11/2012	Responded with no records known from Pencloe
Ofcom	E-mail consultation 6-6-14 to determine whether any fixed microwave links exist in the vicinity of the site	Ofcom identified a link crossing the site belonging to BT. PWEL is in discussion with BT on the nature of the mitigation needed with respect to this link.
Atkins	E-mail consultation 6-6-14 to determine whether any water industry scanning telemetry links exist in the vicinity of the site	No objection to the proposal.
Joint Radio Company	E-mail consultation 6-6-14 to determine whether any fuel and power industry scanning telemetry links exist in the vicinity of the site	JRC do not foresee any potential problems based on known interference scenarios and the data provided.
NATS En Route Ltd	E-mail and telephone consultations to determine whether the development would affect any NATS radar or navigation aid facilities.	Layout revised to ensure no line of sight from any NATS radar or other facilities.
Glasgow Prestwick International Airport	E-mail, telephone and face to face consultations to discuss impact of development on radar and other facilities	Developer will contribute to funding of radar mitigation scheme.
Ministry of Defence	Consultation proforma submitted October 2013	Response awaited. The development is not located within line of sight of any MoD radar facilities. Layout revised to minimise the number of turbines located in a high priority area for military low flying.

Stakeholder	Consultation Method and Reason	Outcome / Action Taken in ES
SEPA	Letter requesting provision of available hydrological and hydrogeological data including surface water and groundwater quality data, details of public and private water supplies, details of licensed abstractions and discharge consents, details of any known flooding issues in the area.	Provided details of licensed abstractions and discharge consents within 4 km of the application site. If within the same catchments of the proposed development, these were included in the baseline assessment of the hydrology, hydrogeology and geology chapter. Provided information on surface water quality and fisheries which was also incorporated into this baseline assessment.
Dumfries and Galloway Council - Environmental Health Department	Letter requesting provision of available hydrological and hydrogeological data including private and public water supplies, details of abstractions and discharge consents, details of any contaminated land sites and details of any known flooding issues in the area.	Confirmed that there were no private water supplies within their jurisdiction within the search area (radius of 2 km from the application site).
Association of Salmon Fishery Boards	Letter requesting details of fisheries and protected /vulnerable watercourses.	Did not provide any requested information. Recommended that we contact the Nith Fishery Trust regarding the proposed development.
Nith District Salmon Fisheries Board	Letter requesting details of fisheries and protected /vulnerable watercourses.	No response received.
Scottish Water	Letter requesting details of Scottish Water assets, any hydrological details that may affect Scottish Water assets, any information on known flooding issues in the area.	Scottish Water confirmed they had no objection to the proposed development and that no known assets are located in the area of the proposed development.
SNH (Landscape and Visual)	<p>Pre –scoping consultation issued to SNH 30th September 2010 to request a preliminary scope for the assessment. Response received 2 November 2010 confirming the following key points:</p> <ul style="list-style-type: none"> • We recommend that the same VPs are considered for Pencloe as were used for Afton, Windy Standard, Windy Standard Extension, Hare Hill and Hare Hill extension (that is, the adjacent windfarm sites) where the ZTVs overlap. • We suggest several additional VPs are required to fill the range of distance and direction, if not already included in our caveat above: <ul style="list-style-type: none"> ○ Lowther Hill, Southern Upland Way ○ C road south of Stinchar Falls ○ Afton Reservoir ○ A77 west of Maybole, Crossraguel Abbey ○ Brown Carrick Hill 	Additional viewpoint locations were included in the assessment. The viewpoint from Blackcraig Hill was retained from the summit area rather than the col to the south.

Stakeholder	Consultation Method and Reason	Outcome / Action Taken in ES
	<ul style="list-style-type: none"> ○ B7037 south of Galston • Consider moving VP 14 (the side-on view in the built up part of Cumnock is unlikely to show the windfarm to any noticeable degree) to a nearby VP on the A 76 south of Auchinleck within Dumfries House boundary (NS 544 218) • Consider moving VP 2 Blackcraig Hill to footpath at Quintin Know • Doon Castle beside Loch Doon. 	

5.5 Community Consultation

5.5.1 Table 5.2 provides a summary of the community engagement activities undertaken.

Table 5.2: Summary of Key Consultation Activities

Activity	Description	Date/Time
Submit copy of Proposal of Application Notice	Submission of PAN to Scottish Ministers, East Ayrshire Council, New Cumnock Community Council, Cumnock Community Council, Carsphairn Community Council, Auchinleck Community Council, Lugar and Logan Community Council and Netherthird & District Community Council	18 th April 2013
Confirm details of public exhibition by letter	All community councils noted above were informed of the public exhibition by letter setting out when and where it was to be held.	May 2013
Place advert in a local newspaper	Adverts inserted in Ayrshire Post advising of dates of Public Exhibitions	15 th and 22 nd May
Public Exhibition at New Cumnock Community Centre	Public Exhibition at which information was presented as described in full within the PAC (Pre-Application Consultation) Report.	29th May 2013 between 12.00 and 19.00
Confirm submission of the Section 36 Application and issue press release in a local and national newspaper	Adverts will be placed in the Ayrshire Post and Herald when this application is submitted to notify the local community and to be in line with regulations.	

5.5.2 Further details are provided within the Pre-Application Consultation (PAC) Report that forms part of the planning application for the proposed development. This also reports some of the changes that have been made to the application following that consultation.

5.6 Further Consultation

5.6.1 On submission of the Section 36 Application, ECDU and EAC will publicise the application to ensure that members of the public and other stakeholders are made aware of the proposed development and are informed as to where they may obtain information on the project and its environmental effects. Throughout the determination period, PWEL will continue to consult with stakeholders to address

any queries which they have and to assist in the on-going detailed design of the project. If consented, PWEL will also continue to liaise, on a regular basis, with the local community with regards to the progress of the development and the timing of construction activities.

6 Planning and Energy Policy

6.1 Introduction

- 6.1.1 This chapter reviews the proposed development in the context of relevant national and local planning policy obligations and initiatives including climate change, promoting sustainability and renewable energy policies. The chapter also includes a description of other relevant material considerations, which includes emerging Development Plans and Supplementary Planning Guidance (SPG).
- 6.1.2 This review seeks to provide a general overview of the policies of most relevance to the determination of this application. Where there are planning policy issues that relate specifically to detailed EIA technical areas (such as for landscape and noise) these policies are identified and considered in the relevant ES chapter.
- 6.1.3 The Section 36 application for the proposed development is accompanied by a separate Planning Statement which considers renewable energy policy, planning policy and the relevant Development Plans. This statement provides a commentary on policy compliance and reaches conclusions on the acceptability of the proposed development in energy and planning policy terms.
- 6.1.4 The Kyoto Agreement of 1997, to which the UK is a signatory, came into force in February 2005. The European Union already had its own objectives in relation to renewable energy targets even before the 1992 Earth Summit, the current EU targets are to meet 20% of the total energy demands in the Community by 2020 (Authority of the House of Lords, 2008). The result of the latest Directive (2008/0016) published in March 2009 (and endorsed by the UK Government) is that the UK has a binding target to meet 15% of its total energy consumption from renewable sources by 2020. In reality, the contribution from renewables has to be substantially higher, since in order to meet the EU targets (which cover sectors where major savings are unlikely to be achievable, such as transport) electricity generation from renewable energy will be rising to 30% by 2020 *“provided that other developed countries commit themselves to comparable emission reductions and economically more advanced developing countries to contributing adequately according to their responsibilities and respective capabilities”* under the guidance in the new Renewable Energy Strategy (European Union, 2011).
- 6.1.5 The Digest of United Kingdom Energy Statistics for 2013 sets out on page 189 that at the end of 2012 the UK had only achieved 4.1% of the target for renewable energy consumption. This statistic helps to demonstrate the significant ‘leap’ that is required in permitting and bringing into operation renewable energy developments throughout the UK.
- 6.1.6 It is very clear that the Scottish Government is committed to ensuring that a greater percentage of its energy is gained from renewable sources. The proposed development will contribute towards meeting them.
- 6.1.7 The Scottish Government has updated its target for Scotland, which is to provide 100% of Scotland’s own electricity demand from renewable resources by 2020. The Scottish Government published the 2020 Routemap document in July 2011 (hereafter referred to as ‘the Routemap’). The Executive Summary notes: *“The Routemap for Renewable Energy in Scotland 2011 is an update and extension to the Scottish Renewables Action Plan 2009. This updated and expanded Routemap reflects the challenge of our new target to meet an equivalent of 100% demand for electricity from renewable energy by 2020”* (Page 3).
- 6.1.8 The 2020 Routemap also places a high priority on achieving the target of 11% of heat demand to be sourced from renewables by 2020. With regard to onshore wind, the Routemap states that the Government is: *“committed to the continued*

expansion of portfolio of onshore wind farms”, It continues to outline that: “Our ambition is that by 2020, onshore wind developments ranging from small land community-scale to large power utility scale maximise engagement with communities; contribute electricity to renewables targets and, through displacement of fossil fuel generation, help to reduce fossil fuel consumption.” The Routemap also sets out that it is a ‘Key Action’ for the: *“Scottish Government to maintain its effective market support for onshore wind, both through the RO and its possible replacement.”* The ambitious targets set by the Scottish Government shows its commitment to renewable energy in meeting future needs and by default the need to permit such proposals in time to meet the 2020 deadline.

- 6.1.9 National Planning Framework 3 (NPF 3) and the new Scottish Planning Policy (SPP) were issued in its final form by the Scottish Government in June 2014. The commitments set out above by Scottish Government have been rearticulated in both NPF3 and the new SPP.

6.2 Statutory Provisions *Electricity Act 1989*

- 6.2.1 Section 36 of the Act requires that consent of the Scottish Ministers is required to construct and operate a generating station with a capacity in excess of 50 MW.
- 6.2.2 Paragraph 3(2) of Schedule 9 imposes obligations on the Scottish Ministers in considering proposals for Section 36 consent.
- 6.2.3 In that regard PWEL, in formulating the current proposals, has considered the desirability of preserving natural beauty, conserving flora, fauna and geological and physiological features of special interest and of protecting sites, buildings and objects of architectural, historic or archaeological interest. Furthermore, PWEL has done all that is reasonable to mitigate the effects on the resources identified above.

The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2000

- 6.2.4 Regulation 3 (Prohibition of grant of consent without consideration of environmental information) outlines that Scottish Ministers: *“shall not grant a Section 36 or a Section 37 consent which relates to EIA development unless the requirements of regulation 4 have been satisfied.”* It sets out at Regulation 4 (Procedure for grant of consent where environmental statement is required) that an applicant is required to submit an environmental statement (ES) for a Section 36 development. It continues to outline at Regulation 4(2) that Scottish Ministers should not grant consent unless: *“they are satisfied that the applicant has complied with his obligations in providing the ES, that they have taken into account all the environmental information and that the proper procedures for publicity have been addressed.”*

The Town and Country Planning (Scotland) Act 1997

- 6.2.5 Section 57(2) sets out that the Scottish Ministers, on granting consent under Section 36: *“may direct that planning permission for that development and any ancillary development shall be deemed to be granted, subject to such conditions (if any) as may be specified in the direction.”*
- 6.2.6 Section 37(2) of the Act outlines that: *“in dealing with such an application the authority shall have regard to the provisions of the development plan, so far as material to the application and to any other material considerations”.*
- 6.2.7 Section 25 states: *“where, in making any determination under the Planning Acts, regard is to be had to the development plan, the determination shall be made in accordance with the plan unless material considerations indicate otherwise”.* In a number of recent applications for consent under Section 36 there has been debate

as to whether the Scottish Ministers should give primacy to the Development Plan or if they should decide on how much *'weight'* they want to attach to it in combination with other material considerations. Topics which have caused the debate include those in relation to landscape and visual and heritage effects. The Court of Session has held that Section 25 does not apply to the determination of a Section 36 application. That is not to say that a development plan is not a material consideration but that the weight afforded to that consideration is a matter for the Scottish Ministers (Court of Session, 2012, Opinion of Lord Malcolm in the Petition of William Grant & Sons Distillers Limited).

The Climate Change (Scotland) Act 2009

- 6.2.8 This Act put in place a legislative framework in Scotland to pursue a reduction in emissions associated with the unsustainable use of fossil fuels and placed a duty on public bodies to reduce emissions. The Scottish Government's commitment to increase the amount of electricity generated from renewable sources is an important part of its response to climate change.

6.3 Scottish Government Policies

The Climate Change Delivery Plan (CCDP) 2009

- 6.3.1 This was prepared to deliver the targets presented in The Climate Change (Scotland) Act 2009. It sets out the Scottish Government's aim of developing a sustainable way of life which reduces the impact people in Scotland have on the local and global environment. It states that, first and foremost, Scotland needs to play its part in reducing greenhouse gas emissions and as such it references the Climate Change (Scotland) Act 2009 and the commitment to reduce emissions by at least 80% from 1990 levels by 2050.
- 6.3.2 The CCDP identifies the high level measures required to meet the interim statutory target for a 42% cut in emissions by 2020 and the work to be done over the next decade to prepare for the more radical changes needed by 2030 if the emissions reduction target for 2050 is to be achieved.
- 6.3.3 There is a wide range of policy related and socio economic drivers that provide the case for renewable energy and a low carbon economy, which are set out in 'A Low Carbon Economic Strategy for Scotland' (2010). The chief drivers include:
- Higher and more volatile energy prices;
 - Reduction in business costs from resource efficiency;
 - Depletion of fossil fuels, minerals and other resources;
 - Environmental benefits from using resources more sustainably;
 - Rapid growth of emerging markets;
 - Supply chain pressures to lower carbon emissions;
 - Growing customer demands;
 - Government regulation and incentives;
 - Climate change impacts and international market opportunities and
 - Moral imperative.

Energy

- 6.3.4 The UK and Scottish Governments have taken forward distinct policies on renewable energy, with the adoption of commitments for Scotland which are proportionately higher than those in the UK as a whole.

- 6.3.5 Following a range of consultations on the subject of renewable resources, the Scottish Government adopted targets of 18% of electricity supply generated by renewables by 2010, rising to 40% by 2020. This latter figure was estimated to be equivalent to an installed capacity of 6 GW of renewables by 2020. Subsequently (late 2007 in the Scottish Budget Spending Report) this figure was raised again to an interim target of 31% of Scottish electricity consumption by 2011 and 50% by 2020, with the latter figure being stated to be the equivalent of 8GW of installed capacity of renewables.
- 6.3.6 In 2010 the Scottish Government increased the 2020 target to 80% and in May 2011 the First Minister of Scotland, Alex Salmond, announced the increase of Scotland's renewable electricity target to 100% of Scotland's gross annual electricity consumption by 2020. This does not mean that Scotland will be 100% dependent on renewable generation, rather that renewable energy will form the key part of the wider electricity mix. In order to meet this 'headline' target, further substantial increases in renewable electricity generating capacity must be achieved in the short to medium term. **Table 6.1** details the Scottish Renewable Action Plan Updates and sets out the objectives of each.

Table 6.1: Scottish Renewable Action Plan Updates

Updates	Summary
June 2009	<p>The Scottish Government's 'Renewables Action Plan' (RAP) (June 2009) set out Scotland's renewable energy targets and stated that Scotland is committed to achieve a headline target of 20 % of total Scottish energy use coming from renewable sources by 2020. The Action Plan contains a vision for onshore wind: <i>"continued expansion of portfolio of onshore windfarms to help meet renewables target, with robust planning framework supporting timely processing of consents applications and ensuring wind farms are consented where they are environmentally acceptable."</i></p> <p>Key objectives are summarised as follows:</p> <ul style="list-style-type: none"> i. to establish Scotland as a UK and EU leader in the field; ii. to ensure maximum returns for the Scottish domestic economy and iii. to meet targets for energy from renewables and for emissions reductions, to 2020 and beyond (RAP, Executive Summary, page 5). <p>The RAP makes it clear that the Scottish Government is continuing to engage very closely with the UK Government on the shape and scope of renewable energy legislation and the financial incentives that they create. There is reference to the Renewables Obligation (RO) mechanism and the RAP states that the Scottish Government is working with <i>"UK colleagues on the further changes to the RO required to align it with the demands of the EU 20% target...."</i> (page 17).</p> <p>Section 4 of the RAP highlights that each technology will have its own part to play in helping Scotland meet its energy targets <i>"and ministers are committed to a diverse renewables mix to maximise the scope to match supply with demand and to enhance security of supply"</i> (page 20).</p>
January 2010	<p>In regard to onshore wind energy, this sets out that work is being undertaken by the aviation/radar group and that the mapping study: <i>"could unlock further potential for development"</i>. It also mentions that the Consents Unit is: <i>"efficiently turning round decisions, with the aim for a decision within 9 months of submission of an application, unless there is a Public Inquiry."</i> This also outlined that since May 2007, Ministers have given consent to 14 windfarm planning applications totalling 1748.8 MW and refused 5 totalling 1157.1 MW.</p>
July 2010	<p>This update provides the same onshore wind highlights as that raised in January 2010 but also mentions that since May 2007 Scottish Ministers have given consent to 18 windfarm planning applications totalling 2.1 GW and refused 5 totalling 1.2 GW.</p>

Updates	Summary
January 2011	This highlights that on the 23rd September (2011) it was announced that an increase from 50 % to 80 % of Scotland's electricity demand will be met from renewables. It states that in 2009, renewables met over 27% of Scotland's Energy use. The update also sets out that since May 2007 Ministers have given consent to 20 onshore windfarm applications totalling 2.4GW and refused 5 totalling 1.2GW.
March 2011	This update mainly focusses on micro-generation. However, in regard to onshore windfarms this highlights that Scottish Ministers consented two onshore windfarms – a 69MW, 23 turbine extension to the existing Black Law Windfarm near Shotts enough to power 32,000 homes and support up to 80 jobs during construction and the 69 MW, 23 turbine Blackcraig Windfarm near New Galloway which will generate enough power for 32,000 homes and employ up to 60 people in construction.

A Low Carbon Economic Strategy for Scotland – ‘Scotland – a Low Carbon Society’

- 6.3.7 The Scottish Government issued this policy document In November 2010. In the report (page 6), the Government states an aspiration that within less than 10 years, 80% of electricity will be generated from renewables. In addition, the Government has developed an ambitious set of targets which will include the decarbonisation of electricity generation by 2030.
- 6.3.8 The Low Carbon Economic Strategy is an integral part of the Government's overall Economic Strategy and seeks to establish strong policy direction around Scotland's key low carbon economic opportunities.
- 6.3.9 The energy sector is referred to in Section 2.2 of the Report and onshore wind is specifically referred to a “.....*the technology that can make the most immediate positive impact on our low carbon economy and therefore the Scottish Government will continue to encourage large, medium and small scale Developments that are sited appropriately*”.

2020 Routemap for Renewable Energy in Scotland

- 6.3.10 The Routemap is an important Scottish Government policy document. The Executive Summary concludes by stating that: “*Across all scales of renewable generation, from householder to community to large-scale commercial schemes, the Scottish Government is working to make Scotland the renewables powerhouse of Europe. The benefits are not only in terms of energy generation and future security of supply, but can underpin our economic recovery over the next decade and beyond.*”
- 6.3.11 The Routemap provides an increase in the Scottish Government's overall renewable energy target to 30% by 2020. It specifically recognises the: “*scale of the challenge*” that requires to be addressed to meet the revised 2020 targets. It is noted that meeting the challenge: “*will be heavily dependent on regulatory processes, which we will seek to influence but over which we do not currently have control*” (page 19).
- 6.3.12 The Routemap provides a: “*synopsis of the main challenges*” that require to be addressed to meet the 2020 renewables targets, one of which is ‘*consents and planning*’. With respect to consents and planning, the Routemap identifies that a “*Further increase in consenting/deployment rates [is] required...*” (page 19).
- 6.3.13 Chapter 2 of the Routemap is entitled ‘*Crosscutting Challenges*’ and notes that there are a number of crosscutting challenges that require to be faced by all sectors

that make up the renewables industry if the 2020 targets are to be realised. One of the challenges identified is planning and consents.

- 6.3.14 The Routemap states that to meet the 2020 renewable electricity target of 100% renewables: *“a further increase in consenting and deployment rates will be required...This will be achieved by driving excellence in planning and consenting processes...”* (page 40).
- 6.3.15 Under the heading ‘Key Actions’, the Routemap identifies that the planning system *“must continue to balance environmental sensitivities with the need to make progress on renewables targets”* (page 70). This is a very important policy statement as it highlights that decision makers should be balancing the environmental effects of a development against the contribution that the development would make to achieve the 2020 targets.

The Routemap Update (October 2012)

- 6.3.16 On 30th October 2012 the Scottish Government issued ‘2020 Renewable Routemap for Scotland – Update’ (“The Update”). The Foreword refers to a new interim pre-2020 target that renewable electricity generation should account for the equivalent of 50% of Scottish demand by 2015. It adds that *“the vast majority of this new target will still be met by hydro and onshore wind”*.
- 6.3.17 The Update states that the Government estimates that approximately 35% of Scotland’s electricity needs are likely to have come from renewables in 2011, exceeding the 2011 interim target of 31%.
- 6.3.18 It also refers to various challenges affecting the sector and deployment. There is an acknowledgement that a number of onshore wind developments have helped to raise the profile of the renewable sector within the media and amongst the wider public and there is reference to public perceptions with regard to wind energy.
- *“We believe that the wider debate over renewables policy and the progress of applications through the planning system can sometimes be hampered by the widespread availability and acceptance of flawed information and myths about renewables.”* (Section 2.3);
 - *“Contrary to some claims by detractors, we estimate that less than 2% of Scotland’s land mass will be required as a contribution by onshore wind towards meeting the 2020 target. Onshore wind – in the right areas – will also play a vital role in strengthening the grid, supply chain and other infrastructural components which emerging technologies, such as offshore wind, wave and tidal energy, will depend upon.”* (Section 2.4);
 - *“The Government intends to continue to engage with stakeholders to ensure that all facts regarding wind energy development are accurately represented. This includes consideration being given to how to update the existing evidence base around the effects of wind turbines on tourist’ attitudes and behaviour.”*(Section 2.5) and
 - *“Surveys continue to suggest that a very large majority of people support the deployment of renewable energy technologies. The most recent findings from DECC’s tracking survey of public attitudes, which began in March this year, show that 77% of those surveyed support the use of renewables to produce electricity, heat and transport fuel, with only 4% opposed.”* (Section 2.6)

Progress to 2020 Target

- 6.3.19 The 2020 target of delivering the equivalent of 100% of Scottish electricity consumption equates to 16 GW of installed capacity. Figures released from DECC, show that as at December 2012, Scotland had 5.9 GW of installed renewable electricity generation capacity, with an additional 4.3 GW of capacity either under

construction or consented, the majority of which is expected from wind generation, particularly offshore. This equates to 10.2 GW of future operational capacity. This illustrates the continued requirement for further renewable electricity.

The Scottish Government Economic Strategy (2011)

- 6.3.20 An important material consideration is the Government's Economic Strategy, which was issued on 12 September 2011. It states that a new Strategic Priority has been established as a transition to a low carbon economy. The opportunity is set out to reindustrialise the nation and create thousands of new jobs by 2020. The Foreword states that the Government is: "*determined to deliver on this ambition.*"
- 6.3.21 It comments (page 52) that the transition to a low carbon economy will create opportunities for all of Scotland with strong prospects for rural Scotland, particularly in the renewable energy sector.
- 6.3.22 At page 53 of the document there is reference to transformational changes and these include decarbonisation of electricity generation by 2030.
- 6.3.23 This strategy highlights that the Government views renewable energy as key to the delivery of sustainable economic growth and key to accelerating Scotland's economic recovery, including job creation.

Electricity Generation Policy Statement (EGPS) 2013

- 6.3.24 The EGPS 2013 sets out the Scottish Government's position on the respective roles of renewable generation and fossil fuel thermal generation in Scotland's future energy mix. The EGPS 2013 forms the: "*basis for further and ongoing modelling of the future electricity generating mix in Scotland, beyond 2020.*" It states that there is a requirement for rapid expansion of renewable electricity installations and new efficient thermal capacity.
- 6.3.25 The EGPS 2013 highlights a number of targets and requirements, as follows (inter alia):
- "*Delivering the equivalent of at least 100% of gross electricity consumption from renewables by 2020 as part of a wider, balanced electricity mix;*
 - "*An interim target of 50% gross electricity consumption from renewables by 2015;*
 - "*Enabling local and community ownership of at least 500MW of renewable energy by 2020;*
 - "*Seeking increased interconnection and transmission upgrades capable of supporting projected growth in renewable capacity and*
 - "*Reducing final energy consumption in Scotland by 12%*"
- 6.3.26 The EGPS 2013 continues by outlining that: "*Scotland's renewables potential is considerable. Figures published on the UK Department of Energy and Climate Change website in May 2013 estimated that, between April 2010 and January 2013 the industry announced projects amounting to over 9,000 jobs and £13 billion investment in Scotland.*"
- 6.3.27 Under the heading '*Delivering the Scottish Government's Objectives for Electricity Generation*' it comments in the section '*Scale of Overall Challenge*' that: "*Target requires a sustained annual renewable deployment rate of more than twice that ever experienced in Scotland and thus will depend upon investment in and installation of large-scale schemes. Especially offshore wind.*" It further states under the section '*Consents and Planning*' that: "*Further increase in consenting/deployment rates required especially for offshore wind in harmony with environment. Need to ensure that, as renewable penetration increases onshore, environmental and land use considerations are not compromised.*"

6.3.28 It is very clear that not only does the EGPS 2013 advocate that: “*rapid expansion of renewable energy across Scotland*” is necessary but also to meet the 2020 targets outlined above requires significant investment, double the current deployment rate, large scale schemes and an expedited consenting process to help ensure quick delivery.

6.4 Planning Policy National Planning Framework (NPF) 3 (June 2014)

6.4.1 Scotland’s third National Planning Framework (NPF3) was published by the Scottish Government on 23 June 2013. NPF3 is a long term strategy for Scotland and is the spatial expression of the Government’s Economic Strategy and plans for development and investment in infrastructure.

6.4.2 NPF3 sets out the Government’s “vision” for Scotland which is referred to as inter alia:-

- A successful, sustainable place;
- A low carbon place; and
- A natural resilient place

6.4.3 NPF3 highlights the Government’s ambition “*to achieve at least an 80% reduction of greenhouse gas emissions by 2050*”.

6.4.4 NPF3 also refers to the Government’s aim to meet at least 30% of overall energy demand from renewables by 2020 – this includes generating the equivalent of at least 100% of gross consumption from renewables with an interim target of 50% by 2015 and the Electricity Policy Statement sets out how these energy targets will be met.

6.4.5 NPF3 makes it clear that onshore wind development is recognised as a key technology in the energy mix which will contribute to Scotland becoming ‘a low carbon place’ which in turn will be a key part of the ‘vision’ for Scotland.

Scottish Planning Policy (SPP) (June 2014)

6.4.6 A new Scottish Planning Policy (SPP) was published on 23rd June 2014. The purpose of the SPP is to set out national planning policies which reflect Scottish Government Ministers’ priorities for the operation of the planning system and for the development and use of land.

6.4.7 The content of SPP is a material consideration that carries significant weight, although it is for the decision maker to determine the appropriate weight to be afforded to it in each case.

6.4.8 SPP introduces four planning outcomes which explain “*how planning should support the vision*” for the planning system in Scotland. Three of these outcomes are particularly relevant namely:-

- Outcome 1: a successful sustainable place – supporting sustainable economic growth andthe creation of well designed, sustainable places;
- Outcome 2: a low carbon place – reducing our carbon emissions and adapting to climate change; and
- Outcome 3: a natural, resilient place – helping to protect and enhance our natural and cultural assets, and facilitating their sustainable use.

6.4.9 A key new ‘Policy Principle’ in the SPP is the statement at Paragraph 27 which is as follows:

“This SPP introduces a presumption in favour of development that contributes to sustainable development”.

6.4.10 Paragraph 28 continues and states:

“the planning system should support economically, environmentally and socially sustainable places by enabling development that balances the cost and benefits of the proposal over the longer term. The aim is to achieve the right development in the right place; it is not to allow development at any cost”.

6.4.11 The introduction of the presumption in favour for development that contributes to sustainable development has important consequences for development management practice. The text in SPP explains how this Policy Principle is ‘operationalised’ in development management and is addressed in more detail in the context of the proposed development within the Planning Supporting Statement.

6.4.12 Onshore wind is specifically addressed in Paragraph 161 of SPP. Detailed guidance is provided for Planning Authorities with regard to the preparation of spatial frameworks for onshore wind development, and it makes it clear that proposals for onshore wind turbine development should continue to be determined whilst spatial frameworks and local policies are being prepared and updated.

6.4.13 In terms of development management, Paragraph 169 of SPP set out that *“proposals for energy infrastructure should always take account of spatial frameworks for wind farms and that considerations will vary relative to the scale of proposals and area characteristics but are likely to include a number of matters”.* These matters are set out in detail the accompanying planning statement and have been taken in consideration in the development of the revised proposals.

6.4.14 Support for renewable energy development at an appropriate scale remains SPP, with the 2020 targets being reiterated and the continued support for onshore wind being firmly re-stated.

6.4.15 Both NPF3 and SPP are relevant to the consideration of the proposed development and have been assessed in detail in the accompanying planning supporting statement.

Land Use Strategy for Scotland

6.4.16 ‘*Getting the best from our land: A land use strategy for Scotland*’ was published by the Scottish Government in 2011 in response to the need for strategic direction due to the scale and complexity of the issues around land use and sets the agenda for a five-year period.

6.4.17 Renewable energy is recognised as a key resource for Scotland and states that onshore wind power is currently one of the two main sources of renewable energy supplies. Wind energy is part of the strategy to move Scotland towards a low-carbon economy in response to climate change.

6.4.18 It outlines the Scottish Planning Policy framework for windfarms with reference to renewable planning advice and their work with Scottish Natural Heritage.

6.5 Planning Advice Notes

6.5.1 Planning Advice Notes which are considered to be relevant to the proposed development are listed below in **Table 6.2**.

Table 6.2: Planning Advice Notes

Guidance	Summary
PAN 2/2011 Archaeology the Planning Process and Scheduled Ancient Monument Procedures (2011)	Provides best practice advice on addressing archaeological issues within the planning process and on best practice separate controls over scheduled monuments.
Scottish Government Web Based Renewables Guidance	Advises on aspects of 'Onshore Wind Turbines' and on the 'Process for preparing spatial frameworks for windfarms'.
PAN 1/2011 Planning and Noise (2011)	Sets out the role of the planning system in preventing and limiting the adverse effects of noise. It references 'The Assessment and Rating of Noise from Wind Farms' (ETSU-R-97) in relation to wind turbines.
PAN 3/2010 Planning Advice on Community Engagement (2010)	This advice note provides guidance to help developers interact with the general public and local communities effectively. This can bring added value to the planning and development process. Although there are legal requirements for applicants to engage with the community on some applications, the PAN advocates that some applicants voluntarily engage with communities before making a planning application. This is beneficial to the developer as it educates and informs them of the community's view of the development and provides an early opportunity to address these concerns. The Scottish Government recommends that section 36 applications follow the PAN process.
PAN 51 Planning, Environmental Protection and Regulation (Revised 2006)	The purpose of PAN 51 is to support existing policy on the role of the planning system in relation to the environmental protection regimes. The PAN summarises the responsibilities of the environmental protection bodies and lists relevant legislation which may also be a consideration for development proposals.
PAN 1/2013 Environmental Impact Assessment	Relates specifically to environmental impact assessment for development projects authorised under planning legislation. It provides information and advice on: the legislative background to EIA; EIAs in Scotland; the process of EIA; environmental studies and statements; the evaluation of environmental information by the planning authority and implementation through planning decision.
PAN 60 Planning for Natural Heritage (2000) (Updated 2008)	Gives basic advice in relation to development and natural heritage. It reiterates the Government's commitment to the protection and enhancement of the natural heritage.
PAN 68 Design Statements (2003)	In accordance with PAN 68 the ES explains how the scheme design has evolved and been influenced by site constraints.
PAN 69 Planning and Building Standards Advice on Flooding (2004)	This provides best practice advice to help guide future built development away from areas at a significant risk from flooding. It identifies three broad stages that must be followed where EIA is required. Firstly, the developer must compile detailed information about the impacts and measures and how to address them. Secondly the ES must be publicised giving all relevant authorities and the public an opportunity to give their views about the project and ES. The ES together with the comments received must then be taken into account when deciding whether to grant development consent.
PAN 75 Planning for Transport (2005)	Provides advice on the requirement to link transport strategies and development plans and the need to take into account accessibility, location, modal split parking and design.

Guidance	Summary
PAN 79 Water and Drainage (2006)	The purpose of this PAN is to provide advice on good practice in relation to the provision of water and drainage.

Online Renewables Planning Advice (First published in February 2011 with latest update in May 2014)

- 6.5.2 The Scottish Government introduced new online renewables advice in February 2011 which has been updated a number of times, with the most recent edition provided in May 2014. As noted in **Table 6.2** this advice takes the form of web based renewables advice notes which have replaced PAN45: Renewable Technologies and PAN45: Annex 2: Spatial Frameworks and Supplementary Guidance for Wind Farms.
- 6.5.3 When formulating Development Plans, planning authorities should provide greater clarity on where groups of wind turbines can be located by ensuring that a spatial framework for windfarms greater than 20MW has been set out in the Development Plan.
- 6.5.4 The advice note updated in 2014 states that wind turbines can impact upon the landscape by virtue of their number, size or layout, how they impact on the skyline, their design and colour, any land form change, access tracks and ancillary components anemometers, substations and power lines. The ability of the landscape to absorb development often depends largely on features of landscape character such as landform, ridges, hills, valleys and vegetation. As more areas of search are taken up and as more sites are proposed within or near sensitive landscapes, landscape protection and designing appropriate mitigation through conditions and/or legal agreements, will become a more routine consideration alongside maximising the potential of wind energy. In relation to landscape impact, a cautious approach is necessary in relation to particular landscapes which are rare or valued, such as National Scenic Areas and National Parks.
- 6.5.5 SPP refers to a guideline separation distance of up to 2 km between areas of search for groups of wind turbines and the edge of towns, cities and villages, to reduce visual impact. However, this 2 km separation distance is a guide not a rule and decisions on individual developments should take into account specific local circumstances and geography

Online Policy Subject: Wind Farm Developments on Peat Land, Scottish Government, 2011

- 6.5.6 The Scottish Government supports the development of the carbon calculator for use in the consideration of carbon savings from windfarm developments on peatlands. The purpose of the tool is to assess, in a comprehensive and consistent way, the carbon (GHG emissions) impact of windfarm developments. This is done by comparing the carbon costs of windfarm developments with the carbon (GHG emissions) savings attributable to the windfarm. The calculation is summarised as the length of time (in years) it will take the carbon savings to amount to the carbon costs; this is referred to as the payback period. Applications for windfarms are screened to establish whether they are on deep peat sites and where they do, developers will be expected to use the carbon calculator in preparing their application.

Scottish Historic Environment (SHEP) 2011

- 6.5.7 SHEP outlines the Scottish Ministers' policies for the historic environment, provides greater policy direction for Historic Scotland and provides a policy framework.
- 6.5.8 Paragraph 1.13 of the document sets out that the key outcomes of SHEP include protecting and enhancing the historic environment, securing greater economic benefits from it and ensuring that the people of Scotland and visitors value, understand and enjoy the historic environment.

6.6 Local Planning Policy Context

- 6.6.1 This section sets out the relevant local planning policy context for the proposed development. The application site for the Pencloe Windfarm is within East Ayrshire Council local planning authority jurisdiction and is immediately to the north of the Dumfries & Galloway Council border.
- 6.6.2 The review of relevant local planning policy is structured, as follows:
- Ayrshire Joint Structure Plan (AJSP) 2007;
 - East Ayrshire Local Plan (EALP) 2010;
 - Core Paths Plan 2008;
 - Proposed East Ayrshire Local Development Plan (EALDP);
 - Supplementary Planning Advice;
 - Ayrshire Joint Structure Plan 2025 – Report of Survey Technical Report TR03/2006 – Renewables;
 - Addendum to the Ayrshire Joint Structure Plan (AJSP) Technical Report TR03/2006 'Guidance on the Location of Wind farms within Ayrshire and
 - East Ayrshire Landscape Wind Capacity Study (EALWCS) 2013.

Ayrshire Joint Structure Plan 2007

- 6.6.3 The Ayrshire Joint Structure Plan (AJSP) was approved in November 2007 and seeks to establish: *“a framework that brings together the aspirations of communities with those of business and industry and the area's many supporting agencies and organisations, to provide a strategic land use context to the year 2025.”*
- 6.6.4 The AJSP includes five key objectives, of which the following three are considered relevant to the proposed development:
- *“to support measures that encourage economic development underpinned by a sustainable population;*
 - *to develop strong and vibrant communities by realising their potential for regeneration and growth and through the promotion of appropriate development for rural areas and*
 - *to safeguard and enhance the quality of the environment.”*
- 6.6.5 Policy STRAT 1 Sustainable Development: *“The three councils shall as appropriate, apply the guiding principles of sustainable development in Schedule 1 to the preparation of development plans, the consideration of masterplans and to planning applications.”* Schedule 1 (Guiding Principles for Sustainable Development) comments on:
- Economic Resources;
 - Community Regeneration;
 - Environmental Quality;
 - Improving Accessibility and

- Development Obligations.
- 6.6.6 Paragraph 43 recognises that Ayrshire has: “*significant renewable energy resources and is well placed to exploit its generation and use.*”
- 6.6.7 Policy ECON 6 Renewable Energy sets out that: “*Proposals for the generation and utilisation of renewable energy should be promoted and will conform to the plan both in stand-alone locations and as integral parts of new and existing developments where it can be demonstrated there will be no significant adverse impact, including adverse cumulative impact or infrastructure constraints and there the design of the development is sensitive to landscape character, biodiversity and cultural heritage.*”
- 6.6.8 Paragraph 46 expands by stating that: “*...there is an onus to find wind farm locations that would contribute to the overall national supply and take environmental impacts into account. It is also recognised, however, that local benefits arising from wind farms can be important to the future economic regeneration of local communities.*” It further comments that two areas of search have been identified and that outside these areas energy proposals will be judged against Policy ECON 7.
- 6.6.9 Policy ECON 7 ‘Wind Farms’ sets out that: “*In designated Areas of Search, proposals for large scale and small scale wind farm development will be supported subject to specific proposals satisfactorily addressing all other material considerations.*”
- 6.6.10 Outside the ‘Areas of Search’ the policy comments that: “*all wind farm proposals will be assessed against the following constraints any positive or adverse effects on them and how the latter can be overcome or minimised:*
- *Historic environment;*
 - *Areas designated for their regional and local natural heritage value;*
 - *Tourism and recreational interests;*
 - *Communities;*
 - *Buffer zones;*
 - *Aviation and defence interests and*
 - *Broadcasting installations.*”
- 6.6.11 The policy continues by stating that: “*Proposals affecting Sensitive Landscape Character Areas shall satisfactorily address any impacts on the particular interest that the designation is intended to protect but the designation shall not unreasonably restrict the overall ability of the plan area to contribute to national targets.*”
- 6.6.12 The policy further states: “*In all cases, applications for wind farms should be assessed in relation to criteria including, as appropriate, grid capacity, impacts on the landscape and historic environment, ecology (including birds), biodiversity and nature conservation, the water environment, communities, aviation, telecommunications, noise and, shadow flicker.*”
- 6.6.13 The proposed development is not located within an: ‘Area of Search for Large Scale Wind Farm Development’ as designated within the AJSP but does fall within a ‘Sensitive Landscape Character Area’ (see **Figure 7.2.3 Volume III**).
- 6.6.14 As with most of the Ayrshire area, the proposed development is located within an area highlighted as presenting ‘Potential Constraint’ to windfarm developments as set out in Map 4 of the advisory addendum to the Structure Plan (see **Figure 6.1 Volume III**). However, the application site is located outside of the regions designated for ‘Significant Protection’ against the development of windfarms within their boundaries (see **Figure 6.1 Volume III**).

6.6.15 The advisory addendum states that:

“The existence of a constraint does not necessarily preclude development but should be taken as a signal to the developer that a clear understanding of the nature of the constraint, the factors that must be satisfactorily addressed and any mitigation required to produce an acceptable level of impact will need to be fully demonstrated and agreed. Identifying and clarifying constraints in this way should steer applicants away from potentially constrained areas and towards areas with fewer or no constraints. In all cases developers will be required to show that their proposals are consistent with all the relevant Ayrshire Joint Structure Plan policies.”

6.6.16 The Addendum to the AJSP Technical Report TR03/2006 ‘Guidance on the Location of Wind farms with Ayrshire’ (outlined further below) sets out environmental and technical areas throughout its jurisdiction and the site location relevant to each is outlined in **Figures 6.1 and 6.2 Volume III**. Furthermore, there are a number of additional relevant AJSP policies which are relevant to the proposed development and these are set out below.

Table 6.3: AJSP policies

AJSP Policy	Policy Topic	Policy Text
ECON 14	Rural Diversification	This policy acknowledges the role renewable energy among others has to play in supporting rural diversification.
ENV 1	Landscape Quality	This policy recognises that the quality of Ayrshire’s landscape should be maintained and enhanced. It notes that particular care should be taken to conserve features which contribute to local distinctiveness. This includes the setting of communities in the landscape, skylines, hill features and prominent views.
ENV 2	Landscape Protection	This sets out that in ‘ <i>Sensitive Landscape Character Areas</i> ’ the protection and enhancement of the landscape will be given full consideration.
ENV 4	Green Network	Development within, adjacent or affecting the areas identified in the ‘ <i>Green Network</i> ’ should be designed to enhance the landscape quality and expand the habitat potential of the areas concerned.
ENV 5	Woodland and Forestry	This policy supports proposals for woodland and forestry where they are will be supported where they are consistent with the objectives and key actions of the ‘ <i>Ayrshire and Arran Woodland Strategy</i> ’ as well as AJSP and local plans.
ENV 6	Protection of the Built Heritage	This policy seeks to protect built heritage including listed buildings, conservation areas, historic gardens, designed landscapes and archaeological locations from development considered to have ‘ <i>adverse effects</i> ’ upon these assets.
ENV 7	Natural Heritage Designations	This policy underlines the importance of the protection of the natural heritage resource, including nationally designated sites under the collective banner of Natura 2000 network.
ENV 8	Flooding	This policy will not permit any development proposals which would be at significant risk of flooding or which would increase the probability of flooding elsewhere.
ENV 11	Air, Noise and Light Pollution	This policy operates a presumption against proposals that cause harm in regard to air, noise and light pollution.
TRANS 1	Land Use and Transportation	This policy defines criteria that aim to promote sustainable transport measures, the provision of appropriate transport infrastructure and minimise environmental impacts of road traffic.

Local Plan Policy

- 6.6.17 The application site falls within East Ayrshire Council local planning authority jurisdiction and is immediately to the north of the Dumfries & Galloway Council border.

East Ayrshire Local Plan (EALP) 2010

- 6.6.18 The East Ayrshire Local Plan 2010 was adopted by the Council on 26 October 2010 and includes a number of policies to protect the landscape. These policies seek to protect the defining characteristics of the landscape and the constituent features. In addition, a number of strategic policies are set out which include: Strategic Policy ENV3 whereby:

“The Council will give priority and prime consideration to the protection and enhancement of the landscape in its consideration of development proposals within the Sensitive Landscape Character. Areas identified on the local plan maps. The Council will ensure that all development proposals in these areas respect, in terms of their design, size, scale and location, the local landscape characteristics of the particular area within which they are proposed.”

- 6.6.19 The proposed Pencloe Windfarm is located within the ‘Sensitive Landscape Area’ which extends to the south of New Cumnock. (See **Figure 7.1.2 Volume III**). A number of relevant policies are included below in in **Table 6.4**.

Table 6.4: EALP Policies

EALP 2010 Policy	Policy Topic	Policy Text
Policy SD1	Strategic	This refers to AJSP Policy STRAT 1 and the Guiding Principles for Sustainable Development detailed in Schedule 1 of the AJSP. It outlines that new development should not have any unacceptable adverse impact on: <ul style="list-style-type: none"> iv. <i>“the character and appearance of the particular location in which it is proposed;</i> v. <i>the environment and amenity of local communities and residents of the area;</i> vi. <i>landscape character and quality and</i> vii. <i>natural or built heritage resources.”</i>
Policy SD5	Development Proposals outwith Settlement Boundaries	This comments on proposal outside settlement boundaries and states that these will only be acceptable where development: <i>“Contributes to the rural diversification through the development of appropriate industrial, business, tourism, leisure, recreational and other developments with a justified need for a rural location.”</i>
Policy CS12	Renewable Energy Developments (General)	This policy operates a positive presumption in favour of renewable energy development : <i>“where it can be demonstrated that there will be no significant, unacceptable adverse impact, including adverse cumulative impact with other existing renewable energy developments or other renewable energy developments, which are consented or under construction;”</i> (including inter alia): <ul style="list-style-type: none"> viii. <i>on any recognised statutory or non-statutory sites of nature conservation interest;</i> ix. <i>on the amenity of nearby communities or sensitive</i>

EALP 2010 Policy	Policy Topic	Policy Text
		<p><i>establishments;</i></p> <p>x. <i>on any recognized built heritage resources;</i></p> <p>xi. <i>On the visual amenity of the area and</i></p> <p>xii. <i>On existing infrastructure. “</i></p> <p>The policy continues to state that developers will be required to demonstrate <i>“there will be no unacceptable adverse environmental impact caused by any proposed connections linking the proposed development with the national grid and the surrounding road network.”</i></p>
Policy CS14	Wind Energy Developments	Policy CS14 refers to the need for proposals to be consistent with AJSP Policy ECON7. Policy ECON7 is outlined further above.
Policy CS15	Wind Energy Developments	This refers to a Renewable Energy Fund which will be used to: <i>“finance sustainable community environmental projects, particularly those designed to help reduce carbon emissions and counteract global warming. For a period of 10 years from the commencement of construction work on the wind farm, all contributions will be directed exclusively to local projects within 10 km of the boundary of the wind farm. Thereafter, 50% of the contributions received will be directed towards local projects with 50% being reserved for use in the wider East Ayrshire area.”</i>
Policy CS16	Wind Energy Developments	This policy refers to wind turbines that have not been in operation producing electricity for a continuous period of 6 months. In this scenario, the operator will need to provide evidence to the Council setting out why this has occurred other otherwise the subject turbine may be deemed as being surplus to requirements. Potentially, this could result in the removal of a wind turbine.
Policy CS17	Wind Energy Developments	The policy seeks to safeguard operational windfarms from other forms of development that could potentially inhibit their operational effectiveness.
Strategic Policy ENV1	Strategic – Built Heritage	This seeks to protect Listed Buildings and Conservation Areas, together with their respective settings, Historic Gardens and Designed Landscapes, Scheduled Ancient Monuments and Archaeological and Industrial Archaeological Sites and Landscapes.
Strategic Policy ENV2	Strategic -Natural Heritage	This policy aims to protect, preserve and enhance all natural heritage resources requiring conservation including Special Protection Areas, Special Areas for Conservation, Sites of Special Scientific Interest, Confirmed or Provisional Wildlife Sites and Local Nature Reserves.
Strategic Policy ENV3	Strategic – Landscape	Policy ENV3 sets out that the Council will give ‘ <i>prime consideration</i> ’ to: <i>“the protection and enhancement of the landscape in its consideration of development proposals within the Sensitive Landscape Character Areas identified on the local plan maps. The Council will ensure that all development proposals in these areas respect, in terms of their design, size, scale and location, the local landscape characteristics of the particular area within which they are proposed.”</i>

EALP 2010 Policy	Policy Topic	Policy Text
Policy ENV 6	Ancient Monuments and Archaeology	This policy sets out that the Council will protect Scheduled Ancient Monuments and other identified nationally important archaeological resource. It further comments that these assets shall be preserved in situ and within an appropriate setting. The policy also highlights that: <i>“Developments which have an adverse effect on Scheduled Monuments or the integrity of their settings shall not be permitted unless there are exceptional circumstances.”</i>
Policy ENV8	Historic Gardens and Designed Landscapes	Policy ENV 8 seeks to safeguard Historic Gardens and Designed Landscapes. It aims to protect and enhance such areas including: <i>“important views to, from and within them, or upon the site or setting of component features which contribute to their value.”</i>
Policy ENV13	Natural Heritage	<i>This sets out that any proposal that would have a significant effect on a Natura 2000 site will be subject to an “appropriate assessment”.</i> In the scenario that such an assessment does not provide a positive conclusion development will only be permitted where (inter alia): <ul style="list-style-type: none"> <i>i. “there are no alternative solutions and</i> <i>ii. there are imperative reasons of overriding public interest.”</i> <p>The policy continues: <i>“Development that affects a Site of Special Scientific Interest will only be permitted where an appraisal has demonstrated that:</i></p> <ul style="list-style-type: none"> <i>i. the objectives of the designated area and the overall integrity of the area would not be compromised; or</i> <i>ii. any significant adverse effects on the qualities for which the area has been designated are clearly outweighed by social or economic benefits of national importance.”</i>
Policy ENV15	Natural Heritage	This aims to prevent development causing: <i>“unacceptable and irreparable damage to important landscape features”</i> It places an onus on, developers: <i>“to conserve and enhance features which contribute to the intrinsic landscape value and quality of the area concerned and which are likely to be adversely affected by the particular development proposed.”</i>
Policy ENV16	Landscape Character	Policy ENV 16 seeks to prevent development which would create unacceptable visual intrusion or irreparable damage to the landscape character of rural areas.” It continues to state: <i>“The Council will ensure, through the development process that any authorised development is in keeping with, has minimal visual impact and reflects the nature and landscape character of the rural area in which it is located, in terms of layout, materials used, design, size, scale, finish and colour. The design and material finish of any ancillary features will also be required to be sympathetic to the character and appearance of the area.”</i>
Policy ENV17	Specific Development Opportunity Sites	This policy operates a general presumption against any development which would: <i>“have significant unacceptable adverse impact or cause irreparable damage to built heritage resources requiring conservation or their settings including listed buildings, conservation areas, historic gardens and</i>

EALP 2010 Policy	Policy Topic	Policy Text
		<i>designed landscapes, scheduled ancient monuments, archaeological and industrial archaeological sites.</i> This presumption will continue against development proposals that result in significant unacceptable adverse impact or cause irreparable damage to natural heritage resources, have significant unacceptable adverse visual impact or cause irreparable damage to the landscape character and scenic quality of the area within which it is proposed. The policy is also applicable to proposals which affect the quality of water resources or result in the destruction of any areas of peat which are considered to be of significant ecological value.
Policy ENV21	Flooding	This operates a safeguarding presumption against development that is likely to result in increased flood risk.
Policy ENV24	The Water Environment	This operates a presumption against any developments which have an adverse effect on the water environment.
Policy ENV25	Air Quality, Noise and Light Pollution	This requires proposals to have: <i>“minimal adverse impacts on air quality and ensure that any new development will have minimum adverse effects on the physical environment and the amenity of an area as a result of light and noise pollution.”</i>
Policy ENV26	Noise	This operates a presumption against any proposals: <i>“located in areas demonstrated or proven to be directly adversely affected by existing noise or other polluting activities, or within safety zones around recognised hazardous installations.”</i>
Policy T3	Roads	This requires developers to ensure that proposals meet with the Councils roads standards.
Policy T5	Section 75 Agreements	This sets out that where necessary Section 75 Agreements with the Council will be required.
Policy T9	Rights of Way	This policy seeks to protect existing or potential rights of way, bridle paths or footpaths used by the general public for recreational or other purposes.

Core Paths Plan 2008

6.6.20 The East Ayrshire Core Paths Plan was adopted in November 2008. Within a 5 km radius from the centre of the application site, there are numerous footpaths within the East Ayrshire Local Authority area shown as Core Paths. The South Ayrshire Local authority area does not highlight any Core Paths. An overview of Core Paths is set out in **Chapter 7: Landscape and Visual** and impacts on rights of way are addressed in **Chapter 14: Socio-Economics**.

Proposed East Ayrshire Local Development Plan (EALDP)

6.6.21 The Council is in the process of preparing a ‘*Proposed Local Development Plan*’ (EALDP) and is due for publication in June 2014. Adoption of the LDP is expected in early 2016 when it will replace the East Ayrshire Local Plan 2010, the Ayrshire Joint Structure Plan 2007 and the Opencast Coal Subject Plan 2003.

Guidance

6.6.22 The key policy considerations arising from a review of current planning policy as it relates to windfarm development and landscape matters are set out below:

- The application site is located within an area of Unconstrained Land as defined on Map 2 of the Ayrshire Supplementary Planning Guidance (SPG): Wind Farm Development, October 2009, but falls into an area of Potential Constraint due to the presence of radar issues with Prestwick Airport the Planning Statement which accompanies this ES will expand on this in greater detail.
- The SPG summarises the findings of the Ayrshire and Clyde Valley Wind Farm Landscape Capacity Study as a series of maps which indicate that the application site falls into an area with: “Low Landscape Sensitivity to Large Scale Wind farms” Please see **Chapter 7: Landscape and Visual Assessment** for further detail.
- The SPG includes a summary of key issues with regard to Landscape Units defined in the Ayrshire Landscape Assessment. The application site falls into the Southern Uplands with Forests Landscape Unit. The document states that: “Large parts of the southern uplands have potential for wind power development. Wind farm development will be steered to those parts of the southern uplands already affected by forestry or other developments.” The document also states that “The siting of turbines should use adjacent forested landscapes to aid screening and back clothing. Development should be located away from key skylines and valleys.” Please see **Chapter 7: Landscape and Visual Assessment** for further detail.
- The application site lies on the border of Dumfries and Galloway Council whose ‘Interim Planning Policy: Wind Energy Development’ indicates that the application site is immediately adjacent to a Lower Sensitivity Landscape Area and also a Wind Energy Area of Search for large scale wind energy developments; it states that: “proposals for wind farms and wind turbines will be considered favourably.”
- The East Ayrshire Local Plan 2010 includes a number of policies to protect the landscape. These policies seek to protect the defining characteristics of the landscape and the constituent features. In addition, a number of strategic policies are set out which include Strategic Policy ENV3 whereby: “The Council will give priority and prime consideration to the protection and enhancement of the landscape in its consideration of development proposals within the Sensitive Landscape Character. Areas identified on the local plan maps. The Council will ensure that all development proposals in these areas respect, in terms of their design, size, scale and location, the local landscape characteristics of the particular area within which they are proposed.” The proposed Pencloe Windfarm is located within the ‘Sensitive Landscape Area’ which extends to the south of New Cumnock.

6.6.23 Current East Ayrshire and Dumfries and Galloway planning policy is therefore supportive of large scale of wind energy development within the area identified for the proposal. It is recognised that the development needs to observe its location within a ‘*Sensitive Landscape Area*’ and that the detailed design of the proposals will need “*to ensure that the landscape quality of Sensitive Landscape Character Areas is maintained for the benefit of local communities.*” **Chapter 7: Landscape and Visual Assessment** and the Planning Statement will explore this policy in greater detail.

Ayrshire Joint Structure Plan (AJSP) – Report of Survey Technical Report TR03/2006 – Renewables

6.6.24 This report was prepared as part of the ‘*Report of Survey*’ for the AJSP. This was created to provide evidence to help form the policies that would make up the AJSP. This document recognises that much of the renewable energy targets would be met from onshore windfarms. It states that: “*Proposals for the generation and utilisation*

of renewable energy should be promoted and will conform to the plan both in standalone locations and as integral parts of new and existing developments where it can be demonstrated that there will be no significant adverse impact, including adverse cumulative impact or infrastructure constraints and where the design of the development is sensitive to landscape character, biodiversity and cultural heritage.”

Addendum to the Ayrshire Joint Structure Plan (AJSP) Technical Report TR03/2006 ‘Guidance on the Location of Wind farms within Ayrshire’ (2009)

- 6.6.25 As referred to further above an Addendum to the AJSP Technical Report TR03/2006 ‘*Guidance on the Location of Wind farms within Ayrshire*’ This was prepared to support the implementation of wind energy policy as set out in the AJSP and to provide clarity regarding those areas where development is likely to be acceptable.
- 6.6.26 The guidance states that cumulative impacts will most frequently involve landscape and visual impacts but may also affect natural heritage designations and aviation interests, taking into account existing windfarms, those which have permission and those that are the subject of valid but undetermined applications. Where the limit of acceptable cumulative impact has been reached within a specified area, windfarms will be steered away from these locations.
- 6.6.27 As highlighted further above, like the vast majority of Ayrshire the proposed development is within an ‘*Area of Potential Constraint*’. It is important to note that paragraph 23 of the Addendum sets out that: “*The existence of a constraint does not necessarily preclude development but should be taken as a signal to the developer that a clear understanding of the nature of the constraint, the factors that must be satisfactorily addressed and any mitigation required to produce an acceptable level of impact will need to be fully demonstrated and agreed.*” Clearly, there is no moratorium on windfarm development within such areas and each case will be considered on its individual merits.
- 6.6.28 The addendum also states that within defined areas of ‘*Sensitive Landscape Character*’, in which the proposed development is located, the protection and enhancement of landscape is recognised in policy as a priority. However, this does not necessarily preclude windfarm development in this area but rather requires a clear understanding of the nature of the constraint(s) and careful consideration of mitigation measures to ensure an acceptable level of impact. Developers will be required to show that their proposals are consistent with all the relevant Ayrshire Joint Structure Plan policies.

East Ayrshire Landscape Wind Capacity Study (EALWCS) 2013

- 6.6.29 The aim of the EALWCS 2013 is to inform strategic planning for wind energy development and guidance on the appraisal of individual windfarm proposals.
- 6.6.30 The application site is within a character type termed ‘*Southern Uplands with Forestry*’ Landscape Character 20c. While the application site of the proposed development exhibits limited characteristics identified within this type, the evolution of the layout and its design rationale has given consideration to the findings of the studies in regard to what is termed the ‘*Large Wind Turbine Typology*’. The assessment and design rationale against the topic areas to Southern Uplands with Forestry Typology is provided **Chapter 7: Landscape and Visual Assessment Section 7.9.**

6.7 Summary

6.7.1 The following documents have been reviewed and the policies which are most relevant to the proposed Pencloe Windfarm have been highlighted and explored further in **Chapter 7: Landscape and Visual Assessment** and the standalone Planning Statement which accompanies the ES:

- Ayrshire Joint Structure Plan (AJSP) 2007;
- East Ayrshire Local Plan (EALP) 2010;
- Core Paths Plan 2008;
- Proposed East Ayrshire Local Development Plan (EALDP);
- Supplementary Planning Advice;
- Ayrshire Joint Structure Plan 2025 – Report of Survey Technical Report TR03/2006 – Renewables;
- Addendum to the Ayrshire Joint Structure Plan (AJSP) Technical Report TR03/2006 ‘Guidance on the Location of Wind farms within Ayrshire and
- East Ayrshire Landscape Wind Capacity Study (EALWCS) 2013.

6.8 References

- Ayrshire Joint Structure Plan (AJSP) – Report of Survey Technical Report TR03/2006 – Renewables (2006) <http://www.ayrshirejsu.gov.uk/download/Technical%20Report%203%20-%20Renewables1.pdf>
- Addendum to the Ayrshire Joint Structure Plan (AJSP) Technical Report TR03/2006 ‘Guidance on the Location of Wind farms within Ayrshire’ (2009) <http://www.ayrshire-jsu.gov.uk/publications.html>
- East Ayrshire Landscape Wind Capacity Study (EALWCS) (July 2013) <http://www.east-ayrshire.gov.uk/Resources/PDF/L/Landscape-wind-capacity-study---main-study.pdf>
- Electricity Act 1989, (July 1989) <<http://www.legislation.gov.uk/ukpga/1989>>
- The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2000 <<http://www.legislation.gov.uk>> (came into force 5th October 2000)
- The Town and Country Planning (Scotland) Act 1997 <<http://www.legislation.gov.uk>> (came into force 27th February 1997)
- Scottish Government, National Planning Framework 3, (June 2014) <<http://www.scotland.gov.uk>>
- Scottish Government, National Planning Framework 3, Main Issues Report and Draft Framework, (April 2013) <<http://www.scotland.gov.uk>>
- Scottish Government, Scottish Planning Policy, (June 2014) <<http://www.scotland.gov.uk>>
- Scottish Government, Online Policy Subject Onshore Wind Turbines, (October 2012) <<http://www.scotland.gov.uk>>
- Scottish Government, Online Policy Subject Wind Farm Developments on Peat Land, (June 2011) <<http://www.scotland.gov.uk>>
- Historic Scotland, Scottish Historic Environment, (December 2011) <<http://www.historic-scotland.gov.uk>>
- Scottish Government, PAN1/2011 Planning and Noise, (March 2011) <<http://www.scotland.gov.uk>>
- Scottish Government, PAN2/2011 Planning and Archaeology, (July 2011) <<http://www.scotland.gov.uk>>

- Scottish Government, PAN 3/2010 Planning Advice on Community Engagement, (2010) <<http://www.scotland.gov.uk>>
- Scottish Government, PAN51 Planning, Environmental Protection and Regulation, (October 2006) <<http://www.scotland.gov.uk>>
- Scottish Government, PAN58 Environmental Impact Assessment, (August 2005) <<http://www.scotland.gov.uk>>
- Scottish Government, PAN 60 Planning for Natural Heritage, (August 2000) <<http://www.scotland.gov.uk>>
- Scottish Government, PAN61 Planning and Sustainable Urban Drainage Systems, (2001) <<http://www.scotland.gov.uk>>
- Scottish Government, PAN68, Design Statements, (2003) <<http://www.scotland.gov.uk>>
- Scottish Government, PAN69 Planning and Building Standards Advice on Flooding, (2004) <<http://www.scotland.gov.uk>>
- Scottish Government, PAN75 Planning for Transport, (2005) <<http://www.scotland.gov.uk>>
- Scottish Government, PAN79, Water and Drainage, (2006) <<http://www.scotland.gov.uk>>
- Ayrshire Joint Structure Plan, (2007) <<http://www.ayrshire-jsu.gov.uk>>
- East Ayrshire Local Plan, (2010) <<http://www.east-ayrshire.gov.uk>>
- East Ayrshire Local Development Plan <<http://www.east-ayrshire.gov.uk>>
- Dumfries and Galloway Interim Planning Policy: Wind Energy Development (February 2012) <http://www.dumgal.gov.uk/index.aspx?articleid=9982>

7. Landscape and Visual Assessment

7.1. Introduction

7.1.1. This chapter provides an assessment of the potential effects on landscape resources and visual amenity that would be likely to result from the construction, operation and decommissioning of Pencloe Windfarm (the proposed development). The location of the proposed development and the extent of the application site are shown in **Figure 4.1 Volume III**.

7.1.2. The chapter has been prepared by a Chartered Landscape Architect and has been peer-reviewed by another. It describes the baseline landscape and visual conditions currently existing within the application site and within the surrounding 35km Study Area, the likely significant effects on the landscape and visual resource, the mitigation measures included to prevent, reduce or offset adverse effects and the likely residual effects after these measures have been employed.

7.1.3. The assessment concentrates on the key landscape and visual issues identified during the Scoping stage and in conjunction with East Ayrshire Council, Dumfries and Galloway Council and Scottish Natural Heritage (SNH), including:

- Landscape effects – both physical changes to constituent elements of the landscape fabric and how changes in the character and qualities of the landscape and designated areas within it are perceived by people, as a result of the proposed development and
- Visual effects – changes to views or visual amenity as experienced by people, from key viewpoints, settlements, roads, footpaths and cycle routes as a result of the proposed development.

LVIA Contents

7.1.4. The Landscape and Visual Impact Assessment (LVIA) is organised into the following main sections, additional data is also included in Appendices as described below:

- Introduction;
- Project Description
 - a description of the aspects of the proposed development with the potential to influence landscape and visual amenity within the Study Area;
- Design Optimisation and Mitigation Measures
 - a description of how the layout design has responded to potential landscape/ visual effects over the duration of the Environmental Impact Assessment (EIA) process and a description of mitigation measures incorporated at the design stage aimed at reducing or minimising potentially adverse landscape and visual effects;
- Policy and Legislation
 - a review of policy context relevant to landscape and visual matters;
- Scope and Method of Assessment
 - an explanation of how the LVIA has been carried out, with reference to the methodology developed by Jacobs as well as other recommended methodologies and guidelines;

- Baseline Landscape and Visual Resources
 - a description of the existing landscape and visual amenity and receptors identified within the application site and the wider Study Area;
- Assessment of Effects at Construction Stage
 - an assessment of the likely effects arising during the construction stage of the proposed development;
- Assessment of Residual Landscape and Visual Effects at Operational Stage
 - a detailed assessment of the residual effects arising from the operation of the proposed wind turbines on the landscape resource and perception of the landscape character and designated areas within the Study Area;
 - an assessment of residual effects on visual amenity arising from the operation of the proposed wind turbines, including an assessment from a range of viewpoints identified and agreed through consultation with East Ayrshire Council, Dumfries and Galloway Council and SNH;
- Assessment of Cumulative Landscape and Visual Effects
 - an assessment of the potential effects arising from the operation of the proposed wind turbines in conjunction with built/consented windfarms within the Study Area and those at planning application stage;
- Assessment of Effects at Decommissioning Stage and Post-Operational Stages
 - an assessment of the effects arising from the decommissioning and restoration phase; and
- Summary and Conclusion
 - a summary of the key landscape and visual effects arising from the proposed development and conclusion on the significance of effects.

Supporting Graphics

- 7.1.5. The LVIA chapter should be read alongside the following plans, photographs and visualisations, which are included in **Volume III**.
- 7.1.6. The baseline landscape context is illustrated in **Figure 7.1.1**, LVIA Study Area; **Figure 7.1.2**, Landscape Designations Plan and **Figure 7.1.3**, Landscape Character Plan. Viewpoint locations are shown on **Figure 7.1.4**. A detailed Study Area for the effects upon landscape character extends to a 20 km radius from the outermost turbines, with a wider 35 km radius study area for the assessment of effects on Landscape Designations, visual receptors and the cumulative assessment, based on the nature of the development, accepted industry best practice and the recommendations set out in SNH guidance.
- 7.1.7. The assessment of Landscape and Visual effects is supported by the Zone of Theoretical Visibility (ZTV) maps in **Figures 7.2.1 to 7.2.9** and viewpoint photographs and wireframes/photomontages in **Figures 7.3.1 – 7.3.24**.

- 7.1.8. The cumulative assessment is illustrated with the cumulative site location plans, **Figures 7.4.1 and 7.4.2 Volume III**, cumulative ZTVs in **Figures 7.5.1 – 7.5.30 Volume III** and with cumulative wireframes in **Figures 7.6.1 – 7.6.5 Volume III**.

Appendices

- 7.1.9. This chapter is accompanied by **Appendices 7.1 to 7.7** in **Volume IV**. These provide greater detail and background information on: LVIA Methodology, Landscape Character Types, Inventoried Gardens and Designed Landscapes, Assessment of Effects on Wild Land Areas, Cumulative Assessment and Viewpoints with No Visibility.

7.2. Project Description

- 7.2.1. The assessment covers the construction, operational and decommissioning phases of the proposed development as described in **Chapter 4: Project Description**.

- 7.2.2. The main elements of the proposed development can be summarised as follows:

- 21 wind turbines which will have a maximum overall tip height of up to 125 m;
- Permanent foundations supporting the wind turbines and associated crane hardstandings (used during construction, operational repair and decommissioning);
- Transformers (one per turbine) which will be housed externally next to the base of the turbine;
- Crane hardstandings at each turbine;
- 17.8 km of permanent access tracks into the application site from the public highway and between turbines, including 5.2 km of upgrade to existing forestry tracks;
- One new access bell mouth arrangement from the unclassified road along Glen Afton;
- A control building and substation compound (including electrical metering, stores, office and welfare facilities);
- Underground cabling between the turbines and control building and substation compound, running alongside access tracks where possible;
- High voltage export cable or overhead line to the nearest Scottish Power Energy Networks (SPEN) substation (a new facility planned adjacent to the application site);
- Three permanent free-standing anemometry masts and associated foundations and hardstanding and
- Two temporary construction compounds and a temporary security office.

- 7.2.3. The temporary elements that would be present during the construction period are – due to their nature and short-term duration – much less likely to have significant landscape and visual effects in comparison to the operational elements of the proposed development. These construction elements and associated effects are set out in **Section 7.8**.

- 7.2.4. The proposed development will connect into a new local 132kV 'collector' substation (developed by SPEN), located immediately south of the application site, where generation from the windfarm will enter the transmission network. The connection to this new substation will be subject to a separate planning application by SPEN and, if required, an appropriate environmental assessment will be undertaken.

- 7.2.5. Construction of the proposed development will take approximately 18 months. The proposed development will be designed to operate for a period of 25 years, after which it will be decommissioned.

Reinstatement

- 7.2.6. After construction has been completed, the crane hardstandings will remain in place for future maintenance and the construction compounds will be restored as close as possible to their original condition. All portacabins, machinery and equipment will be removed from the compounds prior to the windfarm becoming operational. The borrow pits will be used for the placement of surplus soils and peat and will be revegetated through both direct seeding with moorland species and natural regeneration.
- 7.2.7. Site restoration will be programmed, managed and carried out to allow restoration of disturbed areas as early as possible and in a progressive manner. A restoration plan will be agreed with East Ayrshire Council and Forestry Commission Scotland and is expected to adopt the principles for ongoing land use set out in the Forest Design Plan.

7.3. Design Optimisation and Mitigation

General

- 7.3.1. Landscape and visual effects of the proposed development has been one of several technical aspects considered as part of the evolution of the design, which is described in detail in **Chapter 2: Site Selection, Design and Alternatives**. In summary, the optimised 21 turbine development has been through a sequence of design review with careful analysis of computer generated wireframes to ensure that the development minimised any significant effects on landscape and visual receptors. The proposal development, following iteration of the layout, broadly comprises three turbine arrays proposed on the adjacent ridges of Milray Hill, Auchincally Hill and Meikle Hill.

Mitigation Measures

- 7.3.2. The principal means of mitigation with regard to wind energy development is the consideration of the siting, design and layout of the turbines and ancillary infrastructure, in relation to landscape and visual receptors as part of the design optimisation process described above.
- 7.3.3. In addition to this, standard/embedded mitigation measures have been incorporated such as the adoption of three bladed horizontal axis turbines with tubular steel towers and the selection of a mid-grey paint finish which will reduce the distance over which the turbines will be visible particularly in dull and overcast conditions, however the exact colour of the wind turbines will be agreed with East Ayrshire Council prior to the construction of the proposed development.

7.4. Policy and Legislation

- 7.4.1. Planning policies and guidance are covered in detail in **Chapter 6: Planning Policy and Context**. The policies, legislation and guidance relevant to the LVIA are set out below and **Figures 7.1.2 and 7.1.3 Volume III** identify the location and extent of the landscape policy designations. At present the Section 36 application for the proposed development, with regard to landscape and visual matters, would be considered under national, regional and local policy, as reviewed below.
- 7.4.2. In preparing this LVIA, reference has been made to existing policies, guidance and advice contained in the Ayrshire Joint Structure Plan (2007), the Dumfries and

Galloway Structure Plan (1999), the East Ayrshire Local Plan (2010), the South Ayrshire Local Plan (2007), the South Lanarkshire Local Plan (2009), the Nithsdale Local Plan (2006) and the Stewartry Local Plan (2006). Technical reports and Supplementary Planning Guidance to support the implementation of wind energy policy were also reviewed including: Windfarms: Addendum to Ayrshire Joint Structure Plan Technical Report TR03/2006. Planning policies and guidance are covered in detail in **Chapter 6** of the assessment.

7.4.3. The application site falls within a designated Sensitive Landscape Area, whilst the Study Area is covered by various landscape planning policies. Those policies relevant to the LVIA are set out below and **Figure 7.1.2 Volume III** identifies the location and extent of landscape policy designations.

7.4.4. Planning policies and guidance are covered in detail in **Chapter 6: Planning Policy and Context**. At present the Section 36 application for the proposed development, with regard to landscape and visual matters, will be considered under the policies provided in the National Policy, Structure Plan and Local Plan reviewed below.

National Policy

Scottish Planning Policy: 2014

7.4.5. Scottish Planning Policy (SPP) is the statement of the Scottish Government's policy on nationally important land-use planning matters. The 2014 document provides the core principles, statutory guidance, planning policies and expectations of the Scottish planning system.

7.4.6. The new SPP published in June 2014 is a material consideration that will inform the determination of planning applications.

7.4.7. A greater emphasis has been placed on the role of spatial frameworks in identifying areas with strategic capacity, as well as those locations that are not suitable for windfarm development, as well as more specific guidance being given on constraints with regard to landscape or natural heritage designations. The SPP recommends 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 windfarms following the approach set out in Table 1 of the SPP and as follows:

“Group 1: Areas where windfarms will not be acceptable:

National Parks and National Scenic Areas

Group 2: Areas of significant protection:

Recognising the need for significant protection, in these areas windfarms may be appropriate in some circumstances. 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.

National and international designations:

- *World Heritage Sites;*
- *Natura 2000 and Ramsa sites;*
- *Sites of Special Scientific Interest;*
- *National Nature Reserves;*
- *Sites identified in the Inventory of Gardens and Designed Landscapes;*
- *Sites identified in the Inventory of Historic Battlefields.*

Other nationally important mapped environmental interests:

- *areas of wild land as shown on the 2014 SNH map of wild land areas;*
- *carbon rich soils, deep peat and priority peatland habitat.*

Community separation for consideration of visual impact:

- *an area not exceeding 2 km around cities, towns and villages identified on the local development plan with an identified settlement envelope or edge. The extent of the area will be determined by the planning authority based on landform and other features which restrict views out from the settlement.*

Group 3: Areas with potential for windfarm development:

Beyond groups 1 and 2, windfarms are likely to be acceptable, subject to detailed consideration against identified policy criteria.”

- 7.4.8. SPP confirms that *“The approach to spatial framework preparation set out in the SPP should be followed in order to deliver consistency nationally and additional constraints should not be applied at this stage. The spatial framework is complemented by a more detailed and exacting development management process where the merits of an individual proposal will be carefully considered against the full range of environmental, community and cumulative impacts.”*
- 7.4.9. With regard to Development Management the SPP highlights the following matters relevant to Landscape and Visual effects which should be considered:
- *“cumulative impacts – planning authorities should be clear about likely cumulative impacts arising from all of the considerations below, recognising that in some areas the cumulative impact of existing and consented energy development may limit the capacity for further development;*
 - *impacts on communities and individual dwellings, including visual impact, residential amenity, noise and shadow flicker;*
 - *landscape and visual impacts, including effects on wild land;*
 - *impacts on tourism and recreation.”*

Regional and Local Policy

Ayrshire Joint Structure Plan 2007

- 7.4.10. The development is covered by the Ayrshire Joint Structure Plan area. The key relevant policies are:
- Policy ECON 7 : Windfarms

“B) Areas designated for their national or international natural heritage value and green belts, will be afforded significant protection from large scale windfarms;

D) Cumulative impact will be assessed in all relevant cases, taking into account existing windfarms, those that have permission and those that are the subject of valid but undetermined applications. The weight to be accorded to undetermined applications will reflect their position in the application process.

F) Proposals affecting Sensitive Landscape Character Areas shall satisfactorily address any impacts on the particular interest that the designation is intended to protect but the designation shall not unreasonably restrict the overall ability of the plan area to contribute to national targets.”

- Policy ENV 1 : Landscape Quality

“The quality of Ayrshire’s landscape and its distinctive local characteristics shall be maintained and enhanced. In providing for new development, particular care shall be taken to conserve those features that contribute to local distinctiveness including:

- A. *Settings of communities and buildings within the landscape;*
- B. *Patterns of woodland, field, hedgerows and tree features;*
- C. *Special qualities of rivers estuaries and coasts;*
- D. *Historic Landscapes and*
- E. *Skylines and hill features including prominent views.*

Local plans shall seek to protect and enhance landscape character and establish criteria for the assessment of future development proposals in the context of the particular local landscape type within which the development is proposed.”

- Policy ENV 3 : Landscape Protection

“A) Development that affects a National Scenic Area will only be permitted where it has been demonstrated:

- a) *The overall objectives of the designated area and the overall integrity of the area would not be compromised; or*
- b) *Any significant adverse effects on the qualities for which the area has been designated are clearly outweighed by social or economic benefits of national importance.*

B) In Sensitive Landscape Character Areas the protection and enhancement of the landscape shall be given full consideration in the preparation of local plans and the determination of planning applications.”

Ayrshire Supplementary Planning Guidance: Windfarm Development, February 2009

- 7.4.11. Ayrshire supplementary planning guidance includes the following document: *Wind Farm Development, February 2009*, which provides the following guidance with regard to windfarm development.

“The guidance has been prepared to provide developers with greater clarity regarding those areas where the principle of development is likely to be acceptable - and likewise where it is not - and to provide further explanation regarding the criteria against which new development will be assessed.” (Paragraph 1).

“This Guidance is divided into two sections: Spatial Framework and Visual and Landscape considerations.” (Paragraph 8).

- 7.4.12. The Spatial Framework defines the area identified for the proposed Pencloe Windfarm as being within an area of Potential Constraint since it falls within a Sensitive Landscape Character Area and is designated as Forestry Commission Access Land. The following qualification is applied to areas of Potential Constraint: *“The existence of a constraint does not necessarily preclude development but should be taken as a signal to the developer that a clear understanding of the nature of the constraint, the factors that must be satisfactorily addressed and any mitigation required to produce an acceptable level of impact will need to be fully demonstrated and agreed.”*

- 7.4.13. With regard to ‘*Visual and Landscape Considerations*’ the SPG identifies management and planning guidelines for each Landscape Character Type. The proposed development falls within the Southern Uplands with Forestry Landscape

Type which is assessed to have a low sensitivity to Large, Medium and Small Windfarm Developments and is given the following management recommendation in respect of windfarm development:

“The aim of the development strategy is to conserve and where appropriate, restore the character of the southern uplands landscape, promoting more natural patterns of land cover and reducing the visual impact of extensive areas of forestry. Large parts of the southern uplands have potential for wind power development. Windfarm development will be steered to those parts of the southern uplands already affected by forestry or other developments. More sensitive sites should be avoided. Medium scale wind power development may be suitable in areas where landform can minimise intrusion. The siting of turbines should use adjacent forested landscapes to aid screening and back clothing. Development should be located away from key skylines and valleys.”

Dumfries and Galloway Structure Plan 1999

7.4.14. The development will be located outside the Dumfries and Galloway Structure Plan area. The landscape of the Structure Plan area will not be directly affected by the development and so potential effects of the proposed development will therefore relate primarily to impacts upon visual character and amenity and setting of landscape features and designated landscapes. The key relevant policies are:

- Policy E2 : Regional Scenic Areas

“The siting and design of development should respect the special nature of the area. Development within, or which would have a significant impact on Regional Scenic Areas (RSAs), may be permitted where it can be demonstrated that:-

1. the landscape character and scenic interest for which the area has been designated would not be adversely affected.”

- Policy E3 : Landscape Character

“When assessing development proposals likely to have a significant impact on the landscape the Council will take into account the guidance set out in the Landscape Assessment.”

- Policy E11 : Historic Gardens and Designed Landscapes

“Development in or affecting the setting of a site listed in the Inventory of Gardens and Designed Landscapes or mentioned in the list of Non-Inventory Sites will require an evaluation of the proposal’s impact on the site and its setting. There will be a presumption against development which would adversely affect the landscape features, character and setting of these sites and the approaches and environs of Inventory Sites.”

East Ayrshire Local Plan 2010

7.4.15. The development is located within the East Ayrshire Local Plan area. The key relevant policies are:

Strategic Environment Policies

- Strategic Policy ENV3

“The Council will give priority and prime consideration to the protection and enhancement of the landscape in its consideration of development proposals within the Sensitive Landscape Character Areas identified on the local plan maps. The Council will ensure that all development proposals in these areas respect, in terms of their design, size, scale and location, the local landscape characteristics of the particular area within which they are proposed.”

Landscape and Rural Environment Policies

- Policy ENV15

“The Council will not be supportive of development which would cause unacceptable and irreparable damage to important landscape features within rural areas. In this regard, developers will be expected to conserve and enhance, (and reinstate or replace where appropriate) those features which contribute to the intrinsic landscape value and quality of the area concerned and which are likely to be adversely affected by the particular development proposed, including:

- (i) existing setting of settlements and buildings within the landscape;*
- (ii) existing woodlands, shelter belts, hedgerows and trees;*
- (iii) existing burns, rivers, lochs and other water features;*
- (iv) existing field patterns and means of enclosure including dry stone dykes, hedging and fencing;*
- (v) existing Public Rights of Way, footpaths and bridleways and*
- (vi) existing skylines, landform and contours.*

Development which results in the permanent loss of landscape features which are not readily renewable and whose loss would be unacceptable in landscape terms, will not be supported by the Council.”

- Policy ENV16

“The Council will not be supportive of development which would create unacceptable visual intrusion or irreparable damage to the landscape character of rural areas. In this regard, the Council will ensure, through the development process, that:

- (i) any authorised development is in keeping with, has minimal visual impact and reflects the nature and landscape character of the rural area in which it is located, in terms of layout, materials used, design, size, scale, finish and colour. The design and material finish of any ancillary features will also be required to be sympathetic to the character and appearance of the area;*
- (ii) any authorised development is sensitively sited, landscaped and screened so as to blend into, respect and complement the landscape characteristics of the particular area in which it is to be located and*
- (iii) the landscape setting of a particular area affected by a proposed development is safeguarded from adverse or irreversible change by the use of appropriate planning conditions, management agreements, preparation and*

promotion of environmental improvement schemes, development and design briefs etc.”

▪ Policy ENV17

“In assessing development proposals relating to land within the rural area which has not been identified as specific development opportunity sites on the local plan maps, the Council shall ensure that these have minimum impact on the rural environment. There will be a general presumption against any development which would:

(i) cause the permanent and irreversible loss of prime quality agricultural land (i.e. Classes 1, 2 and 3.1 in the Macaulay Land Classification System) (see Appendix 3);

(ii) have significant unacceptable adverse impact or cause irreparable damage to built heritage resources requiring conservation or their settings including listed buildings, conservation areas, historic gardens and designed landscapes, scheduled ancient monuments, archaeological and industrial archaeological sites;

(iii) have significant unacceptable adverse impact or cause irreparable damage to natural heritage resources requiring conservation and to existing species and habitats;

(iv) have significant unacceptable adverse visual impact or cause irreparable damage to the landscape character and scenic quality of the area within which it is proposed;

(v) adversely affect the quality of water resources, water catchment areas, land drainage or flood protection interests or create water pollution problems;

(vi) result in the destruction of any areas of peat which are considered to be of significant ecological value.”

East Ayrshire Council Supplementary Planning Guidance

East Ayrshire Landscape Wind Capacity Study, Final Main Report 2013

- 7.4.16. The study considers the sensitivity of 12 landscape character types within East Ayrshire to a range of wind turbine developments. Four development typologies were considered in the sensitivity assessment, these principally categorised on the basis of turbine height. The assessment considers key sensitivities related to landscape character and visual amenity. The sensitivity assessment also considers potential cumulative issues associated with existing and consented windfarm developments.
- 7.4.17. The study recommended that landscapes with a combined sensitivity of medium and lower offer greatest scope to accommodate the medium and large development typologies (turbines greater than 50 m and 70 m tall) whilst minimising significant impact on key landscape and visual sensitivities. The application site located within the Southern Uplands with Forestry (20c) LCA where the *‘large scale and relatively simple land cover of this character type reduces sensitivity to larger wind turbine typologies’* however, due to the sensitivity of the nearby Doon Valley, overall the LCA is identified with an overall Medium-high landscape sensitivity to the large typology turbines (>70 m). The SPG provides useful guidance with respect to cumulative issues and constraints which should be considered when siting development in this landscape character area.

7.4.18. A review of how the design of the turbine layout responded to the issues raised in the SPG is set out in **Chapter 3: Site Selection, Design and Alternatives** however, in summary; the following points indicate how the proposed development accords with the recommendations:

- The turbines will be set well back from the more sensitive western edges of the Southern Uplands with Forestry LCA and will avoid significant impact on the setting of Loch Doon and the upper Doon valley with no effect on the settlement of Dalmellington.
- The turbines of proposed development will have limited, not significant effects on the setting of Glen Afton and the Upland Basin centred on New Cumnock.
- The appearance of the turbines for the proposed development will be compatible with the existing views to Hare Hill and Windy Standard I and II Windfarms when seen in views from the north.

South Lanarkshire Local Plan 2007

7.4.19. The proposed development will be located outside the South Lanarkshire Local Plan area. The landscape of the Local Plan area will not be directly affected by the proposed development and so potential effects will therefore relate primarily to impacts upon visual character and amenity and setting of landscape features and designated landscapes.

7.4.20. Policy ENV9 Review of Landscape Character Proposal commits the Council to undertake an assessment of the landscape character of South Lanarkshire Council's area and a review of related landscape designations for Council's area. This exercise has been completed and the outcome is presented in Validating Local Landscape Designations, November 2010. The revised proposals for the Special Landscape Areas (SLA) identified in this document have been used as the basis for the assessment of local landscape designations in South Lanarkshire. The boundaries of the SLAs are identified on **Figure 7.1.2 Volume III**.

South Ayrshire Local Plan 2009

7.4.21. The development will be located outside the South Ayrshire Local Plan area. The landscape of the Local Plan area will not be directly affected by the proposed development and so potential effects of the proposed development will therefore relate primarily to impacts upon visual character and amenity and setting of landscape features and designated landscapes. Policy relating to these potential effects is as follows:

▪ STRATEGIC POLICY ENV8

“Notable areas of particular landscape quality are the Heads of Ayr, the Carrick Hills, the mainly upland area of South Carrick and the coastal strip in the southern part of the Plan area. These have been afforded Scenic Area status in the Plan. It should however be noted that in general, potential impacts on the environment and landscape will be considered even if the area is not specifically identified as being within a designated scenic area.

The acceptability of proposals located within or having an impact on, scenic areas, will be considered using the following criteria:

- a. The significance of impacts and cumulative impacts on the environment, particularly landscape and visual impacts and where relevant*
- b. The extent of any economic benefit; or*
- c. Specific, justified requirement for a rural location.”*

Strategic Locational Guidance for Onshore Windfarms in Respect of the Natural Heritage, SNH

- 7.4.22. SNH's Policy Statement No. 02/02 *Strategic Locational Guidance for Onshore Windfarms in Respect of the Natural Heritage* (revised March 2009) offers broad guidance as to which parts of Scotland are most suited to windfarm development, in natural heritage terms. It identifies three broad zones of lowest, medium and high sensitivity, mapped and classified according to designated and non-designated landscape and recreation interests, as well as designated and non-designated biodiversity interests.
- 7.4.23. The proposed development falls within Zone 2 Medium Sensitivity of the SNH Locational Guidance. Areas of local landscape designations, regional parks, most SSSIs and areas with a high proportion of peatland are included within this zone, as are areas adjacent to National Scenic Areas and areas with a high proportion of sensitive bird species. Zone 2 includes 48% of the land area of Scotland. The policy states that, with regard to Zone 2 (para 34), there are natural heritage sensitivities but often scope for development of an appropriate scale if there is "careful choice of location and care in design to avoid natural heritage impacts".
- 7.4.24. In this regard the proposed development has been carefully sited and designed to form an appropriate addition to the landscape, in a setting which is appropriate for windfarm development and which avoids effects on sensitive landscape receptors.

7.5. Scope and Method of Assessment

Scoping

- 7.5.1. A critical aspect of the EIA process is to undertake a thorough and rigorous scoping study which identifies environmental sensitivities relative to the proposed development and to present the proposed scope of the LVIA in order to address these issues. A thorough scoping exercise was carried out with East Ayrshire Council, Dumfries and Galloway Council and the representatives of the SNH Area Office at an early stage of the project development to ensure that the proposed methodology and scope of assessment were agreed with these key statutory consultees and that all potentially significant issues relating to the landscape and visual resources of the area were addressed in the LVIA Chapter of the ES.
- 7.5.2. The principal aim of the information provided in the pre-scoping correspondence was to agree the key landscape and visual receptors that should be included in the LVIA, the study area that should be used for the assessment of impacts and the viewpoint locations that should be used for the assessment impacts upon visual amenity. The information provided to consultees included a draft zone of theoretical visibility (ZTV) and a list of suggested viewpoints with grid coordinates, which it was proposed would be assessed within the LVIA. A list of constructed, consented and proposed windfarms to be included in the cumulative assessment was also provided.
- 7.5.3. LVIA scoping for the proposed development first commenced in February 2007 with East Ayrshire Council and Dumfries and Galloway Council and continued until the submission of the Section 36 application.
- 7.5.4. The final scope of the assessment was defined by Jacobs, including details of the viewpoints to be assessed within the LVIA and the other existing and proposed windfarms to be assessed cumulatively.
- 7.5.5. The scoping correspondence with Statutory Consultees is summarised in **Table 7.1**.

Table 7.1 Scoping Correspondence Relating on Landscape and Visual Matters

Consultee	Comment
<p>SNH 17.09.2012</p>	<p><u>Landscape</u> SNH are content that the assessment process outlined in the scoping report will provide an adequate assessment of the projects impacts.</p> <p><u>Cumulative landscape</u> We believe that the list of proposed windfarms within 35Km of the site may be out of date. We recommend that the site and all of the relevant local authorities are approached and that the list is refreshed.</p> <p><u>Experience</u> Experience at the newly constructed Clyde windfarm has shown that the cutting of platforms for the crane hardstandings can form significant skyline features. The potential of this potential impact should be taken into account when considering viewpoint assessments.</p>
<p>Scottish Government, Development Consents Unit, 16th January 2013</p>	<p><u>Design, Landscape And The Built Environment</u> Scottish Ministers place particular importance on the layout design of wind farms and considers there is a need for a coherent, structured and quality driven approach to windfarm development. The appearance of windfarms is of particular interest and the need for a coherent design strategy to be considered at scoping stage and to be prepared before submission of the Environmental Statement. The strategy should explain the design principles behind the layout plan in a rational way that can be easily understood. The design strategy for the windfarm should be expressed through a design statement. The Design Statement should describe a clear strategy for meeting these objectives, a justification for the resulting layout and evidence that the design ideas have been tested against the objectives.</p> <p>Windfarms are prominent features in the landscape and hence a full assessment of the effects on landscape and visual amenity is important. The assessment methodology should follow the approach promoted by the Landscape Institute and Institute of Environmental Management and Assessment ('Guidelines for Landscape and Visual Impact Assessment', second edition, Spon 2002). General guidance on the range of issues to be considered in assessment of windfarms is set out, in the form of a scoping checklist, at Appendix 1 of 'Hydroelectric schemes and the natural heritage (SNH 2010)</p> <p>As regards the portrayal of visual and landscape impacts within Environmental Statements, guidance has also been developed, jointly by SNH and the Scottish Renewables Forum, on 'Visual Representation of Windfarms – Good Practice Guidance' (SNH 2007), published at: http://www.snh.gov.uk/planning-and-development/renewable-energy/onshore-wind.</p> <p>Visual information should be presented in a way which communicates as realistically as possible the actual visual impact of the proposal. The format of the images and the focal length of the lens will have to be taken into consideration.</p> <p>All visualisation images should be accompanied by a description of how to view the image so that it best replicates what will be seen if the proposal is constructed. This should include the required viewing distance between the eye and the image and whether it is a single frame image or a composite panoramic image. If a composite image, it is desirable either to curve the edges of panoramic images so that peripheral parts of the image are viewed at the same intended viewing distance, or to 'pan' across the image with the eye remaining at the recommended viewing distance. This is not required for single frame images.</p> <p>The viewpoints from which the photographs are taken should be agreed with the planning authority and SNH. The horizontal field of view should be shown on a map so that the images can be used accurately on site.</p> <p>The ES should include a description of the landscape character of the area and how that character will be affected by the impact on any landscapes designated for their landscape or scenic value, including National Parks, National Scenic Areas, or local landscape designations such as Area of Great Landscape Value or</p>

Consultee	Comment
	Regional Scenic Area (the terminology is varied) and the impact on any area which is a recognised focus for recreational enjoyment of the countryside, eg a Regional Park or Country Park.
Forestry Commission	<p>Landscape and visual assessment</p> <p>The new <i>UK Forestry Standard</i> and associated <i>Forests and Landscape UKFS Guideline</i>, FC Forestry Practice Guide: <i>Forest Design Planning – A Guide to Good Practice</i>, The <i>Scottish Forestry Strategy 2006</i> and SNH suite of <i>Landscape Character Assessments</i> should all be on the list of documents that the developer should be aware of. All are free to view and download from FC and SNH web-sites.</p> <p>The <i>Scottish Forestry Strategy</i> identifies that forests and woodlands contribute to Scotland’s diverse and attractive landscape. It promotes the benefits of well designed and managed woodlands that reflect local landscape character and that their contribution to the wider landscape should help Scotland meet the undertakings of the <i>European Landscape Convention</i> (page 44).</p> <p>The Scoping Report should promote a full assessment by the developer of all the landscape and visual issues. This should include a full description of the general landscape character within which the developer proposes to introduce the windfarm and a statement of the landscape and visual sensitivities that may be potentially affected by that development.</p> <p>It should also include an assessment of the cumulative landscape and visual impacts affecting the windfarm proposal and identify relevant criteria that may have a bearing on that assessment.</p> <p>The <i>UK Forestry Standard</i> sets out the criteria and standards for the sustainable management of all forests and woodlands in the UK. Landscape is a specific <i>Criteria for Sustainable Forest Management</i> (page 18) and the two <i>Forest Management Unit Indicators</i> as evidence that landscape quality is enhanced are:</p> <ul style="list-style-type: none"> ▪ Landscape principles of forest design are used; ▪ Cultural and historical character of countryside is taken into account when making changes to existing woods. <p>The new FC <i>Forests and Landscape UKFS Guideline</i> provides an essential introduction to both the appreciation of the established principles of forest design and appraisal of the landscape with regard to appreciating its local character.</p> <p>Of forest landscape design, the principles and process of restructuring an existing forest are described in the aforementioned FC Forestry Practice Guide: <i>Forest Design Planning – A Guide to Good Practice</i>. Not only should a design plan consider how best to clear fell woodland or shelterbelts to accommodate the windfarm development, but also describe how the remaining woodland elements – both within and outwith the scheme boundary – can be best integrated with the development site. Such integration could be achieved, for example, by the selective restocking of strategic areas within the windfarm site area.</p> <p>Regards landscape character, the <i>Scottish Forestry Strategy</i> specifically advocates the use of Scottish Natural Heritage’s suite of <i>Landscape Character Assessments</i>, which provide valuable descriptive information about the landscapes of Scotland.</p> <p>The potential removal of existing woodland and shelterbelts within the windfarm proposal area may create significant areas of open ground (that is, ground without woodland cover) that may affect the contribution of the proposed site to local landscape character.</p> <p>We would advise that when forest landscape design is being considered as part of the forest management associated with such a development, a chartered Landscape Architect with a comprehensive knowledge of forestry should be commissioned.</p>

L VIA Assessment Methodology

7.5.6. The chapter is supported by **Appendix 7.1 Volume IV**, which contains a detailed description of the method of assessment.

Guidance

- 7.5.7. The Landscape and Visual Assessment methodology has been developed by Jacobs and follows good-practice guidance and advice on the assessment of the impacts of development on landscape and visual resources. A key source of guidance is the Guidelines for Landscape and Visual Impact Assessment (Third Edition, 2013) (GLVIA 3). Other documents specific to windfarms, photography and visualisation techniques and cumulative impacts in particular (primarily SNH or Scottish Government) have also been referred to including the East Ayrshire Landscape Wind Capacity Study - Main Study Report, Carol Anderson Landscape Associates (July 2013). These are listed in full in the reference section at the end of this chapter and in **Appendix 7.1 Volume IV**.

General Methodology

- 7.5.8. The general approach to the LVIA includes the following key tasks:
- Desk study and preliminary site survey;
 - Confirmation of scope and methodology with the Local Authority and SNH;
 - Baseline assessment of landscape and visual resources (consisting of desk study, field survey and reporting);
 - Layout and design optimisation;
 - Assessment of landscape and visual effects (construction, decommissioning and, in particular, residual operational effects) and
 - Assessment of cumulative landscape and visual effects.

Process of Assessing Residual Effects and their Significance

- 7.5.9. Once the baseline situation in relation to landscape and visual receptors has been reviewed, this information is combined with an understanding of the proposed change or development that is to be introduced in order to identify and describe the landscape and visual effects. The assessment process determines whether the level of an effect would be significant or not through methodical consideration of, firstly, the sensitivity of landscape and visual receptors relative to changes as a result of the proposed development and, secondly, the magnitude of change that they would experience.
- 7.5.10. A summary of the key principles used in assigning sensitivity to change to landscape and visual receptors and evaluating the likely magnitude of change that would be experienced in relation to the proposed development and in the subsequent consideration of sensitivity and magnitude in determining the level and overall significance of resultant effects, is set out below. A more detailed description of these categories and definitions, as informed by GLVIA 3 and refined by Jacobs, is included in **Appendix 7.1 Volume IV**.

Sensitivity to Change:

- 7.5.11. The assessment of landscape and visual receptors in terms of their sensitivity uses a combination of judgements about their susceptibility to the type of change proposed, as well as the value attached to the landscape or particular views. The key considerations that influence the establishment of susceptibility and value are summarised from GLVIA 3 (Part 2, Chapters 5 and 6) and set out in **Table 7.2** below.

Table 7.2 Key Considerations informing Landscape and Visual Sensitivity to Change

<i>Sensitivity</i>	<i>Landscape Receptors</i>	<i>Visual Receptors</i>
Susceptibility relates to:	<ul style="list-style-type: none"> - The ability of the landscape receptor to accommodate the proposed development without undue consequences for the maintenance of the baseline situation. 	<ul style="list-style-type: none"> - The occupation or activity of people experiencing the view at particular locations and the extent to which their attention or interest may therefore be focussed on the view.
Value relates to:	<ul style="list-style-type: none"> - Landscape designations and the level of importance they signify. - Where there are no designations, judgements based on criteria that can be used to establish landscape values. - Individual contributors to landscape character, especially the key characteristics (i.e. elements/ features/ qualities and combinations of these). 	<ul style="list-style-type: none"> - Recognition through, for example, heritage assets or planning designations. - Indicators of value attached to views by visitors through, for example, appearance in guidebooks or on tourist maps and/ or provision of facilities for their enjoyment (of the view, such as parking, signage and interpretation). - References to the view in literature, music or art.

7.5.12. The determination of the sensitivity of landscape and visual receptors to change as a result of the proposed development is assigned as high, medium, low or negligible, or intermediate categories between these. These categories, in relation to the above considerations, are described in detail in **Appendix 7.1 Volume IV**.

Magnitude of Change:

7.5.13. The assessment of the magnitude of change that landscape and visual receptors would experience as a result of the proposed development uses a combination of judgements relating to the factors of the geographical extent of the area influenced, the size or scale of change and the duration and reversibility of effects. The key factors that influence the establishment of these factors are summarised from GLVIA 3 (Part 2, Chapters 5 and 6) and set out in **Table 7.3**.

Table 7.3 Key Considerations informing Landscape and Visual Magnitude of Change

<i>Magnitude Of Change</i>	<i>Landscape Receptors</i>	<i>Visual Receptors</i>
<ul style="list-style-type: none"> • Geographical extent relates to: 	<ul style="list-style-type: none"> - Influences within the development site. - Influences on the immediate setting of the site. - Influences on the landscape character area or type that the proposed development would lie within. - Wider influences at a larger scale upon the perception of landscape character areas/ types beyond the development site. 	<ul style="list-style-type: none"> - Angle of view in relation to the main activity of the visual receptor. - Distance of viewpoint from the proposed development. - Extent of area over which changes would be visible.
<ul style="list-style-type: none"> • Size or scale of change relates to: 	<ul style="list-style-type: none"> - Extent of existing landscape elements lost, the proportion of total extent that this represents and the contribution of those elements to landscape character. 	<ul style="list-style-type: none"> - Scale of change in the view with respect to the loss/ addition of features, changes in composition and the proportion of view occupied by the proposed development.

<i>Magnitude Of Change</i>	<i>Landscape Receptors</i>	<i>Visual Receptors</i>
	<ul style="list-style-type: none"> - Degree to which aesthetic/ perceptual qualities are altered by the removal of existing components or addition of new ones. - Whether the effect changes those key elements or aspects of the landscape that are critical to its character. 	<ul style="list-style-type: none"> - Degree of contrast or integration of changes in the landscape with the existing/ remaining elements and characteristics, in terms of form, scale and mass, line, height, colour and texture. - Nature of the view of the proposed development, in terms of the length of time over which it will be experienced by people and whether views will be full, partial or glimpses.
<ul style="list-style-type: none"> • Duration and reversibility relate to: 	<ul style="list-style-type: none"> - Short-term, medium-term or long-term landscape effects. - Whether the proposed development would (in terms of human generations) result in permanent, partially reversible or wholly reversible landscape changes. 	<ul style="list-style-type: none"> - Short-term, medium-term or long-term effects on views. - Whether the proposed development would (in terms of human generations) result in permanent, partially reversible or wholly reversible changes to views.

7.5.14. The determination of the magnitude of change that would be experienced by landscape and visual receptors as a result of the proposed development is assigned as substantial, moderate, slight, negligible or none, or intermediate categories between these. These categories, in relation to the above considerations, are described in detail in **Appendix 7.1 Volume IV**.

Level of Effects and Determination of Significance:

7.5.15. The level of any identified landscape or visual effect has been assessed as major, moderate, minor or no effect, or intermediate categories between these. These categories have been determined by consideration of the sensitivity of landscape or visual receptor and the predicted magnitude of change that would be experienced as a result of the proposed development, as summarised above and described in detail in **Appendix 7.1 Volume IV**. The following matrix in **Table 7.4** is used as a guide to correlating sensitivity and magnitude to determine the level of predicted effects and their significance.

Table 7.4 Significance of Effects on Landscape and Visual Receptors

Sensitivity	Magnitude Of Change/Effect			
	Substantial	Moderate	Slight	Negligible
High	Major	Major/ Moderate	Moderate	Moderate/ Minor
Medium	Major/ Moderate	Moderate	Moderate/ Minor	Minor
Low	Moderate	Moderate/ Minor	Minor	Minor/None
Negligible	Moderate/ Minor	Minor	Minor/ None	Minor/ None

- 7.5.16. Generally, those effects of a major or major-to-moderate level will be significant, with other effects being Not Significant. However, the matrix is not used as a prescriptive tool and the methodology and analysis of potential effects at any particular location must make allowance for the exercise of professional judgement. Thus, in some instances, a particular parameter may be considered as having a determining effect on the analysis.

7.6. Baseline Landscape and Visual Resources

Introduction

- 7.6.1. This section provides a general description of the landscape and visual context of the application site and study area.

The Application Site

- 7.6.2. The application site is located to the south of New Cumnock in East Ayrshire as indicated in **Figure 7.1.1 Volume III**. The site is set within the Southern Uplands, to the west of Glen Afton.
- 7.6.3. The application site is set on Milray Hill, Auchincally Hill and Meikle Hill, a sequence of rolling hills which increase in height towards the southwest of the application site. The proposed development will extend across three ridges with turbines located in three adjacent arrays at a height of approximately 340 m AOD to 500 m AOD.
- 7.6.4. The application site drains to the north via the Carcow, Glenhastel, Glenshalloch, Lochingerroch and Bolt Burns, which in turn feed into the Afton Water. The land cover of the site is predominantly coniferous plantation and there is no proposed change of use of the land after the construction phase of the proposed development. The application site will continue to be used for commercial forestry purposes and remain as Forestry Commission Access Land.
- 7.6.5. Access is proposed from a single track road which runs south from New Cumnock along Glen Afton to Craigdarroch and Afton Reservoir. This minor road links onto the B741 which in turn links to the A76.

The Study Area

- 7.6.6. The Study Area for the landscape and visual assessment is defined by a 35km radius circle centred on the proposed development, as shown in **Figure 7.1.1 Volume III**, this extent of Study Area being appropriate given the size of the wind turbines proposed and following consultation with the relevant consultees.
- 7.6.7. The landscape of the Study Area is defined by the rolling Southern Uplands to the south with plateau moorland and the Ayrshire Basin to the north and west. The Study Area extends westwards to Maybole and Ayr and eastwards to the Lowther Hills. To the south, the Study Area extends to New Galloway and the Galloway Forest Park and to the north, to just north of Darvel.
- 7.6.8. There is considerable diversity of landscape character within the Study Area resulting from the interaction of natural and human influences. Remote upland areas in the south of the Study Area vary between areas of high scenic value and large areas of blanket commercial afforestation, in contrast, the lowland Ayrshire basin is heavily populated with a dense network of settlement and roads, whilst the moorland to the north holds a legacy of dereliction from past and current mining activities.

Topographical Features

- 7.6.9. The application site is located within the Southern Uplands which are characterised by wide smooth domed summits with extensive foothills and plateaux underlain by sedimentary sandstones and shales.

- 7.6.10. The Galloway Uplands to the southwest of the Study Area are dominated by a granite intrusion which has been subjected to differential erosion leaving a series of hills and lochs surrounded by rugged outer summits.
- 7.6.11. To the northwest, the Study Area comprises the lowland Ayrshire Basin is bounded to the south by the small scale Carrick Hills and Valleys which have been formed by a series of southwest to northeast faultlines producing a series of valleys and ridges. To the east of the Ayrshire Basin is the Ayrshire Rim, an extensive area of plateau moorland with broad shallow sloped hills.
- 7.6.12. Rivers drain the Study Area forming valleys which form prominent features within the landscape. The upper reaches of the glacial valley features of Nithsdale and Glenken penetrate into the uplands from the south.

Natural Heritage Features

- 7.6.13. The Study Area encompasses upland, upland fringe, river valley and lowland landscapes which support a variety of flora and fauna. In addition, the complex geology of the region provides a broad range of geological and geomorphological interest. The key natural heritage attributes can be broadly summarised as follows:
- Upland/moorland habitats;
 - Native and semi-natural woodlands;
 - Forestry and plantation woodlands and
 - Grasslands.

Archaeological Features

- 7.6.14. There are scattered archaeological sites throughout the Study Area and these are dealt with in more depth in **Chapter 11: Archaeology and Cultural Heritage**. Archaeological features within the Study Area include Neolithic standing stones, Roman forts and more recent industrial architectural remains.

Settlement

- 7.6.15. The largest settlements in the Study Area are to be found to the northwest at a distance of over 25 km and consist of the conurbations surrounding Ayr and Kilmarnock. The market towns of Cumnock, Dalmellington and Sanquhar lie approximately 10 km to 15 km from the application site. These settlements are located at strategic locations where ancient routes cross the Southern Uplands following river valleys. These fast-flowing rivers aided the establishment of the cloth and woollen industry in the 18th century in the area and by the 19th century coal mining had also become important. Several of these historic market towns have more recently suffered from the economic decline of their traditional industries and this has been exacerbated by their relatively remote location.
- 7.6.16. Throughout most of the Study Area settlement is sparse, with a pattern of villages located in the valleys and isolated farmsteads and cottages scattered throughout the uplands.
- 7.6.17. Within 5 km of the application site, the only substantial settlement is New Cumnock, at a distance of approximately 2.5 km to the north at its closest point to the site boundary (the nearest turbine is 5.2 km to the south). Smaller clusters of properties and individual farmsteads are located along the A76, the B741 and the access road to the Afton Reservoir. To the west, south and east of the application site there is little settlement in the hills and valleys apart from a few isolated individual dwellings.
- 7.6.18. Architecturally, traditional stone buildings reflect the local underlying geology, creating distinct townscapes with a vernacular style. The introduction of building

styles from other regions or 'standard' designs of modern residential development diminishes the distinctiveness and individuality of some local settlements.

Transport Routes

Main Roads

- 7.6.19. Principal transport routes within the Study Area typically follow the broader valleys of these upland regions. Running on a northwest – southeast axis are the A76 and A713 which run to the north and south of the proposed development and application site respectively. The A76 links Dumfries with Kilmarnock and lies approximately 5 km to the north of the proposed development. The route follows Nithsdale south of New Cumnock. The A713 links Ayr with New Galloway and this road follows the Glenkens approximately 10 km to the southwest of the application site at its nearest point.
- 7.6.20. Three further A roads cross the Study Area on a roughly northeast – southwest axis. The A70 links Glasgow with Ayr and runs approximately 13 km to the north of the application area. The A71 runs from Glasgow to Kilmarnock following the southern bank of the River Clyde and lies 30 km to the north of the application area. The A702 runs from the M74 at Abington to St John's Town of Dalry and this trunk road is approximately 22 km to the south of the application site.
- 7.6.21. A network of minor roads link the outlying villages, hamlets and farm steadings, tending to follow the river valleys. Nearby minor public roads include the B741 which runs to the north of the proposed development linking New Cumnock to Dalmellington. An unclassified road from New Cumnock follows the valley of the Afton Water to the head of Glen Afton to the east of the application site.

Railway Lines

- 7.6.22. There are two railway lines within the Study Area. The closest is the Glasgow South Western Line which runs from Glasgow to Dumfries, passing through Kilmarnock, Auchinleck, New Cumnock, Kirkconnel and Sanquhar within the Study Area. The Stranraer Line runs adjacent to the coast in the west of the Study Area passing through Prestwick, Ayr and Maybole.

Airports

- 7.6.23. Prestwick Airport lies on the north western edge of the Study Area, to the north of Ayr.

National Cycle Routes

- 7.6.24. National Cycle Route 7: Lochs & Glens South, passes through the west of the Study Area following the coast through Ayr and then continuing south through the Galloway Hills and the Galloway Forest Park.
- 7.6.25. A short section of National Cycle Route 74: Glasgow to Gretna also passes through a small area to the northeast of the Study Area.
- 7.6.26. National Cycle Routes through the Study Area are illustrated in **Figure 7.1.2 Volume III**.

Long Distance Routes

- 7.6.27. A long distant walking route, the Southern Upland Way crosses the Study Area to the south and east of the application site. This 341km coast-to-coast walk between Portpatrick on the west coast and Cockburnspath on the east coast crosses the Study Area over the Lowther Hills to the east, passing through the village of Sanquhar and across remote upland hills to St John's Town of Dalry and then continuing through the Galloway Forest Park to the southwest of the Study Area. This remote and challenging path passes approximately 7 km to the southeast of the application site at Polskeoch at its nearest point, the route passes Andy Goldsworthy's Striding Arches and the summit of Benbrack Hill at 581m AOD with a 360 degree panorama of the Southern Uplands and Galloway Hills.
- 7.6.28. The route of the Southern Upland Way through the Study Area is illustrated in **Figure 7.1.2 Volume III**.

Tourism and Recreation

- 7.6.29. There are many opportunities for outdoor pursuits within the Study Area due to the abundance of open countryside within the area and facilities are primarily for walking, cycling, mountain biking, horse-riding and fishing. These outdoor pursuits utilise designated paths and also take place in the forested areas such as the Forestry Commission owned Galloway Forest Park to the southwest of the Study Area.
- 7.6.30. There are also several museums and visitor attractions within the Study Area including Drumlanrig Castle, the Sanquhar Tollbooth Museum and the Baird Institute in Cumnock. Mauchline was home to the Scottish poet Robert Burns and contains the Burns House Museum and various other Robert Burns related attractions.

Landscape Designations

- 7.6.31. The application area is located within an area designated as a Sensitive Landscape Character Area within the East Ayrshire Local Plan (2010), whilst parts of the Study Area are subject to further landscape designations. These are described below and illustrated in **Figure 7.1.2 Volume III**.

Sensitive Landscape Character Areas

- 7.6.32. Three Sensitive Landscape Character Areas are found within the Study Area, one of which extends to the south and north of New Cumnock and covers the application site. Sensitive Landscape Character Areas are designated within the East Ayrshire Local Plan (2010) to either protect or enhance the landscape and local landscape character or to promote the social and economic well-being of communities.

Regional Scenic Areas and Scenic Areas

- 7.6.33. A number of Regional Scenic Areas and Scenic Areas are located within the Study Area designated by the Dumfries and Galloway Structure Plan. These areas are designated for the quality of their landscape character and scenic interest. Regional Scenic Areas within the Study Area include the Thornhill Uplands to the east and the Galloway Hills to the southwest within the whilst Scenic Areas are located at the Heads of Ayr, the Carrick Hills, the mainly upland area of South Carrick and the South Ayrshire coastal strip.

Special Landscape Areas

- 7.6.34. Two Special Landscape Areas are located to the northeast and east of the Study Area, surrounding the village of Douglas and covering the Lowther Hills respectively. Special Landscape Areas were identified in accordance with the requirements of the

South Lanarkshire Local Plan, in the document Validating Local Landscape Designations, November 2010.

Historic Gardens and Designed Landscapes

- 7.6.35. The Inventory of Gardens and Designed Landscapes in Scotland is a list of nationally important Gardens and Designed Landscapes that meet the criteria published in the Scottish Historic Environment Policy 2011. There are 16 sites listed within the Inventory of Gardens and Designed Landscapes (GDLs) in Scotland found within the Study Area as summarised in **Table 7.5**. A description of the location and setting of each is set out in **Appendix 7.2 Volume IV** and their locations relative to the application site are illustrated in **Figure 7.1.2 Volume III**.

Table 7.5 Gardens and Designed Landscapes within the Study Area

Gardens and Designed Landscapes	Grid Reference	Approximate Distance and Direction from Pencloe Windfarm Site
Auchencruive House	NS 920340	25.6 km NW
Bargany	NS 251008	32.3 km W
Blairquhan	NS 650605	22.3 km W
Caprington Castle	NS 407361	34.2 km NW
Carnell	NS 670205	28.0 km NW
Craigengillan	NS 695425	11.0 km W
Culzean Castle	NS 238100	32.9 km W
Drumlanrig Castle	NS 540010	22.8 km SEE
Dumfries House	NS 450045	13.8 km NNW
Kilkerran	NS 050320	27.7 km W
Lanfine	NS 490665	29.4 km NNW
Loudoun Castle	NS 090785	31.2 km NNW
Maxwelton (Glencairn Castle)	NX 215980	25.7 km SE
Rozelle (La Rochelle)	NS 385900	28.8 km NWW
Scots Mining Company House	NS 860480	28.3 km NEE
Skeldon House	NS 740395	23.3 km NWW

Other Relevant Landscape Areas

- 7.6.36. In addition to the above nationally and regionally important landscape designations, other areas that are not landscape designations but are of potential sensitivity to the proposed development have been taken into account.

Wild Land Areas

- 7.6.37. Wild Land is a concept introduced by SNH in their 2002 policy statement *Wildness in Scotland's Countryside* (Policy Statement 02/03). This initially followed on from *National Planning Policy Guideline 14: Natural Heritage* (NPPG 14), which sought to identify Wild Land as an aspect of landscape character to be protected through land-use planning. The NPPG also advised Councils to identify and protect Wild Land in their development plans, as part of their policies for the conservation and enhancement of their areas. SPP states that in the context of mapped environmental interests, which include wild land, that whilst recognising the need for significant protection, in these areas windfarms may be appropriate in some circumstances. 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.

- 7.6.38. In this regard the LVIA has adopted the approach provided in the guidance on the assessment of impacts on Wild Land Areas provided by SNH in their 2007 document *Assessing the Impacts on Wild Land: Interim Guidance Note*.
- 7.6.39. Current Wild Land Areas are identified on Scottish Natural Heritage's new map of Wild Land, June 2014. These areas are not landscape designations, but are a consideration in the LVIA. There is one Wild Land Area within the Study Area, Area 1 – The Merrick. The extent of the Wild Land Area and its position relative to the application site is illustrated in **Figure 7.1.2 Volume III**.

Baseline Landscape Context

Landscape Character Assessment

- 7.6.40. The detailed baseline assessment of the landscape character of the study area is presented in **Appendix 7.3 Volume IV**. A summary of the landscape context of the application site is given in the following text in order that the reader may gain an understanding of the landscape throughout the study area.
- 7.6.41. Scottish Natural Heritage's Landscape Character Assessment has classified the landscape of Scotland into Landscape Character Types (LCT) and described these in a series of 35 documents. Three of these Landscape Character Assessment documents coincide with the study area, as well as more recent Landscape Character and Wind Capacity Assessments:
- No. 111: The Ayrshire Landscape Assessment SNH, LUC (1998);
 - No 94: The Dumfries and Galloway Landscape Assessment, SNH, LUC (1998);
 - No. 116: The Glasgow and Clyde Valley Landscape Assessment SNH, LUC (1999);
 - East Ayrshire Landscape Wind Capacity Study; Carol Anderson Landscape Associates, 2013;
 - Dumfries and Galloway Windfarm Landscape Capacity Study; Carol Anderson and Alison Grant, Landscape Architects, 2011;
 - South Ayrshire Landscape Wind Capacity Study; Carol Anderson Landscape Associates, 2013 and
 - South Lanarkshire Landscape Character Assessment; Ironside Farrar, 2010.
- 7.6.42. Using accepted, systematic methods of landscape character assessment the countryside has been subdivided into different landscape character types, each with a distinctive character based upon local patterns of geology, land form, land use, cultural and ecological features. This provides a baseline against which to make judgements on the likely effects of the proposed development upon landscape character.
- 7.6.43. The LVIA for Pencloe Windfarm seeks to identify and classify the landscape character of the 35km radius Study Area based on the existing landscape assessments. The 63 Landscape Character Types (LCT) that coincide with the 35km radius Study Area are illustrated graphically on **Figure 7.1.3 Volume III**.
- 7.6.44. The application site is situated within the 'Southern Uplands with Forestry' Landscape Character Type identified in the Ayrshire Landscape Assessment. This landscape is characterised by the steep, smooth slopes of the southern Uplands which rise to smooth rounded summits. Cut into the uplands are a series of distinctive glacial valleys with U-shaped cross sections.

- 7.6.45. In topographic respects the Southern Uplands with Forest landscape type is the same as the Southern Uplands type. Its character is, however, considerably different due to the dominant forestry landcover. With regard to wind power development in this LCT, the Ayrshire Landscape Character Assessment states that: *“it is likely that large parts of the southern uplands have potential for wind power development...All other things being equal, it would be logical to steer windfarm development to those parts of the southern uplands already affected by forestry or other development.”*
- 7.6.46. In undertaking the preliminary assessment and review of baseline material against the visibility mapping of the windfarm and through subsequent fieldwork, it is considered that beyond a 20 km radius from the outermost turbines the proposed development would be seen as a distant element in the landscape and that there would be only a limited influence on the characteristics, defining features and/ or special qualities of the LCTs. Although there may be some effects on landscape character beyond a 20 km radius from the application site, these are unlikely to be significant and, in this regard LCTs beyond 20 km of the application site have not been assessed further. Whilst beyond 15 km the windfarm will only be seen under conditions of clear visibility and as a minor element in the landscape, a 20 km radius has been selected given the elevation of the Southern Uplands and the remote and development free nature of some of the Landscape Character Types. LCTs within a 20 km radius of the proposed development have been reviewed in detail and provide an appropriate basis to describe the landscape character of the area surrounding the proposed Pencloe Windfarm.
- 7.6.47. A description of each of the LCTs within the core 20 km study area, as listed below in **Table 7.6**, is provided in **Appendix 7.3 Volume IV** setting out the main features, key characteristics and sensitivity of the landscape to proposed development.

Table 7.6: Landscape Character Types within 20 km of the proposed development

Landscape Character Type	Code/ Number	Susceptibility to Change	Sensitivity to Change Associated with the proposed development
East Ayrshire Lowlands	EA 7c	Medium	Medium
East Ayrshire Plateau Moorlands	EA 18a	Medium	Medium
East Ayrshire Southern Uplands	EA 20a	High	Medium
Foothills	DG 18	High	High
Foothills with Forestry	DG 18a	Medium	Low-Medium
Foothills with Forest and Windfarm	SA 17c	Medium	Medium
Foothills with Forest and Opencast Mining	EA 17a	Medium	Medium
Foothills with Forest west of Doon Valley	EA 17b, SA 17b	High	Medium
Intimate Pastoral Valleys	SA 13	High	High
Lowland River Valleys	SA 9, EA 9	High	High

Landscape Character Type	Code/ Number	Susceptibility to Change	Sensitivity to Change Associated with the proposed development
Maybole Foothills	SA 17d	High	High
Middle Dale	SA 12	High	High
Narrow Wooded River Valleys	DG 4	Medium	Medium
Rolling Moorland	SL 7	High	High - Medium
Rolling Moorland Forestry	SL 7a	Medium	Medium
Rugged Granite Uplands	DG 21	High	High
Rugged Granite Uplands and Forestry	DG 21a	High	High - Medium
Rugged Uplands with Lochs and Forest	SA 21, EA 21	High	High
South Ayrshire Lowlands	SA 7d	High	High
Southern Uplands	DG 19	Medium	Medium
Southern Uplands and Forestry	EA 20c	Low	Low
Southern Uplands with Forestry	DG 19a	Low	Low
Upland Basin	EA 15	Low	Medium
Upland Glens	EA 14, DG 10	High	Medium
Upland River Valleys	EA 10	Low	Medium
Upper Dales	DG 9	High	High

Baseline Visual Resources

- 7.6.48. A key component of the assessment is the appraisal of effects from key locations within the Study Area. This assessment is undertaken through analysis of visibility mapping and confirmation of the extent of visibility through the preparation of wireframes and use of these in the field in combination with the photomontages.

Viewpoint Selection

- 7.6.49. Viewpoints for the visual assessment were identified following production of the ZTV and a list of viewpoints were selected and confirmed to consultees including East Ayrshire Council, Dumfries and Galloway Council and Scottish Natural Heritage, as part of the scoping exercise, as summarised in **Section 7.5**. The types of receptors considered included the following:

- Different LCAs/LCTs;
- Designated and other sensitive landscapes, including proposed Wild Land Areas;

- Inventory Gardens and Designed Landscapes;
 - Settlements (towns and villages, as well as smaller groups of residential properties);
 - Roads (main and minor);
 - Public footpaths and cycle routes including National Trails, marked footpaths, National Cycle Network (NCN) Routes and public Rights of Way (pROWs);
 - Marked/ popular viewpoints;
 - Other outdoor recreational resources and
 - Visitor/ tourist facilities such as camp sites, hotels and visitor attractions.
- 7.6.50. Following a site visit and desk based study, it was recognised that principal views in the area will be from:
- The villages and farming settlements within Nithsdale to the north;
 - From local vantage points popular with walkers such as Blackcraig Hill locally to the east, the Rhinns of Kells to the southwest, Cairnsmore of Cairnsphairn to the south and Benbrack on the Southern Upland Way to the southeast;
 - The key local route corridors of the A76, B743 and the B741; and
 - Vantage points within or close to the larger local settlements of New Cumnock and Mauchline.
- 7.6.51. The proposed development has a complex visual footprint with the Southern Uplands providing areas of strong topographic screening contrasting with areas of more open, albeit distant, views from the Ayrshire Lowlands in the north. Of the 24 viewpoints included in the assessment, 15 are taken from locations within 15 km of the proposed development. Beyond 15 km the windfarm will only be seen under conditions of clear visibility and as a minor element in the landscape.
- 7.6.52. Following on from the design optimisation for Pencloe Windfarm, described in **Chapter 2: Site Selection, Design and Alternatives**, it became apparent that two of the 24 proposed viewpoints would no longer lie within the reduced ZTV. Viewers at these locations would therefore not experience any visibility of the proposed development, Viewpoints 19 and 24 and they have therefore not been assessed further below. However, as these locations were originally agreed with the statutory consultees, they have been retained in **Figure 7.1.4 Volume III** for reference and baseline descriptions of them are included within **Appendix 7.5 Volume IV**. The baseline photography and wireframes have also been retained in Volume III, in order to illustrate clearly the locations of the viewpoints and the absence of any visibility.
- 7.6.53. The 22 viewpoints taken forward for full assessment cover a range of representative landscape and visual receptors, distances from the proposed development, altitudes and directions, with the aim of achieving a reasonable distribution at compass points around the application site. Viewpoints were visited as part of the baseline visual assessment and panoramic photographs of the existing views have been taken. The final list of the 24 agreed viewpoints is shown in **Table 7.7** and their locations are illustrated in **Figure 7.1.4 Volume III**. Photographs of the existing views from these viewpoints are shown in **Figures 7.3.1 to 7.3.24 Volume III**. The existing and predicted views of the proposed development are described in the assessment of residual effects in **Section 7.10** below.

Table 7.7 Viewpoint Locations

No	Location	Distance and Direction to Nearest Turbine	Landscape Character Unit	Receptors	Grid Reference
1	Entrance to Pencloe Farm, Glen Afton	2.92 km south	Upland Glen	Residents Road Users	NS 618100
2	Summit of Blackcraig Hill	3.17 km west	East Ayrshire Southern Uplands	Walkers	NS 647064
3	Afton Cemetery Car Park, Afton Road, New Cumnock	5.34 km south	Upland Basin	Road Users Visitors	NS 615125
4	Connel View, Southern edge of New Cumnock	5.39 km south	Upland Basin	Residents	NS 618125
5	Burnside, B741	4.57 km south	Upland Basin	Residents Road Users	NS 588113
6	Mansfield, Pathhead	7.20 km south	Upland Basin/ Upland River Valley	Residents Road Users	NS 625143
7	Minor road near Mounthope Farm	8.50 km south	East Ayrshire Plateau Moorlands	Residents Road Users	NS 635154
8	Layby A76, near Calton Farm	10.00 km south	Upland Basin	Residents Road Users	NS 591169
9	Minor road near Auchincross Farm	7.77 km south east	Upland Basin	Road Users	NS 573142
10	Minor road at Guffock Hill above Nithsdale	15.47 km south west	Southern Uplands	Road Users	NS 748146
11	Southern Upland Way at the summit of Benbrack	10.70 km north west	Southern Uplands and Forestry	Walkers	NX 680970
12	Summit of Cairnsmore of Carsphairn	7.37 km north	Southern Uplands	Walkers	NX 594979
13	Minor Road at Lamford	8.25 km north east	Southern Uplands and Forestry	Road Users	NX 537992
14	Penders Wynd, Netherthird, Cumnock	11.51 km south	East Ayrshire Lowlands	Residents Road Users	NS 578182

No	Location	Distance and Direction to Nearest Turbine	Landscape Character Unit	Receptors	Grid Reference
15	Catrine Road, B705, Mauchline	22.04 km south east	East Ayrshire Lowlands	Residents Road Users	NS 503267
16	Summit of Corserine	20.60 km north east	Rugged Uplands, Lochs and Forest	Walkers	NX 497870
17	B743 at Crook Moss	19.90 km south	Upland River Valley	Road Users	NS 606271
18	Lowther Hill, Southern Upland Way	27.72 km west	Southern Uplands, Leadhills	Walkers	NS 889107
19	Minor road south of Stinchar Falls	24.30 km north east	Rugged Uplands, Lochs and Forest	Road Users	NX 281940
20	Afton Reservoir	1.88 km north west	Upland Glen	Walkers Visitors	NS 631048
21	A77 west of Maybole/ Crossraguel Abbey	31.71 km east	Maybole Foothills	Visitors	NS 274083
22	Brown Carrick Hill	30.88 km south east	Brown Carrick Hills	Walkers Cyclists	NS 300162
23	B7037 south of Galston	25.44 km south east	East Ayrshire Lowlands	Road Users	NS 526312
24	Doon Castle beside Loch Doon	14.94 km north east	Rugged Uplands, Lochs and Forest	Road Users	NX 484950

7.7. Cumulative Windfarm Baseline

Existing Windfarms

7.7.1. In September 2014 there were 34 commercial-scale windfarm developments within the 35 km radius Study Area that were operational, under construction or consented. In addition a 75m high single turbine is located at High Park and due to its relative proximity to the proposed development has been included in the assessment. As these windfarms are either already part of the current landscape and visual baseline resource, or will become part of the predicted baseline conditions in the near future, they have been considered as an integral part of the baseline within the main assessment of landscape and visual effects in **Section 7.9** below. Other proposed windfarms within the Study Area that are within the planning system but yet to be determined have been considered separately when gauging the cumulative impact of the proposed development in addition to these as-yet-undetermined applications.

7.7.2. Details of these built and consented windfarms are given below in **Table 7.8** and their locations relative to the proposed development are illustrated in **Figure 7.4.2 Volume III**. In accordance with SNH guidance a location plan of cumulative sites to a 60km radius is included at **Figure 7.4.1 Volume III**. A ZTV plan showing the existing visibility of the built/ consented sites plus the proposed development is illustrated in **Figure 7.5.1 Volume III**.

Table 7.8 Built and Consented Windfarms within the 35 km Study Area

Windfarm	Developer	Stage	Distance / Direction from Pencloe Windfarm	Number of Wind turbines	Blade Tip Height
Afton	E.ON	Consented	0.1 km SE	27	120 m
Windy Standard Extension	RWE npower renewables	Consented	0.8 km S	30	120 m
Windy Standard	RWE npower renewables	Operational	1.8 km S	36	56.5 m
Hare Hill	Scottish Power Renewables	Operational	2.1 km NE	20	63.5 m
Hare Hill Extension	Scottish Power Renewables	Consented	2.5 km NE	39	91m
High Park Single Turbine	Private	Operational	4.59 km N	1	75 m
Sanquhar Community	Community Windpower	Consented	5.5 km E	12	126.5 m
Whiteside Hill	SSE Renewables	Consented	8.1 km E	13	121 m
Wether Hill	Scottish Power Renewables	Operational	13.4 km SE	14	91 m
Sunnyside	Whirlwind Renewables	Consented	14.3 km E	2	101 m
Penbreck and Carmacoup	ARSU	Consented	14.9 km NE	9	125 m
Dersalloch	Scottish Power Renewables	Consented	15.5 km W	23	115 m
Torrs Hill	Fred Olsen Renewables	Under Construction	17.1 km SW	2	100 m
Linburn Farm	Andrew Woodburn	Consented	24 km NE	2	67 m
Knockman Hill	Natural Power	Consented	21.9 km SSE	5	81 m
Blackcraig Hill	SSE Renewables	Consented	22.9 km SE	23	110 m
Bankend Rig	I & H Brown	Consented	23.0 km N	11	84.5 m
Galawhistle	Infinis	Consented	24.1 km NE	22	110.2 m & 121.2 m
Dungavel Hill	E.on	Consented	26.0 km N	13	100 m
Hagshaw Hill	Scottish Power Renewables	Operational	26.1 km NE	26	91 m
Andershaw	Force 9 Energy	Consented	26.6 km NE	14	125 m
Nutberry	Falck Renewables	Consented	27.0 km NE	6	115 m
Hagshaw Hill Extension	Scottish Power Renewables	Operational	27.5 km NE	20	91 m
Kype Muir	Banks Renewables	Consented	29.1 km NE	26	132 m

Windfarm	Developer	Stage	Distance / Direction from Pencloe Windfarm	Number of Wind turbines	Blade Tip Height
Hadyard Hill	SSE Renewables	Operational	29.7 km W	52	110 m
Auchrobert	Falck Renewables & Coriolis Energy	Consented	29.8 km NE	12	132 m
Calder Water	Community Windpower	Operational	30.5 km N	13	144.5 m
Whitelee Ext Phase 2	Scottish Power Renewables	Operational	31.4 km NNW	39	110 m
West Browncastle	Falck Renewables	Consented	31.8 km N	9	136.5 m
Whitelee	Scottish Power Renewables	Operational	32.2 km N	140	110 m
Whitelee Ext Phase 1	Scottish Power Renewables	Operational	32.4 km N	36	110 m
Sneddon Law	Community Windpower	Consented	32.7 km NNW	15	130 m
Clyde	SSE Renewables	Operational	34.3 km E	152	125 m
Clyde Extension	SSE Renewables	Operational	34.3 km E	54	125.5 m – 142 m
Dalswinton	Infinis	Operational	35.9 km SE	15	121 m

7.8. Assessment of Effects during the Construction Stage

7.8.1. The construction phase of the proposed development is expected to last approximately 18 months. During this phase, the following activities and elements have the potential to cause an effect on the landscape and visual amenity of the Study Area:

- Upgrade of existing and construction of new site access tracks;
- Excavation of borrow pits;
- Felling of forestry coupes;
- Excavations for underground cables and turbine foundations;
- Formation of temporary construction compounds and fencing;
- Machinery and material storage;
- Plant and vehicle movements;
- Short term use of tall cranes;
- Local vegetation trimming / clearance;
- Construction of control building and substation compound;
- HGV and abnormal load deliveries to site and vehicle movements onsite;
- Construction site lighting in winter months;
- Construction of the turbine foundations and erection of the turbines and
- Reinstatement work, including removal of temporary accommodation.

- 7.8.2. The location and management of these features will be carefully considered to minimise effects on the landscape resource and visual receptors.
- 7.8.3. The ground disturbance on the application site will be restricted as far as practicable to the construction compounds, construction of access tracks, hardstanding areas, turbine foundations, routes for underground cables and the control building and substation compound. The proposed location of these elements is shown in **Figure 4.1 Volume III**. Whilst there will be substantial effects, physical disturbance to the application site will be limited to a relatively small proportion of the overall application site, defined in detail in **Chapter 4: Project Description**, with excavations of turbine foundations, cable runs, etc reinstated on completion of the works.
- 7.8.4. Site access tracks will be constructed to approximately 5m in width.
- 7.8.5. The locations of the construction compounds and control building and substation compound will be in the southern sector of the application site.
- 7.8.6. The turbines will be erected over a relatively short period and the appearance of the construction crane(s) in views of the application site will therefore be of short duration. On completion of the construction phase, all ground disturbance adjacent to built elements will be reinstated.
- 7.8.7. Restoration of replanted areas, such as re-vegetation of track verges could take several years to establish. Restoration will be proactive, using proven restoration techniques, to ensure no construction related erosion features appear along the access tracks. During re-growth, areas of repaired sward will have a different appearance to surrounding undisturbed areas but over time, the species balance will change and plants typical of undisturbed areas will become established.
- 7.8.8. Measures that have been or will be taken to mitigate landscape and visual effects during construction include:
- Layout design to minimise unnecessary loss of immature forestry plantations;
 - Layout design to reduce unnecessary loss of moorland vegetation;
 - Protection of valued features such semi-natural vegetation within the application site;
 - Reinstatement / repair of breached drystone dykes;
 - Control of after dark construction lighting to minimise effects on sensitive views;
 - Maintenance of tidy and contained construction compound and laydown area (see Outline Construction Environmental Management Plan (CEMP) **Appendix 10.7 Volume IV**) and
 - The spreading of peat/topsoil and reseeded and planting on areas to be restored as soon as possible after sections of work are complete.
- 7.8.9. Within 2-3 km of the proposed development, there will be a range of mainly localised effects arising during the construction phase. These will vary from negligible to minor, through to potentially more substantial effects, for example with regard to visibility of tall cranes or night-time construction lighting. However, all of these will be temporary effects that will be short-term in duration and therefore it is not considered that the construction phase of the proposed development would have significant effects upon the landscape resource and visual amenity. The implementation of the windfarm will also require the felling of parts of the existing forestry plantations. This operation will be seen in the context of existing ongoing forestry management operations and is typical characteristic of forestry landscapes. Areas of broadleaved and coniferous tree planting will be planted as part of the adopted forestry management plan, as described in **Appendix 4.1 Volume IV** and will lead to the

restoration of vegetation cover over 3 - 5 years. The residual effects that would remain after construction at the operational stage of the proposed development (taking into account mitigation measures) have been assessed further with regard to possible significant effects in **Section 7.9** below.

- 7.8.10. In addition, once the proposed development is operational there may be occasional infrequent requirements to repair or replace defective turbine components. This would result in large vehicles and cranes being present onsite for a few days and could result in landscape and visual effects for short periods of time. However, these will be temporary and short-term and would not have significant effects upon the landscape resource and visual amenity. Therefore, they have not been assessed further in **Section 7.9**.

7.9. Assessment of Residual Landscape and Visual Effects at Operational Stage

General

- 7.9.1. Identification of the potential for significant residual effects has been undertaken following a review of the visibility mapping provided in **Figures 7.2.1 to 7.2.8 Volume III** and a review of the visualisations provided in **Figures 7.3.1 to 7.3.24 Volume III**. This is in addition to field work assessment and the use of computer-generated visualisations in order to inform the judgements made by the Landscape Architects undertaking the assessment.

Assessment of Effects on the Landscape Resource

- 7.9.2. The following assessment of landscape effects addresses:
- Effects on the application site;
 - Effects on Landscape Character and
 - Effects on Landscape Designations.
- 7.9.3. Landscape character and designations can be affected physically by a windfarm development. This will normally occur where it lies within and causes changes to the fabric of the landscape through the introduction of new features or the removal of existing ones (although off-site physical changes from, for example, widening of access roads at a distance from the application site to allow construction traffic, can also less commonly occur). In general, however, changes to the landscape from windfarm development mainly occur in relation to how the existing character and designations are perceived, through people's visual experience of them being affected. These changes in perception of character, quality or value can affect both the areas and designations that a windfarm may lie within, as well as those surrounding it within the Study Area.

Duration and Reversibility of Landscape Effects

- 7.9.4. The effects will continue for the permitted life of the windfarm, which is set at 25 years. Following this time period, in the absence of a renewed planning permission, the turbines will be removed and the landscape reinstated – with the majority of the proposed changes being fully reversible upon de-commissioning. The duration and reversibility of landscape effects will be the same with regard to all landscape receptors. This has been taken into account in determining the magnitude of change that would be experienced by each landscape receptor and has therefore not been explicitly re-stated with regard to each individual landscape receptor below to avoid repetition.

- 7.9.5. Any landscape effects that may remain after decommissioning and reinstatement are considered further below, with regard to landscape fabric, character and designations respectively.

Assessment of Effects on Landscape Fabric

Location

- 7.9.6. The extent of the application site is shown in **Figure 4.1 Volume III**. The baseline assessment identified predominantly commercial forestry as the context for the proposed development however, there are some smaller areas of grass and heather upland moorland. The application site comprises landscape features commonly found within the local Study Area, with three forested hills, traversed by a network of forestry access tracks, clothed in angular forestry blocks. A network of burns drains the hills to the north and south feeding into the Nith and Ken catchments respectively. The hills merge with the extensive network of hills comprising this north western portion of the Southern Uplands and the prevailing forestry forms the northern edge of the extensive Carsphairn Forest.

Landscape Sensitivity

- 7.9.7. The sensitivity is considered to be Low. The factors which have contributed to this judgement are as follows:

Value

- 7.9.8. Medium: Within the Glenmuir and Afton Special Landscape Character Area.

Susceptibility to Change

- 7.9.9. Negligible:

- Given that felling and replanting operations are typical of forestry landscapes the LCT is not susceptible to the changes to the existing forestry plantations associated with the proposed development.

Magnitude of Change

- 7.9.10. The overall magnitude of change to the existing landscape fabric is Moderate. The factors which have contributed to this judgement are as follows:

Size or Scale

- Within the application site, the turbines and associated infrastructure will lead to the physical loss of discrete areas of forestry and limited areas of moorland through the creation of access tracks, turbine foundations, crane hardstandings, construction compounds, formation of borrow pits and the construction of the control building and substation compound. In total the works will amount to approximately 3% of the total application site and lead to the loss of a very small proportion of the landscape features within the application site.
- The construction of the windfarm will necessitate early felling of forestry coups with the associated loss of tree cover for a short period prior to replanting with a re-structured mix of some broadleaved trees but mainly coniferous trees. The re-planting will be in line with the adopted forestry design plan. The felling of forestry coups will be to a new wind farm edge and therefore the extent of tree felling will be greater than that required to accommodate the footprint of the windfarm infrastructure. The felling/restocking programme is summarised in Chapter 4: Project Description and set out in more detail in the Forest Management Plan (Appendix 4.1 Volume IV).
- Within the application site, users of the informal footpath network will experience a moderate change in the nature of views across the site with the removal of some areas of forestry and the installation of the windfarm.

Geographical Extent

- 7.9.11. The turbines are arranged in three adjacent arrays, arranged from west to east across Milray Hill, Auchincally Hill and Meikle Hill. The site access track follows the broad alignment of the existing forestry access track leading south from Glen Afton around Pencloe Farm into the forest. The existing track will be extended to the south of Meikle and Auchincally Hills with a new loop built to link in Milray Hill. The description of the proposed development and the extent of the felled and re-stocked area is provided in **Chapter 4: Project Description**.

Significance of Effect

- 7.9.12. The combination of the individual judgements of **Low** sensitivity and **Moderate** magnitude of change on the fabric of the landscape at operational stage of the proposed development on the application site, are considered to result in a **Moderate/Minor** effect, which in the context of this assessment is considered to be **Not Significant**.

Assessment of Effects on Landscape Character and Designations

- 7.9.13. People's perceptions of the effects of a windfarm on landscape character and designated or other relevant landscape areas are closely related to the potential extent and nature of visibility of the turbines and ancillary infrastructure. An overview of the nature of the visibility of the wind turbines (the components most likely to be visible) within the Study Area is therefore provided below.

General Appraisal of Visibility within 20 km of the proposed development

- 7.9.14. The potential visual influence of wind turbines is closely related to a range of parameters, the most important of which is distance. It is considered that within 20 km, turbines with a blade tip height of 125 m will be a visible element in the landscape. Although they may not necessarily be intrusive or dominant, a windfarm has the potential to influence landscape character. Beyond 20km, the relative size of the turbines is much reduced, becoming less distinct and less prominent, appearing as an element in the wider views of the landscape.
- 7.9.15. **Figures 7.2.7** and **7.2.8** in **Volume III** indicate the ZTV of the proposed development within a 20 km radius, based on the visibility to the blade tip and hub height of the turbines respectively.
- 7.9.16. The turbine layout has been carefully sited as three adjacent arrays set on Milray Hill, Auchincally Hill, Meikle Hill a sequence of rolling hills which increase in height towards the southwest of the application site. The proposed development would extend across a series of ridges with turbines located at a height of approximately 340 m AOD to 500 m AOD on this north western margin of the Southern Uplands, with local areas of visibility extending across the immediate site area and the Carsphairn Forest. Boltcraig Hill (448 m AOD) and Yarnallows Knowe (476 m AOD) lying to the east of the application site provide partial visual containment and reduce the extent of the visual footprint of the proposed development from Glen Afton. Blackcraig Hill (700 m AOD) and Hare Hill (601 m AOD) to the east of Glen Afton limit all but small patches of visibility to the east, whilst the ridgeline to the south of Glen Afton at c.640m AOD and the block of hills to the south west, centred on Cairnsmore of Cairnsphairn (797 m AOD) significantly limit views to the south.
- 7.9.17. A second inner tier of visibility extends from 5 km to the north across the headwaters of the River Nith from the forested hills around Stannery Knowe (363 m AOD) and Cargailoch Hill (364 m AOD) eastwards through the Cummnock and New Cummnock Lowlands to Corsencon Hill (475 m AOD).

- 7.9.18. Beyond this core visual footprint, potential visibility of Pencloe Windfarm will become increasingly fragmented. To the north a band of visibility lies across the southern edge of the Ayrshire Basin around Cumnock and extending in broad patches of visibility across the elevated moorlands at Airds Moss and Wardlow Hill (497 m AOD), over 13-15 km. To the south-west, a fragmented band of visibility occurs across the moorland and forestry above Loch Doon, at 11 km from the nearest turbine.
- 7.9.19. Limited areas of blade tip visibility are indicated from the national road network. The A76 between Cumnock and New Cumnock has theoretical visibility for southbound drivers however, the road corridor is well vegetated and actual visibility will be reduced.

General Appraisal of Visibility between 20-35 km from the proposed development

- 7.9.20. **Figures 7.2.1 and 7.2.6** in **Volume III** indicate the ZTV of the proposed development within a 35 km radius of the application site, based on the visibility to the blade tip and hub height of the turbines.
- 7.9.21. The proposed development has a complex visual footprint with the Southern Uplands providing areas of strong topographic screening contrasting with areas of more open, albeit distant, views from the Ayrshire Lowlands in the north.
- 7.9.22. Principal areas of theoretical visibility from the landscape between 20 km and 35 km of the application site include:
- the summit areas of the Rhinns of Kells to the south;
 - the north facing hill flanks of the Carrick Forest to the south west;
 - the Maybole area including Brown Carrick Hill;
 - the Ayrshire Basin and
 - the summit areas of the Lowther Hills.
- 7.9.23. With the exception of the Ayrshire Basin, away from the more elevated landscapes there will be little or no visibility of the proposed development from the lower-lying valley landscapes.

Assessment of Effects on Landscape Character

General

- 7.9.24. The assessment of effects on landscape character types has been undertaken through field survey and the analysis of ZTV mapping and wireframe views prepared in Resoft's Windfarm software in order to confirm the likely nature of visibility and associated implications for effects on the key characteristics and defining features of each character unit.
- 7.9.25. The following section provides an assessment of the predicted effects on Landscape Character Types within a 20 km study area that have been identified as having the potential to experience a significant effect following the initial assessment provided in **Appendix 7.4 Volume III**.

7.9.26. Whilst beyond 15 km the windfarm will only be seen under conditions of clear visibility and as a minor element in the landscape, a 20km radius has been selected given the elevation of the Southern Uplands and the remote and development free nature of some of the Landscape Character Types. As such the resulting effects on landscape character will not give rise to significant effects on landscape character beyond 20 km and therefore no further assessment is considered to be appropriate. Analysis of the overlaid ZTVs (to blade tip) provided in **Figure 7.2.4 Volume III** indicates that many of the Landscape Character Units will experience no or limited visibility and perceived changes in their character and qualities and accordingly have not been considered further.

7.9.27. The following Landscape Character Types have been identified for detailed assessment:

- East Ayrshire Lowlands LCT;
- East Ayrshire Plateau Moorlands LCT;
- East Ayrshire Southern Uplands LCT;
- Foothills with Forest west of Doon Valley LCT;
- Rugged Uplands with Lochs and Forest LCT;
- Southern Uplands and Forestry LCT (East Ayrshire);
- Southern Uplands with Forestry LCT (Dumfries and Galloway);
- Upland Basin LCT;
- Upland Glens LCT and
- Upland River Valleys LCT.

7.9.28. These are discussed below.

Assessment of Effects on the East Ayrshire Lowlands LCT

Location

7.9.29. Two units of the East Ayrshire Lowlands occur to the north of the 20 km study area and comprise agricultural lowlands to the south of the Ayrshire Basin with the northern unit extending over Airds Moss. Both units, but particularly the northern unit will experience theoretical visibility of the development.

Landscape Sensitivity

7.9.30. The sensitivity is considered to be Medium. The factors which have contributed to this judgement are as follows:

Value

7.9.31. Medium: The southern unit includes Dumfries House Garden and Designed Landscape and the northern unit is partially within the Upper Ayr Sensitive Landscape Character Area.

Susceptibility to Change

7.9.32. Medium:

- Small to medium scale.
- Variable landscape with more complex and rolling landform in some areas and small areas of flatter remnant moss on more elevated areas close to the North Ayrshire border.

- Relatively simple landcover, dominated by policy woodland and small pastures enclosed by intact hedgerows.
- Limited remoteness and wildness attributes with a regular pattern of small farms and a number of single and small turbines located throughout the LCT.
- Moderate resilience to external change.
- Existing influence of Hare Hill and Windy Standard (and Extension) Windfarms and the consented Afton and Hare Hill Extension Windfarms seen upon the Southern Uplands to the south.

Magnitude of Change

7.9.33. The overall magnitude of change to the East Ayrshire Lowlands LCT will be Slight. The factors which have contributed to this judgement are as follows:

Size or Scale

- No effect on existing landscape elements.
- 10 km or greater separation distance to both units.
- Scattered theoretical visibility of all turbines over the southern unit with extensive theoretical visibility to 16-21 turbines throughout the northern unit. Experienced in the context of the existing Hare Hill and Windy Standard (and Extension) Windfarms and the consented Afton and Hare Hill Extension Windfarms.
- Actual visibility reduced by woodland cover and plantations across the intervening hills.

Geographical Extent

7.9.34. The ZTV in **Figure 7.2.9, Volume III** shows scattered theoretical visibility across elevated areas of the southern unit, which is sheltered by hills in the adjoining Foothills with Forest and Opencast Mining LCT, with actual influence significantly reduced by the frequent hedgerows and tree belts. An extensive area of theoretical visibility, of 16-21 turbines, will influence the northern unit, although the extent of the influence is reduced by distance and the extensive coniferous plantations surrounding Glensham Rock Farm and at Airds Moss.

Significance of Effect

7.9.35. The combination of the individual judgements of **Medium** sensitivity and **Slight** magnitude of change, are considered to result in a **Moderate/Minor** effect, which in the context of this assessment is considered to be **Not Significant**.

Assessment of Effects on the East Ayrshire Plateau Moorlands LCT

Location

7.9.36. The East Ayrshire Plateau Moorlands LCT occurs in the northeastern sector of the 20 km study area and comprises an upland landscape on either side of the Upper Ayr valley, which will experience theoretical visibility of the proposed development.

Landscape Sensitivity

7.9.37. The sensitivity is considered to be Medium. The factors which have contributed to this judgement are as follows:

Value

7.9.38. Medium: Lies partially within Glenmuir and Afton Sensitive Landscape Character Area.

Susceptibility to Change

7.9.39. Medium:

- Large scale.
- Relatively simple landform: undulating upland plateau of subtly rounded hills, shallow basins and some very gently graded lower slopes as well as higher hills with steep slopes and defined ridges and summits.
- Simplicity of landcover: dominated by grass moorland with some coniferous forestry, some small enclosed pastures and mixed woodlands.
- Some remote and wild attributes associated with landmark hills.
- Extensive local changes through open cast workings reduce sensitivity.
- Moderate resilience to external change.
- Existing influence of Sanquhar Community, Hare Hill and Windy Standard (and Extension) Windfarms and the consented Afton and Hare Hill Extension Windfarms seen upon the Southern Uplands to the south.

Magnitude of Change

7.9.40. The overall magnitude of change in the Plateau Moorlands/ East Ayrshire Plateau Moorlands LCT will be Slight. The factors which have contributed to this judgement are as follows:

Size or Scale

- No effect on existing landscape elements.
- 8 km or more separation distance to the unit.
- Moderate proportion of LCT affected by theoretical visibility of 16-21 turbines across elevated areas and southern hills slopes.
- The extent of actual visibility is reduced by areas of conifer plantation within southern parts of the LCT.

Geographical Extent

7.9.41. The ZTV in **Figure 7.2.9 Volume III** shows consistent areas of theoretical visibility to the windfarm over c.8 km from the south facing flanks of the hills above Nithsdale however, these areas are coincident with areas of opencast mining and coniferous plantations, with farming on the lower slopes. More distant theoretical visibility, at over 15 km, of 16 - 21 turbines is seen across elevated areas including Cairn Table and Wardlaw Hill.

Significance of Effect

7.9.42. In the East Ayrshire Plateau Moorlands, the combination of the individual judgements of **Medium** sensitivity and a **Slight** magnitude of change, are considered to result in a **Moderate/Minor** effect, which in the context of this assessment is considered to be **Not Significant**.

Assessment of Effects on the East Ayrshire Southern Uplands LCT

Location

7.9.43. The East Ayrshire Southern Uplands LCT comprises steep sided and rugged open hills which are dominated by grass moorland and two units of the LCT fall within the 20 km radius. The two units lie to the east and west of Glen Afton. The unit to the east of Glen Afton unit lies 600 m to the north of the proposed development at its

closest point whilst the unit to the west of Glen Afton lies 1.8 km to the northwest of the proposed development.

Landscape Sensitivity

7.9.44. The sensitivity is considered to be Medium. The factors which have contributed to this judgement are as follows:

Value

7.9.45. Medium: Both the unit to the east and the unit to the west of Glen Afton are covered by a Special Landscape Character Area designation.

Susceptibility to Change

7.9.46. Medium:

- Large scale.
- Dramatic landform of steep-sided, rugged open hills strongly containing Glen Afton and providing a backdrop to the lower-lying Upland Basin to the north.
- Relatively simple landcover, dominated by grass moorland and landmark hills on the eastern edge of Glen Afton.
- Some remoteness and wildness attributes as this landscape is not settled, it forms a prominent backdrop in views from the settlements and roads within the Upland Basin to the north.
- Moderate resilience to external change.
- Existing influence of Hare Hill and Windy Standard (and Extension) Windfarms and the consented Afton and Hare Hill Extension Windfarms and the large single turbine at High Park to the south of New Cumnock.

Magnitude of Change

7.9.47. The overall magnitude of change across the East Ayrshire Southern Uplands LCT will be Moderate. The factors which have contributed to this judgement are as follows:

Size or Scale

- No effect on existing landscape elements.
- Limited separation distance to both units.
- Scattered theoretical visibility of all turbines over both units, mainly across elevated areas.

Geographical Extent

7.9.48. The ZTV in **Figure 7.2.9 Volume III** indicates that there will be potential for visibility of up to 21 turbines of the proposed development across the western part of the unit to the east of Glen Afton, concentrated across elevated areas and on slopes with a westerly aspect.

7.9.49. Within the unit to the west of Glen Afton, visibility of up to 21 turbines is fragmented, occurring in the eastern and southern parts of the unit which lie closest to the proposed development with further visibility curtailed by ridges to the south.

7.9.50. Indirect impacts on the perceived qualities and characteristics of the LCT beyond the application site will occur as a result of the proposed development. The expansive open moorland will experience a relatively open relationship with the proposed development. **Viewpoint 2, Figure 7.3.2 Volume III** is representative of the typical nature of views from within this LCT, lying at a distance of 3.17 km to the proposed development.

7.9.51. The proposed development will introduce windfarm development to a new area which is located between the two units of the East Ayrshire Southern Uplands LCT. Existing windfarm development within the LCT at Hare Hill and High Park single turbine already has an influence on the character of the LCT and this will be increased by the construction of the consented Hare Hill Extension and also Afton which lies in the adjacent Upper Glen LCT. The turbines of Pencloe Windfarm will reinforce windfarm development as a component of the prevailing landscape character. The proposed development will not undermine the openness and expansiveness of the Southern Uplands but the turbines will consolidate windfarm development as a feature of this landscape.

Significance of Effect

7.9.52. In the East Ayrshire Southern Uplands, the combination of the individual judgements of **Medium** sensitivity and a **Moderate** magnitude of change, are considered to result in a **Moderate** effect, which in the context of this assessment is considered to be **Not Significant**.

Assessment of Effects on the Foothills with Forest west of Doon Valley LCT

Location

7.9.53. The Foothills with Forest west of Doon Valley LCT occurs to the west of the 20 km study area and comprises gently undulating, relatively narrow band of upland lying between the Upland River Valley of the River Doon and the Middle Dale of the Girvan Water valley. The two adjacent units in East Ayrshire and South Ayrshire are considered together. The units of the LCT lie within 20 km of the proposed development and both will experience theoretical visibility of the development.

Landscape Sensitivity

7.9.54. The sensitivity is considered to be Medium. The factors which have contributed to this judgement are as follows:

Value

7.9.55. Medium - High: Eastern unit partially located within the Doon Valley Sensitive Landscape Character Area and the western edge of the Craigengillan Inventory Garden and Designed Landscape.

Susceptibility to Change

7.9.56. Medium:

- Medium scale.
- Simplicity of landform, particularly to the north: a lower, gently undulating plateau with indistinct rounded hills and shallow basins, largely masked by forestry.
- Simplicity of landcover: coniferous forestry dominating the northern plateau and heather and grass moorland and enclosed pastures in the south.
- Limited remoteness and wildness attributes with the B741 traversing the hills and dispersed farms and small settlements.
- Moderate resilience to external change.
- Influence of the consented Dersalloch Windfarm.

Magnitude of Change

7.9.57. The overall magnitude of change in the Foothills with Forest west of Doon Valley LCT will be Negligible. The factors which have contributed to this judgement are as follows:

Size or Scale

- No effect on existing landscape elements.
- 13.5 km or greater separation distance to both units.
- Areas of the eastern unit, mainly coincident with forestry plantations, are affected by theoretical visibility of up to 15 turbines.
- Actual visibility will be reduced by coniferous plantations locally and on the intervening hills.

Geographical Extent

- 7.9.58. The ZTV in **Figure 7.2.9 Volume III** shows moderate theoretical visibility mainly of 6-15 turbines, concentrated within central parts of the combined unit west of Doon Valley LCT. Theoretical visibility is generally across elevated areas of this unit including Green Hill and Keirs Hill, with visibility coincident with the extensive coniferous plantation.
- 7.9.59. To the west of the combined units, theoretical visibility of all turbines is scattered throughout central and elevated areas and again visibility is coincident with the extensive coniferous plantation at and around Lambdoughty Hill and Auldraigoch Hill.

Significance of Effect

- 7.9.60. In the Foothills with Forest west of Doon Valley LCT, the combination of the individual judgements of **Medium** sensitivity and a **Slight** magnitude of change, are considered to result in a **Moderate/Minor** effect, which in the context of this assessment is considered to be **Not Significant**.

Assessment of Effects on the Rugged Uplands with Lochs and Forest LCT

Location

- 7.9.61. The Rugged Uplands with Lochs and Forest LCT occurs to the southwest of the 20 km study area and comprises dramatic craggy hills at its core, with a band of contrasting smoother, more rounded but steep-sided hills to the west. The LCT will experience theoretical visibility of the development. The two adjacent units in East Ayrshire and South Ayrshire are considered together.

Landscape Sensitivity

- 7.9.62. The sensitivity is considered to be High. The factors which have contributed to this judgement are as follows:

Value

- 7.9.63. High:

- The western unit lies partially within the Merrick Wild Land Area.
- The western unit lies within the Doon Valley Sensitive Landscape Character Area.
- The northern part of the western unit is within Craigengillan Inventory Garden and Designed Landscape.
- Southern and eastern parts overlook the Galloway Hills Regional Scenic Area.

Susceptibility to Change

7.9.64. High:

- Small scale.
- Relative simplicity of landform: granite hills at the core, enhanced by a band of smoother, more rounded but steep-sided hills to the west.
- Diversity of landcover: varied pattern of lochs and mature woodland, commercial forestry, heather moor and wetland.
- Remoteness and wildness attributes within southern parts associated with the Merrick Wild Land Area.
- Low resilience to external change.
 - Existing influence of windfarm development at Windy Standard (and Extension) and Hare Hill Windfarms and the consented Afton and Hare Hill Extension Windfarms.

Magnitude of Change

7.9.65. The overall magnitude of change in the Rugged Uplands with Lochs and Forest will be Slight. The factors which have contributed to this judgement are as follows:

Size or Scale

- No effect on existing landscape elements.
- Long separation distance of 12km to the proposed development.
- The upper area of the north eastern hills slopes are affected by theoretical visibility of between 16-21 turbines.
- The extent of actual visibility is reduced by extensive areas of coniferous plantation forming the Carrick Forest.

Geographical Extent

7.9.66. The ZTV in **Figure 7.2.9 Volume III** shows moderate theoretical visibility of 16-21 turbines across elevated areas of: the western ridge including big Hill of Glenmount, Craiglee and Macaterick and the eastern ridge including Black Craig and Meaul. Actual influence on the perception of landscape character is greatly reduced by distance, topographic screening and areas of dense dense forestry cover.

Significance of Effect

7.9.67. In the Rugged Uplands with Lochs and Forest LCT, the combination of the individual judgements of **High** sensitivity and a **Slight** magnitude of change, are considered to result in a **Moderate** effect, which in the context of this assessment is considered to be **Not Significant**.

Assessment of Effects on the Southern Uplands and Forestry LCT (Dumfries and Galloway)

Location

7.9.68. There are two units of this LCT within the study area which consists of high extensive upland areas with smooth rounded hills, domed summits and large scale plantations. The Carsphairn unit lies immediately to the southwest of the proposed development and the Benbrack / Colt Hill unit to the east of the proposed development. The Carsphairn unit will experience theoretical visibility of the development but the Benbrack unit indicates very limited visibility and thus has not been assessed.

Landscape Sensitivity

7.9.69. The sensitivity is considered to be Low. The factors which have contributed to this judgement are as follows:

Value

7.9.70. Medium: The Galloway Hills RSA extends slightly over the western boundary of the Carsphairn landscape unit.

Susceptibility to Change

7.9.71. Low

- Large scale.
- Relative simplicity of landform: hills with smooth and rounded summits and distinctive glacial valleys with incised burns and occasional crags.
- Simplicity of landcover: extensive commercial forestry and small areas of hill pasture fringe lower hill slopes with grassland and heather moorland on higher more open hill tops.
- Some remoteness and wildness attributes within the interior which has a remote feel due to the distance from settlement and public roads.
- Existing influence of windfarm development at Windy Standard and the consented Afton Windfarm.
- Moderate resilience to external change.

Magnitude of Change

7.9.72. The overall magnitude of change in the Southern Uplands and Forestry LCT will be Moderate for the Carsphairn unit. The factors which have contributed to this judgement are as follows:

Size or Scale

- The proposed development is located adjacent to the LCT and in the limited direct views possible will appear as a prominent new element in views from the north and eastern parts of the LCT.
- A short separation distance to the development.
- Eastern and northern parts of LCT affected by theoretical visibility.
- The extent of actual visibility is reduced by extensive areas of coniferous plantation forestry of the Carsphairn Forest.

Geographical Extent

7.9.73. The ZTV in **Figure 7.2.9, Volume III** shows theoretical visibility over much of the Carsphairn unit with visibility concentrated on summits and in the northeast close to the proposed development. 16-21 turbines will be visible across elevated areas immediately surrounding the proposed development including the hills of Benbrack, Windy Standard, Craignane and Waterhead Hill. Theoretical visibility of all turbines is limited within southern and western parts of the LCT and actual visibility throughout is greatly reduced as visibility coincides with and is screened by extensive woodland plantation forming the Carsphairn Forest. **Viewpoint 13, Figure 7.3.13 Volume III**, lying at a distance of 8.25 km to the proposed development, is representative of the typical nature of views from within this LCT,

Significance of Effect

7.9.74. In the Carsphairn unit of the Southern Uplands and Forest LCT, the combination of the individual judgements of **Low** sensitivity and a **Moderate** magnitude of change,

are considered to result in a **Moderate/Minor** effect, which in the context of this assessment is considered to be **Not Significant**.

Assessment of Effects on the Southern Uplands with Forestry LCT (East Ayrshire)

Location

7.9.75. The proposed development is located within the Southern Uplands with Forest LCT. This LCT consists of high extensive upland areas with smooth rounded hills, domed summits, with the majority of the area covered in blanket plantation forestry. The LCT will experience theoretical visibility of the development concentrated in eastern parts close to the proposed development.

Landscape Sensitivity

7.9.76. The sensitivity is considered to be Low. The factors which have contributed to this judgement are as follows:

Value

7.9.77. Medium: The Glenmuir and Afton Sensitive Landscape Character Area covers the eastern parts of the LCT.

Susceptibility to Change

7.9.78. Low

- Large scale.
- Relative simplicity of landform: hills with smooth and rounded summits and distinctive glacial valleys with incised burns and occasional crags.
- Simplicity of landcover: extensive commercial forestry and small areas of hill pasture fringe lower hill slopes with grassland and small areas of remnant heather moorland on higher more open hill tops.
- Some remoteness and wildness attributes within the interior which has a remote feel due to the distance from settlement and public roads.
- Existing influence of windfarm development at Windy Standard (and Extension) and Hare Hill and the consented Afton and Hare Hill Extension Windfarms.
- High resilience to change. Susceptibility is significantly moderated by the prevailing nature of the forestry landscape which is subject to cyclical timber harvesting.

Magnitude of Change

7.9.79. The overall magnitude of change in the Southern Uplands with Forest LCT will be Substantial. The factors which have contributed to this judgement are as follows:

Size or Scale

- There will be direct effects on existing landscape elements with the felling of areas of forestry and the construction of windfarm infrastructure as the proposed development is located within the LCT.
- Moderate proportion of LCT affected by theoretical visibility concentrated within eastern and southern parts.
- The extent of actual visibility is reduced by large areas of coniferous forestry plantations forming the Carsphairn Forest which are coincident with areas of theoretical visibility.

Geographical Extent

7.9.80. The ZTV in **Figure 7.2.9 Volume III** shows theoretical visibility of predominately 16-21 turbines across elevated areas immediately surrounding the proposed development including the summits of Milray, Prickeny and Enoch Hill, with visibility greater from the ridgelines. Theoretical visibility of all turbines is limited within western parts of the LCT and actual visibility throughout the LCT is greatly reduced as visibility coincides with and is screened by extensive forestry plantations.

Significance of Effect

7.9.81. In the Southern Uplands with Forest LCT, the combination of the individual judgements of **Low** sensitivity and a **Substantial** magnitude of change, is considered to result in a locally **Major/Moderate** effect but a generally **Moderate** effect. In the context of this assessment it is considered that there will locally **Significant** effects across the immediate site area but generally across the LCT the effects will be **Not Significant**.

Assessment of Effects on the Upland Basin LCT

Location

7.9.82. The Upland Basin LCT unit lies 3.2 km to the north of the proposed development and encompasses the landscape surrounding the town of New Cumnock and adjoining villages and farmsteads.

Landscape Sensitivity

7.9.83. The sensitivity is considered to be Medium. The factors which have contributed to this judgement are as follows:

Value

7.9.84. Low: Not within any national, regional or local designations.

Susceptibility to Change

7.9.85. Low:

- Large scale.
- Variable landscape with the steep-sided Southern Uplands, intersected by Glen Afton, seen to the south of the basin and outlying foothills to the north. Areas of flat wetland and water bodies to the east together with occasional more pronounced ridges, small knolls and the incised valley of the Nith.
- Simple landcover of small woodlands, shelterbelts and hedgerows associated with farms. Knockshinnoch Lagoons Nature Reserve.
- Remoteness and wildness attributes absent.
- Existing influence of windfarm development at Windy Standard and Hare Hill and also the consented Afton and Hare Hill Extension, visible legacy of opencast workings and the large single turbine at High Park to the south of New Cumnock.
- Moderate resilience to change.

Magnitude of Change

7.9.86. The overall magnitude of change in the Upland Basin LCT will be Moderate. The factors which have contributed to this judgement are as follows:

Size or Scale

- No effect on existing landscape elements.

- Limited separation distance.
- Theoretical visibility of all turbines over much of the LCT, mainly within central and northern parts.

Geographical Extent

- 7.9.87. The ZTV in **Figure 7.2.9 Volume III** indicates that there will be potential for visibility of up to 21 turbines of the proposed development across much of the LCT with greater visibility concentrated across the central and northern parts of the unit.
- 7.9.88. Indirect impacts on the perceived qualities and characteristics of the LCT beyond the application site will occur as a result of the proposed development. The low lying open agricultural landscape will provide many opportunities for the proposed development to be seen in elevation on the distant horizon.
- 7.9.89. Several representative viewpoints have been included from the Upland Basin LCT; Viewpoint 3, **Figure 7.3.3**, Viewpoint 4, **Figure 7.3.4**, Viewpoint 5, **Figure 7.3.5**, Viewpoint 6, **Figure 7.3.6** and Viewpoint 9, **Figure 7.3.9**, all in **Volume III**.

Significance of Effect

- 7.9.90. In the Upland Basin LCT, the combination of the individual judgements of **Low** sensitivity and a **Moderate** magnitude of change, is considered to result in a **Moderate/Minor** effect, which in the context of this assessment is considered to be **Not Significant**.

Assessment of Effects on the Upland Glens LCT

Location

- 7.9.91. The Upland Glen LCT comprises four units, one of which is Glen Afton which lies 400 m to the east of the proposed development at its closest point. The other three units are located over 10 km to the southeast of the proposed development and comprise the parallel glens of Shinnel Water, Castlefairn and Dalwhat and Scar Water. These units are narrow and strongly enclosed by steep sided slopes and display no theoretical visibility. The Glen Afton unit comprises the narrow steep-sided Glen Afton, with the slopes rising on the eastern edge of the glen to the high well-defined hills of Hare Hill and the distinctly rugged Blackcraig Hill and Craighraneoch Rig in the adjacent East Ayrshire Southern Uplands LCT.

Landscape Sensitivity

- 7.9.92. The sensitivity is considered to be High - Medium. The factors which have contributed to this judgement are as follows:

Value

- 7.9.93. Medium: The Glenmuir and Afton Sensitive Landscape Character Area covers the LCT.

Susceptibility to Change

- 7.9.94. Medium:
- Medium scale.
 - Variable landscape with narrow valleys with flat floors and steep side slopes rising to irregular ridgelines with even and steep upper side slopes and irregular and complex topography on lower hillsides.
 - Diverse landcover, of rough grassland on ridge tops, separating the open grass moor on the upper slopes from fields of unimproved pasture along the lower slopes. Clumps of broadleaves associated with farms, some riparian woodland, conifer plantations and occasional policy woodland in the base of the glen.

- Limited remoteness and wildness attributes with dispersed farms and cottages in the base of the glen.
- Existing influence of windfarm development at Windy Standard and Hare Hill, the large single turbine at High Park to the south of New Cumnock and also the consented Afton and Hare Hill Extension. Water supply infrastructure including the dam, reservoir and associated water works at the head of Glen Afton.
- Moderate resilience to change.

Magnitude of Change

7.9.95. The magnitude of change to the Upland Glens LCT caused by the introduction of the proposed development will be locally Moderate and generally Slight from the Glen Afton unit. The factors which have contributed to this judgement are as follows:

Size or Scale

- No effect on existing landscape elements.
- Limited separation distance.
- Areas of theoretical visibility to all turbines from mainly the higher valley sides and the northern sector of Glen Afton, although limited to 5 turbines across much of the LCT unit.
- Actual visibility will be reduced by coniferous plantations on the intervening hills and the western side of Glen Afton.
- The consented Afton scheme lies partially within the LCT and thus contributes to an existing context of wind development.

Geographical Extent

- 7.9.96. The ZTV in **Figure 7.2.9 Volume III** indicates that there will be very limited visibility to the proposed development across much of the Glen Afton unit, mainly limited to 5 turbines or less where visible. Within the Shinnel Water, Castlefairn and Dalwhat and Scar Water units no visibility is indicated.
- 7.9.97. Indirect impacts on the perceived qualities and characteristics of the Glen Afton unit of the LCT will occur as a result of the proposed development. The turbines will be seen beyond the western ridgeline of the glen with visibility often limited by either landform or forestry where it lines the valley sides. In the settled valley of Glen Afton there will be limited areas of visibility with the turbines seen partially with only the upper parts visible.
- 7.9.98. Viewpoint 1, **Figure 7.3.1 Volume III** and Viewpoint 20, **Figure 7.3.20 Volume III** fall within the Glen Afton unit and are representative of the nature of views from within this LCT.

Significance of Effect

- 7.9.99. In the Glen Afton unit of the Upland Glens LCT, the combination of the individual judgements of **Moderate** sensitivity and a locally **Moderate** but generally **Slight** magnitude of change, is considered to result in a locally **Moderate** and generally **Moderate/Minor** effect, which in the context of this assessment is considered to be **Not Significant**.

Assessment of Effects on the Upland River Valleys LCT

Location

- 7.9.100. Five units of the Upland River Valleys LCT occur within 35 km of the proposed development and comprise the broad valleys of the upper Doon, Nith and Ayr, which are strongly contained by adjacent uplands. Four units of the LCT, including two

within the Ayr Valley lie within 20 km of the proposed development and these will experience theoretical visibility of the development.

Landscape Sensitivity

7.9.101. The sensitivity is considered to be Medium. The factors which have contributed to this judgement are as follows:

Value

7.9.102. Medium: The upper Nith is located within the Glenmuir SLCA and the upper Doon is located within the Doon SLCA and the upper Ayr is located within the Upper Ayr SLCA.

Susceptibility to Change

7.9.103. Low

- Small scale.
- Diversity of landform: often steep valley sides and more gentle lower slopes and occasional broader terraces.
- Diversity of landcover: open flat floodplains of the Rivers Nith and Doon which are patterned with wetlands and water bodies. Mixed policy woodlands on the lower slopes and small woodlands and small to medium-sized fields, enclosed by stone dykes, hedges and shelterbelts throughout with semi-improved pastures and more open grass moorland and coniferous woodlands present on upper valley sides.
- No remoteness or wildness attributes as the LCT units are well settled and as each valley accommodates a major A road.
- Existing influence of windfarm development at Windy Standard and Hare Hill, the large single turbine at High Park to the south of New Cumnock and also the consented Afton and Hare Hill Extension Windfarms.
- Resultant medium/high capacity to accommodate change associated with the proposed development without undue consequence to baseline qualities.

Magnitude of Change

7.9.104. The overall magnitude of change in the Upland River Valleys LCT will be Slight. The factors which have contributed to this judgement are as follows:

Size or Scale

- No effect on existing landscape elements.
- 5km or more separation distance.
- Slight proportion of the northern Ayr valley and Doon valley units affected and moderate proportion of the southern Ayr valley and Nith valley units affected by theoretical visibility concentrated across elevated areas and hill slopes facing the proposed development.
- The extent of actual visibility is reduced by topographic screening, intervening areas of woodland, trees and hedgerows and the separation distance between the proposed development and most LCT units.

Geographical Extent

7.9.105. The ZTV in **Figure 7.2.9 Volume III** shows slight theoretical visibility across elevated areas across elevated areas in the northern Ayr valley unit and visibility of between 1- 10 turbines in the Doon valley unit. The ZTV also identifies moderate theoretical visibility within the southern Ayr valley unit and the Nith unit across south facing hill slopes. Theoretical visibility of all turbines is limited throughout the LCT unit with

actual visibility is reduced by distance to most units and screening from dense intervening vegetation, particularly forming the Carsphairn Forest.

Significance of Effect

7.9.106. In the Upland River Valleys LCT, the combination of the individual judgements of **Medium** sensitivity and an overall **Slight** magnitude of change, are considered to result in a **Moderate/Minor** effect, which in the context of this assessment is considered to be **Not Significant**.

Summary of Effects on Landscape Character Types

7.9.107. **Table 7.9** lists and summarises effects on the ten LCTs assessed above. It sets out their sensitivity to change, the magnitude of change that would arise as a result of the proposed development and the level of resultant effects and their significance in relation to perception of landscape character.

Table 7.9 Summary of Effects on Landscape Character Types

Receptor	Sensitivity to Change	Magnitude of Change	Level of Effect	Significance
East Ayrshire Lowlands LCT	Medium	Slight	Moderate/Minor	Not Significant
East Ayrshire Plateau Moorlands LCT	Medium	Slight	Moderate/Minor	Not Significant
East Ayrshire Southern Uplands LCT	Medium	Moderate	Moderate	Not Significant
Foothills with Forest west of Doon Valley LCT	Medium	Slight	Moderate/Minor	Not Significant
Rugged Uplands with Lochs and Forest LCT	High	Slight	Moderate	Not Significant
Southern Uplands with Forestry LCT (Dumfries and Galloway)	Low	Medium	Moderate/Minor	Not Significant
Southern Uplands and Forestry LCT (East Ayrshire)	Low	Medium	Locally Major/Moderate Generally Moderate/Minor	Locally Significant Generally Not Significant
Upland Basin LCT	Low	Medium	Moderate/Minor	Not Significant
Upland Glens LCT (Glen Afton Unit)	Medium	Slight	Locally Moderate Generally Moderate/Minor	Not Significant
Upland River Valleys LCT	Medium	Slight	Moderate/Minor	Not Significant

Assessment of Effects on Landscape Designations

General

- 7.9.108. The following sections provide an assessment of the potential effects of the proposed development on landscape designations or Wild Land Areas falling within the Study Area. The assessment has considered the nature of visibility and 'influence' the proposed development may have on each receptor and also any effects on the special qualities and features for which each receptor has been designated.
- 7.9.109. It should be noted that there are no direct physical effects on any designated landscapes or Wild Land Areas. Residual effects on designated landscapes and Wild Land Areas will therefore arise mainly as indirect effects from perceived changes in their character and qualities.

Assessment of Effects on Inventory Gardens and Designed Landscapes

- 7.9.110. The Baseline Assessment identified the presence of 16 Inventory Gardens and Designed Landscapes within the study area. The location of GDLs in relation to the proposed development is illustrated in **Figure 7.1.2 Volume III**.
- 7.9.111. There are no physical effects on any of the GDLs identified within the Study Area. With regard to indirect effects on their perceived qualities, analysis of the ZTV indicates that there is theoretical visibility of the proposed development from only two of the the GDLs within the Study Area. This initial assessment is set out in **Appendix 7.4 Volume IV**. Owing to the very limited and long-distance nature of visibility, or absence of visibility, of the proposed development, any perceived influences on 14 of the GDLs will be **negligible** or **none** in magnitude. They will not be affected by the proposed development to a level that could result in significant effects and therefore, these GDLs have not been considered further as part of this assessment.
- 7.9.112. Effects on the Dumfries House GDL and Craigengillan GDL are assessed in more detail below.

Dumfries House Inventory Garden and Designed Landscape

General

- 7.9.113. Dumfries House GDL lies in the valley of the Lugar Water approximately 14km to the northwest of the proposed development. There are extensive views across the parkland from either side of the valley provided by its setting, with gently sloping hills to the north and south. Dumfries House itself is located within the central part of the park and garden with its main approach at Hinnieston Wood and off the A70 in the south, which replaced the original access route from Auchinleck to the east.
- 7.9.114. The GDL contains grazing fields and mixed policy woodland including Shaw, Hinnieston and Tarringzean Woods and coniferous planting south of the A70.
- 7.9.115. The following windfarm developments influence the existing baseline sensitivity through distant visibility:
- Afton, 15 km southeast;
 - Hare Hill (and Extension), 14.5 km southwest;
 - Sanquhar Community, 19 km southwest;and
 - Penbreck and Carmacoup, 18 km east.

7.9.116. In addition, the A70 and the A76 pass through the GDL.

Determination of Landscape Sensitivity

7.9.117. The Dumfries House GDL is considered to have a **High** sensitivity to change associated with the proposed development. The factors which have contributed to this judgement are as follows:

Value

7.9.118. The value of the Dumfries House GDL is considered to be High through designation.

Susceptibility to Change

7.9.119. Medium

- Medium scale lowland landscape.
- Rolling terrain.
- Existing influence of windfarm development at Hare Hill (and Extension) and Afton.
- Relative containment through mixed policy woodlands, hedges and shelterbelts throughout.
- Resultant medium capacity to accommodate change associated with the development without undue consequence to baseline qualities.

Magnitude of Change

7.9.120. In consideration of the limited visibility of the turbines, the distinct separation from the designation and the diverse nature of views, the magnitude of change on the qualities and integrity of the Dumfries House GDL would be **Negligible**.

Size or Scale

7.9.121. The proposed development is not considered to affect the visual amenity of visitors to Dumfries House as there is no visibility of the proposed development from the Category A listed house itself, the main approach or woodland walks within central and southern parts of the GDL.

7.9.122. Parts of the A76 within the park and garden are aligned with the application site and there may be visibility of the proposed turbines for southbound road users, although considering the separation distance and intervening vegetation, it is anticipated the proposed development will appear as a minor element within transitory views.

Geographic Extent

7.9.123. The ZTVs in **Figure 7.2.7** and **7.2.8 Volume III** shows a band of theoretical visibility of mainly blades of up to 21 turbines from the northern edge of the GDL. Theoretical visibility is limited to northern agricultural fields and along the A76, part of which lies with the GDL.

Significance of Effect

7.9.124. In Dumfries House GDL, the combination of the individual judgements of **High** sensitivity and a **Negligible** magnitude of change, is considered to result in a **Moderate/Minor** effect, which in the context of this assessment is considered to be **Not Significant**.

Craigengillan House Inventory Garden and Designed Landscape

General

- 7.9.125. Craigengillan House GDL is a rare example of a complete and unfragmented 16th century estate landscape and is located approximately 13km to the west of the proposed development close to Dalmellington. The gardens form the setting for the A listed house and incorporate formal gardens and policy woodlands within eastern and north western parts.
- 7.9.126. The main approach to Craigengillan House is from the north from Dalmellington, with the house itself located in the southeast of the GDL.
- 7.9.127. The following windfarm developments influence the existing baseline sensitivity through distant visibility:
- Afton, 12 km east;
 - Windy Standard and Extension, 10.5 km east; and
 - Dersalloch, 2.5 km west.

Determination of Landscape Sensitivity

- 7.9.128. The Dumfries House GDL is considered to have a **High** sensitivity to change associated with the proposed development. The factors which have contributed to this judgement are as follows:

Value

- 7.9.129. The value of the Craigengillan House GDL is considered to be High through designation.

Susceptibility to Change

- 7.9.130. Medium
- Relative simplicity of landform: hills with smooth and rounded summits and occasional crags.
 - Mixed landcover: areas of policy woodland and commercial forestry and small areas of hill pasture fringe lower hill slopes with grassland and extensive areas of heather moorland on higher open hill tops.
 - Remoteness and wildness attributes from open moorland areas.
 - Existing influence of windfarm development at Windy Standard and Dersalloch.
 - High resilience to change from the core of the designed landscape reducing to Low resilience from the surrounding moorland.

7.9.131. **Magnitude of Change**

- 7.9.132. In consideration of the very limited visibility of the turbines, the distinct separation from the designation and the diverse nature of views, the magnitude of change on the qualities and integrity of the Craigengillan House GDL would be **Negligible**.

Size or Scale

- 7.9.133. The proposed development is not considered to affect the visual amenity of visitors to Craigengillan House as there is no visibility of the proposed development from the A listed house itself or the main approach to the GDL.

Geographic Extent

7.9.134. The ZTVs in **Figure 7.2.7 and 7.2.8 Volume III** shows theoretical visibility of turbines 1- 15 concentrated within north western parts of the GDL. Theoretical visibility is mainly across Auchengillan Hill, which is covered by extensive woodland, where no key features of the GDL are located.

Significance of Effect

7.9.135. In Craigengillan House GDL, the combination of the individual judgements of **High** sensitivity and a **Negligible** magnitude of change, is considered to result in a **Minor** effect, which in the context of this assessment is considered to be **Not Significant**.

Summary of Effects on Landscape Character Types

7.9.136. **Table 7.10** lists and summarises effects on the two Inventory Gardens and Designed Landscapes assessed above. It sets out their sensitivity to change, the magnitude of change that would arise as a result of the proposed development and the level of resultant effects and their significance in relation to perception of landscape character.

Table 7.10 Summary of Effects on Inventory Garden and Designed Landscapes

Receptor	Sensitivity to Change	Magnitude of Change	Level of Effect	Significance
Dumfries House GDL	High	Negligible	Moderate/Minor	Not Significant
Craigengillan House GDL	High	Negligible	Moderate/Minor	Not Significant

Assessment of Effects on Local Landscape Designations

7.9.137. The baseline assessment identified the presence of eight local landscape designations within the study area. The location of local landscape designations in relation to the proposed development is illustrated in **Figure 7.1.2 Volume III**.

7.9.138. A preliminary assessment of the predicted effects on the visual amenity from the proposed development that would be experienced by local landscape designations within a 20 km study area has been undertaken and is detailed in **Appendix 7.4 Volume IV** of the LVA. With regard to indirect effects on their perceived qualities, analysis of the ZTV indicates that due to the very limited and long-distance nature of visibility, or absence of visibility, of the proposed development, any perceived influences on three of the local landscape designations will be **negligible** or **none** in magnitude. They will not be affected by the proposed development to a level that could result in significant effects and therefore, these local landscape designations have not been considered further as part of this assessment.

7.9.139. Effects on the following local landscape designations are assessed in more detail below:

- Thornhill Uplands Regional Scenic Area;
- Galloway Hills Regional Scenic Area;
- Glenmuir and Afton Special Landscape Character Area;
- Upper Ayr Special Landscape Character Area and
- Doon Valley Special Landscape Character Area.

7.9.140. For the purposes of this assessment local landscape designations are considered to be of high sensitivity to change associated with the proposed development in reflection of the value attributable to their designated status and potential susceptibility to change (though this varies throughout and is dependent on character).

Assessment of Effects on the Thornhill Uplands Regional Scenic Area

General

7.9.141. The Thornhill Uplands RSA consist of contrasting and varied upland and valley landscapes ranging from the exposed, remote summits of the Lowther Hills, through the wooded gorge of the Nith above Drumlanrig to the pastoral character of the wide, enclosed upper Cairn and Mid Nithsdale valleys.

7.9.142. The following windfarm developments influence the existing baseline sensitivity through distant visibility:

- Afton
- Dalswinton
- Blackcraig
- Wether Hill
- Whiteside Hill
- Hare Hill
- Hare Hill Extension
- Clyde
- Hagshaw Hill
- Penbreck and Carmacoup
- Windy Standard and Extension

Determination of Landscape Sensitivity

7.9.143. The Thornhill Uplands RSA is considered to have a **Medium** sensitivity to change associated with the proposed development. The factors which have contributed to this judgement are as follows:

Value

7.9.144. The value of the Thornhill Uplands RSA is considered to be Medium through designation.

Susceptibility to Change

7.9.145. Medium

- Relative simplicity of landform: hills with smooth and rounded summits and occasional crags.
- Diverse landcover: Areas of woodland, forestry, trees and hedgerows within well vegetated valley floors in contrast with open areas of hill pasture on valley sides and extensive areas of moorland on higher open hill tops.
- Remoteness and wildness attributes from open moorland areas.
- Existing influence of windfarm development.
- Medium resilience to change.

Magnitude of Change

7.9.146. In consideration of the very limited visibility of the turbines, the distinct separation from the designation and the diverse nature of views, the magnitude of change on the qualities and integrity of the Thornhill Uplands RSA would be **Negligible**.

Size or Scale

7.9.147. Considering the separation distance, of in excess of 15 km, the turbines will not appear as prominent vertical features within western upland areas of the designation which lie closest to the proposed development. The Pencloe Windfarm application site lies beyond the turbines forming the existing Whiteside Hill windfarm, which is more visible from elevated areas within the RSA.

Geographic Extent

7.9.148. The ZTVs in **Figures 7.2.3 and 7.2.5 Volume III** shows scattered theoretical visibility of turbines 1- 15 across elevated areas of the RSA. Within 20 km of the proposed development, visibility is limited to turbines 1- 10 over the elongated summit of Carinkinna Hill and turbines 1- 5 of Shiel and Countam hills.

7.9.149. The proposed development will slightly increase the influence of wind turbines in views from elevated areas of the RSA but overall will not result in a change to the special features and key characteristics which relate to this varied landscape.

Significance of Effect

7.9.150. The proposed development will result in a **Negligible** magnitude of change across the Thornhill Uplands RSA. The overall effect upon key qualities and features which define the RSA would be **Moderate/Minor** and would therefore be **Not Significant**.

Assessment of Effects on the Galloway Hills Regional Scenic Area

General

7.9.151. The Galloway Hills RSA consists of contrasting upland, valley and coastal landscapes. This area centres on the Rugged Granite Uplands and Coastal Granite Uplands of central Galloway, extending from the Ayrshire boundary south to where the hills meet the sea. It is based on an amalgam of the following areas: Valley of Ken/Dee River System; Cairnsmore, Merrick and Rhinns of Kells Uplands and Fleet Estuary and Valley. It includes the Fleet Valley National Scenic Area and its setting. South of the Fleet Estuary, the area merges into the Solway Coast RSA. Sweeping and dramatic views of the hills, particularly from the south of the RSA are formed by the relationship between the hills and adjacent lowlands.

7.9.152. The following windfarm developments will influence the existing baseline sensitivity through distant visibility:

- Afton
- Dersalloch
- Hadyard Hill
- Blackcraig
- Wether Hill
- Windy Standard and Extension
- Knockman Hill

Determination of Landscape Sensitivity

7.9.153. The Galloway Hills RSA is considered to have a **Medium** sensitivity to change associated with the proposed development. The factors which have contributed to this judgement are as follows:

Value

7.9.154. The value of the Galloway Hills RSA is considered to be Medium through designation.

Susceptibility to Change

7.9.155. Medium

- Diversity of landform: 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. The designated area includes the sculptural peaks of the Cairnsmore of Carsphairn Southern Uplands Landscape Unit to the east.
- Diverse landcover: Areas of woodland, forestry, trees and hedgerows within well vegetated valley floors contrast with open areas of hill pasture on valley sides and extensive areas of moorland on higher open hill tops.
- Strong remoteness and wildness attributes from open moorland areas.
- Existing influence of windfarm development.
- Medium resilience to change.

Magnitude of Change

7.9.156. In consideration of the very limited visibility of the turbines, the distinct separation of the proposed development from the designation and the diverse nature of views, the magnitude of change on the qualities and integrity of the Galloway Hills RSA would be locally **Moderate** and generally **Slight**.

Size or Scale

7.9.157. At its nearest, the Galloway Hills RSA lies approximately 5 km southwest of the proposed development and from here, the turbines will appear as additional man made features within the context of existing windfarm development seen from the open landscape of the summits and northern flanks of Cairnsmore of Carsphairn and Benbrack. These hills provide strong containment and beyond this local visibility there will break in visibility across the Glenkens, before visibility resumes from distant hill tops where the proposed development will appear as a minor element within expansive views.

Geographic Extent

7.9.158. The ZTVs in **Figures 7.2.3 and 7.2.5 Volume III** show distant theoretical visibility of up to 21 turbines across elevated areas of the Rinns of Kells and the Carrick Forest with some visibility coinciding with forestry plantations. Within 7 km there will be local visibility to all 21 turbines from Cairnsmore of Carsphairn.

Significance of Effect

7.9.159. The proposed development will result in a locally **Moderate** but generally **Slight** magnitude of change across the Galloway Hills RSA. The overall effect upon key qualities and features which define the RSA would be locally **Moderate** and generally **Moderate/Minor** and would therefore be **Not Significant**.

Assessment of Effects on the Glenmuir and Afton Sensitive Landscape Character Area

General

- 7.9.160. The Glenmuir and Afton SLCA comprises an area which stretches from the Carsphairn Forest in the south to the River Ayr valley in the north and comprises a simple landscape of broad rounded hills with flatter basins and areas of plateau moorland interspersed with some extensive coniferous plantations. The designation extends around the incised features of Glen Afton and Glenmuir. The Pencloe Windfarm application site lies within the designated area, in the southern part of the SLCA.
- 7.9.161. The following windfarm developments will influence the existing baseline sensitivity through local visibility:
- Afton (located within the Glenmuir and Afton SLCA)
 - Hare Hill and Extension (located within the Glenmuir and Afton SLCA)
 - High Park single turbine (located within the Glenmuir and Afton SLCA)
 - Sanquhar Community
 - Whiteside Hill
 - Penbreck and Carmacoup
 - Windy Standard and Extension

Determination of Landscape Sensitivity

- 7.9.162. The Glenmuir and Afton SLCA is considered to have a **Medium** sensitivity to change associated with the proposed development. The factors which have contributed to this judgement are as follows:

Value

- 7.9.163. The value of the Glenmuir and Afton SLCA is considered to be Medium through designation.

Susceptibility to Change

- 7.9.164. Low
- Relative simplicity of landform: hills with smooth and rounded summits and occasional crags.
 - Diverse landcover: Areas of woodland, forestry plantations, trees and hedgerows within well vegetated valley floors in contrast with open areas of hill pasture on valley sides and extensive areas of moorland on higher open hill tops.
 - Dominance of forestry plantations
 - Some limited remoteness and wildness attributes from open moorland areas.
 - Existing strong influence of windfarm development including Afton, Hare Hill and Extension Windfarms, and High Park single turbine which are located within the landscape designation and Windy Standard (and extension), Sanquhar Community and Whitehill Windfarms which are located within 5 km of the SLCA.
 - Medium resilience to change.

Magnitude of Change

7.9.165. In consideration of the existing modified context, dominant forestry uses and existing windfarm development, the magnitude of change on the qualities and integrity of the Glenmuir and Afton SLCA would be locally **Moderate** and generally **Slight**.

Size or Scale

7.9.166. The proposed development is located within the Glenmuir and Afton SLCA, to the west of Glen Afton and set back from the rising profile of the Southern Uplands. The turbines would be seen in views from the north as new elements set within the context of the existing Windy Standard (and extension) windfarm and in combined views from the north with Afton, Hare Hill and Extension Windfarms visible across the hilly ridgeline of the SLCA, seen to be in proportion to the underlying landscape. Locally the proposed development will appear as a prominent new feature however, the site area is heavily forested and though some clear felling will be required to accommodate the development the forestry uses will continue, maintaining similar characteristics across this southern sector of the SLCA. Glen Afton will experience limited direct visibility and Glenmuir is sheltered by topographic screening with no visibility indicated from the floor of Glenmuir. The influence of the proposed development from the open moorlands above Glenmuir is reduced by distance, with over c.10 km separation and the turbines will be seen in the context of existing windfarm development at Afton, Hare Hill and Extension, High Park single turbine, Windy Standard (and Extension).

Geographic Extent

7.9.167. The ZTVs in **Figures 7.2.3 and 7.2.5 Volume III** show distant theoretical visibility of up to 21 turbines across the uplands and south/west facing flanks of adjoining glens. Topographic screening from the intervening ridges fragments visibility to the north.

Significance of Effect

7.9.168. The proposed development will result in a locally **Moderate** but generally **Slight** magnitude of change across the Glenmuir and Afton SLCA. The overall effect upon key qualities and features which define the SLCA would be locally **Moderate** and generally **Moderate/Minor** and would therefore be **Not Significant**.

Assessment of Effects on the Upper Ayr Sensitive Landscape Character Area

General

7.9.169. The Upper Ayr SLCA covers the broad rolling hills around the headwaters of the River Ayr and extends around the farmed lowlands below to the west and the incised wooded glen of the Lugar Water.

7.9.170. The following windfarm developments will influence the existing baseline sensitivity through distant visibility:

- Afton
- Whitelee and adjacent developments
- Bankend Rig
- Dungavel Hill
- Penbreck and Carmacoup
- Hare Hill
- Hare Hill Extension

Determination of Landscape Sensitivity

7.9.171. The Upper Ayr SLCA is considered to have a **Medium** sensitivity to change associated with the proposed development. The factors which have contributed to this judgement are as follows:

Value

7.9.172. The value of the Upper Ayr SLCA is considered to be Medium through designation.

Susceptibility to Change

7.9.173. Low

- Relative simplicity of landform: hills with smooth and rounded summits.
- Diverse landcover: Areas of woodland, forestry plantations, trees and hedgerows within well vegetated valley floors in contrast with open areas of hill pasture on valley sides and extensive areas of moorland on higher open hill tops.
- Dominance of forestry plantations.
- Limited remoteness and wildness attributes from open moorland areas.
- Existing influence of windfarm development.
- Medium resilience to change.

Magnitude of Change

7.9.174. In consideration of the very limited visibility of the turbines, the distinct separation from the designation and the diverse nature of views, the magnitude of change on the qualities and integrity of the Upper Ayr SLCA would be **Negligible**.

Size or Scale

7.9.175. At its nearest, the Upper Ayr SLCA lies approximately 16 km to the north of the proposed development and from here, the turbines will appear as distant new elements within the context of existing windfarm development seen in views from the open uplands.

Geographic Extent

7.9.176. The ZTVs in **Figures 7.2.3 and 7.2.5 Volume III** shows distant theoretical visibility of up to 21 turbines across elevated areas to the east and west of Blackside and across Airds Moss. Theoretical visibility indicated across lowland areas will be reduced by the prevailing vegetation cover.

Significance of Effect

7.9.177. The proposed development will result in a **Negligible** magnitude of change across the Upper Ayr SLCA. The overall effect upon key qualities and features which define the SLCA would be **Moderate/Minor** and would therefore be **Not Significant**.

Assessment of Effects on the Doon Valley Sensitive Landscape Character Area

General

7.9.178. The Doon Valley SLCA roughly follows the linear valley of the river Doon incorporating the Loch Doon, Craigengillan GDL and north eastern parts of the Merrick Wild Land Area.

7.9.179. The following windfarm developments will influence the existing baseline sensitivity through distant visibility:

- Afton
- Dersalloch
- Windy Standard and Extension
- Hare Hill
- Hare Hill Extension

Determination of Landscape Sensitivity

7.9.180. The Doon Valley SLCA is considered to have a **High** sensitivity to change associated with the proposed development. The factors which have contributed to this judgement are as follows:

Value

7.9.181. The value of the Doon Valley SLCA is considered to be Medium through designation.

Susceptibility to Change

7.9.182. Medium

- Relative simplicity of landform: hills with smooth and rounded summits.
- Diverse landcover: Areas of woodland, forestry plantations, trees and hedgerows within well vegetated valley floors in contrast with open areas of hill pasture on valley sides and extensive areas of moorland on higher open hill tops.
- Dominance of forestry plantations.
- Legacy of open cast mining.
- Limited remoteness and wildness attributes from open moorland areas.
- Existing influence of windfarm development.
- Medium resilience to change.

Magnitude of Change

7.9.183. In consideration of the very limited visibility of the turbines, the separation from the designation and the diverse nature of views, the magnitude of change on the qualities and integrity of the Doon Valley SLCA would be **Negligible**.

Size or Scale

7.9.184. At its nearest, the Doon Valley SLCA lies approximately 8 km to the west of the proposed development and through topographic screening, the turbines, where visible will be seen mainly to blade tip only from small areas of the uplands.

Geographic Extent

7.9.185. The ZTVs in **Figures 7.2.3 and 7.2.5 Volume III** shows distant theoretical visibility of up to 10 turbine hubs across elevated areas to the west of the Doon Valley.

Significance of Effect

7.9.186. The proposed development will result in a **Negligible** magnitude of change across the Doon Valley SLCA. The overall effect upon key qualities and features which define the SLCA would be **Minor** and would therefore be **Not Significant**.

Summary of Effects on Landscape Designations

7.9.187. **Table 7.11** lists and summarises effects on the five landscape designations assessed above. It sets out their sensitivity to change, the magnitude of change that would arise as a result of the proposed development and the level of resultant effects and their significance in relation to perception of landscape character.

Table 7.11 Summary of Effects on Regional Scenic Areas (RSA) and Special Landscape Character Areas (SLCA)

Receptor	Sensitivity to Change	Magnitude of Change	Level of Effect	Significance
Thornhill Uplands RSA	Medium	Negligible	Moderate/Minor	Not Significant
Galloway Hills RSA	Medium	Locally Moderate Generally Slight	Locally Moderate Generally Moderate/Minor	Not Significant
Glenmuir and Afton SLCA	Medium	Locally Moderate Generally Slight	Locally Moderate Generally Moderate/Minor	Not Significant
Upper Ayr SLCA	Medium	Negligible	Moderate/Minor	Not Significant
Doon Valley SLCA	High	Negligible	Minor	Not Significant

Wild Land Areas

7.9.188. The potential effects on Wild Land Areas have been examined in accordance with SNH's Interim Guidance Note on *Assessing the Impacts on Wild Land* (February 2007) and set out in detail in **Appendix 7.6 Volume IV**. The Wild Land assessment has been informed by **Figure 7.1.2, Volume III**, which indicates the location of Wild Land Areas within the Study Area. A summary of the findings of the detailed assessment is provided as follows.

Baseline Review

7.9.189. The Merrick Wild Land Area covers a portion of the Galloway Forest Park and is closely associated with the enclosed valleys and summits close to the Merrick. The Wild Land Area exhibits a range of wild qualities and 'wildness' throughout its extents, the summit areas allowing for views across the Southern Uplands and the settled landscapes of Ayrshire and Dumfries and Galloway, whereas the lower lying 'hidden' areas afford a greater sense of isolation and 'wildness'.

7.9.190. The Merrick Wild Land Area lies fully within the 35km study area, located c.19.9 km-30.8 km to the southwest of the proposed development. The quality and condition of the Wild Land Area varies throughout as it is influenced by a range of factors both internal, such as the presence of footpaths as well as external, such as forestry plantations (several of which surround the Wild Land Area), windfarms, settlements and roads.

- 7.9.191. The interior reaches and ‘hidden’ valleys of the Wild Land Area such as that associated with Loch Valley below the Rig of the Jarkness, exhibit the ‘wildest’ characteristics where there is limited external visibility and a more tangible sense of remoteness. From the summit and elevated areas where views to the wider surrounds are experienced (such as the Merrick and its associated footpath), the sense of wildness is diminished as the views of the surrounding landscapes and manmade artefacts are gained with an increase in relative elevation and the obvious accessibility of the summit. However from these locations there is a degree of remoteness afforded by change in the landscape and the separation distance from manmade features and settlements and any obvious refuge that these might offer.
- 7.9.192. The influences upon the Merrick Wild Land Area from existing and consented sites are: the large scale Hadyard Hill Windfarm (existing) to the north west; Dersaloch Windfarm (consented) to the north; Windy Standard Windfarm and Extension (existing) to the north east and Torrs Hill Windfarm (consented) to the east. Further east Wether Hill (existing), Knockman Hill (consented) and Blackcraig Hill (existing) will be present as visible windfarms within the Southern Uplands. The influence of Windfarms is evident in areas to the north and north east of the Wild Land Area and, while they reduce the physical attributes of the area through the introduction of development, the windfarms are distant and the landscape of the Wild Land Area still typifies the perceived characteristics of Wild Land, as set out in the SNH guidance.

Effects on Wild Land Attributes

- 7.9.193. Theoretical visibility of up to 21 turbines of the proposed development is displayed within some open elevated areas to the north and central areas of the Wild Land Area. Theoretical visibility of up to 21 turbines also occurs within limited valley areas and on northeast facing slopes at Loch Riecawr and Loch Macaterick. A number of these slopes are steep and craggy and inaccessible to most visitors to the Wild Land Area, whilst plantation forestry cover is a further constraint to access and it is anticipated that the number of receptors from these slopes will be limited. Visibility, particularly leading to Loch Riecawr coincides with forestry, which will limit views from northern parts of the Wild Land Area.
- 7.9.194. The proposed development will be seen from 19.9 km from the Wild Land Area. This long separation distance combined with the presence of extensive intervening woodland plantation and existing windfarm development beyond the Galloway Forest Park serve to reduce the perception of change to the landscape. Interior and valley areas enclosed by craggy and woodland plantation covered hills exhibit the greatest ‘wildness’ attributes in the Wild Land Area and views from these areas are focussed on these hills, with external panoramas limited by landform.
- 7.9.195. The Wild Land assessment identified a very limited loss in the baseline of physical attributes for Perceived Naturalness and no loss in respect of Rugged or Otherwise Challenging Terrain and Remoteness and Inaccessibility. For the physical attributes Lack of Constructions or Other Artefacts and for Evidence of Contemporary Land Uses a Low magnitude of change was identified in areas with visibility to the proposed development from elevated northern and central parts of the Wild Land Area.

Conclusion

- 7.9.196. It is important to note that Wild Land assessment is an exacting process which acknowledges the very high sensitivity of Wild Land to the influence of development. In this regard the assessment reflects a balance of judgements in respect of the existing baseline qualities of the Wild Land areas and existing influences and the nature and extent of the influence of proposed development on the physical attributes and perceptual responses of the landscape.

- 7.9.197. The baseline review of Wild Land identified the Merrick Wild Land Area within the 35 km study area and 19.9 km southwest of the proposed development, to the nearest turbine.
- 7.9.198. The influence of proposed development on the sense of remoteness and largely development free prospects is set in the context of the pattern of development around and further north of The Glenkens, within northern parts of the Lowther Hills and in the eastern Southern Uplands.
- 7.9.199. No significant effects were identified relating to the introduction of the proposed development within any parts of the Wild Land Area. Pencloe Windfarm does build on the existing pattern of development beyond the extents of the Galloway Forest Park but will not greatly increase the influence of existing built and consented windfarms upon the Merrick Wild Land Area.

7.10. Assessment of Residual Effects on Visual Receptors

General

- 7.10.1. The following sections provide an assessment of the residual visual effects that would be likely to arise from the proposed development during the operational period. The effects are residual because they take into account the layout and design optimisation and mitigation measures discussed in **Section 7.3** and in **Chapter 2: Site Selection, Design and Alternatives**.
- 7.10.2. The following assessment addresses effects on the visual amenity of people, through assessing:
- Effects on Settlements;
 - Effects on Key Transport Routes and
 - Effects on Viewpoints.
- 7.10.3. The assessment has been undertaken through field survey and the analysis of mapping ZTV and wireframe views, in order to confirm the likely nature of visibility. An indication of the predicted extents of visibility (both blade tip and hub height) is provided within the visibility mapping in **Figures 7.2.1 to 7.2.9 Volume III**. All ZTV drawings are based on bare-ground conditions, in accordance with current good practice as indicated in GLVIA 3. Where the ZTV indicates theoretical visibility, buildings and vegetation are likely to provide a degree of containment between receptors and the proposed development. Buildings, localised topography and vegetation do not register on the ZTV and, therefore, views to the proposed development will tend to be more restricted and more intermittent than the ZTV indicates.

Assessment of Effects on the Visual Amenity of Settlements

- 7.10.4. The following section provides an assessment of the predicted effects on the visual amenity that would be experienced by residents of principal settlements within the Study Area that have been identified in **Appendix 7.4 Volume IV** as having the potential for significant visual effects.
- 7.10.5. In accordance with the criteria outlined in the detailed methodology in **Appendix 7.1 Volume VI**, residential receptors, within settlements in the Study Area, have a high susceptibility to change as views are experienced regularly from prolonged periods and are generally considered to have a high sensitivity overall to the proposed development. In addition, particular visual characteristics within a settlement – such as views relating to the setting of a Conservation Area or visual influences from a designated landscape that the town or village may sit within or overlook – can be

important with regard to the value of specific views in and around a city, town or village.

- 7.10.6. Analysis of the visibility mapping indicates that there is no predicted visibility of the proposed development from the great majority of the main settlements, smaller villages and hamlets within the Study Area.
- 7.10.7. The four settlements within the Study Area which have been identified within **Appendix 7.4 Volume IV** to have theoretical visibility of Pencloe Windfarm which may result in significant effects upon residential receptors are considered below.

Bankglen

- 7.10.8. The hamlet of Bankglen is located c.5.4 km north of the proposed development. The linear settlement with detached houses lies either side of the B741. The hamlet is spread across undulating land incorporating a small wooded glen and surrounded by agricultural land with intermittent views to the hills to the south and the existing Hare Hill Windfarm, 4.8 km to the southeast, the consented Afton and the large single turbine at High Park, on Dalhanna Hill will be prominent in views.

Determination of Visual Sensitivity

Susceptibility to Change

- 7.10.9. The susceptibility of residents to change is considered to be High.

Value attached to Settlement and Views

- 7.10.10. No value through designation is attached to this settlement or views.

Overall Sensitivity

- 7.10.11. Viewers within Bankglen are considered to be of high sensitivity to changes resulting from the proposed development.

Determination of Magnitude of Change

Geographical Influence from Predicted Visibility

- 7.10.12. Analysis of the ZTV and computer modelling indicates that there will be theoretical visibility across Bankglen of up to 21 turbines. The turbines will be seen at a distance of 5.4km.

Scale and Nature of Change to Views from Settlement

- 7.10.13. The hamlet is set within open countryside but has a high proportion of adjacent woodland to the south and east, whilst hedgerow trees line sections of the B741. This intervening vegetation will provide significant filtering of views at locations where theoretical visibility is indicated. The turbines will be seen beyond the hills to the south of the settlement, at a distance of 5.4 km viewed against the skyline on the horizon. The hamlet already has views of the wind development at Hare Hill which lies 4.8 km to the southeast and will also experience views of the consented Afton scheme once it is built and thus where visible the proposed development will introduce new vertical elements into the landscape from this location, but these will be perceived in the context of the existing wind development.

Overall Magnitude

- 7.10.14. The change in visual amenity as a result of the proposed development will be Slight in magnitude.

Significance of Effect

- 7.10.15. The change in visual amenity as a result of the proposed development on the **High** sensitivity receptors will be **Slight** in magnitude. The resulting level of effect will be **Moderate** and **Not Significant**.

Burnside

- 7.10.16. The hamlet of Burnside is located c.4.2 km north of the nearest turbine in the proposed development. The hamlet comprises modern detached housing orientated northeast – southwest, built on a small grid of streets adjacent to the B741. The hamlet is located within the low undulating Nith valley with the land slowly rising to the hills in the south. Burnside is surrounded by open agricultural land which allows for panoramic views in all directions and with theoretical visibility to the existing Hare Hill (and Extension) Windfarm, 5.8 km to the southeast. The large single turbine at High Park is visible to the east on Dalhanna Hill.

Determination of Visual Sensitivity

Susceptibility to Change

- 7.10.17. The susceptibility of residents is considered to be High.

Value attached to Settlement and Views

- 7.10.18. No values have been attached to this settlement or views.

Overall Sensitivity

- 7.10.19. Viewers within Burnside are considered to be of High sensitivity to changes resulting from the proposed development.

Determination of Magnitude of Change

Geographical Influence from Predicted Visibility

- 7.10.20. Analysis of the ZTV and computer modelling indicates that there will be theoretical visibility to the east of Burnside of up to 13 turbines. The remainder of the hamlet will not experience any visibility.

Scale and Nature of Change to Views from Settlement

- 7.10.21. The hamlet is set within open countryside and where theoretical visibility is indicated the views will not be screened by any intervening vegetation. The turbines will be seen beyond the hills to the south of the settlement, on the horizon and against the skyline at a distance of 4.2km. **Viewpoint 5, Figure 7.3.5 Volume III** is indicative of the nature of views that may be experienced from the B741 at Burnside. The photomontage indicates that four turbines will be visible to hub height, with visibility to parts of blades of nine further turbines, introducing moving elements which will not be particularly noticeable within the open expansive countryside.

Overall Magnitude

- 7.10.22. The change in visual amenity as a result of the proposed development will be Slight in magnitude.

Significance of Effect

- 7.10.23. The change in visual amenity as a result of the proposed development on the **High** sensitivity receptors will be **Slight** in magnitude. The resulting level of effect will be **Moderate** and therefore **Not Significant**.

Cumnock

- 7.10.24. The town of Cumnock lies c.11.6 km northwest of the proposed development and is set in a landscape of woodland and moorland at the confluence of the Lugar and Glaisnock waters. The eighteenth and nineteenth century core of the town is surrounded by new suburbs arranged across the surrounding low hills. Netherthird lies to the south of the settlement adjacent to the A76 Dumfries Road.

Determination of Visual Sensitivity

Susceptibility to Change

- 7.10.25. The susceptibility of residents is considered to be High.

Value attached to Settlement and Views

- 7.10.26. A Conservation Area covers the central part of the town.

Overall Sensitivity

- 7.10.27. Viewers within Cumnock are considered to be of High sensitivity to changes resulting from the proposed development.

Determination of Magnitude of Change

Geographical Influence from Predicted Visibility

- 7.10.28. Analysis of the ZTV and computer modelling indicates that there will be discontinuous patches of theoretical visibility within Cumnock of up to 21 turbines, extending across parts of the southern, central and northern districts of the settlement.

Scale and Nature of Change to Views from Settlement

- 7.10.29. Cumnock is set within open rolling countryside and where views are obtained to the turbines, they will be seen beyond the hills to the south of the settlement, on the horizon at a distance of over 11 km. However in most locations within the settlement, intervening built form will limit views to the proposed development whilst the undulating topography enhances the importance of local views across and within the town and restricts views to the surrounding countryside.
- 7.10.30. Due to the long separation distance the turbines will only be seen under clear weather conditions when they will be perceived as minor new vertical elements within the countryside to the south of the town. **Viewpoint 14, Figure 7.3.14 Volume III** taken from Netherthird is indicative of the nature of views that may be experienced from the very southern edge of Cumnock. The photomontage indicates that all 21 turbines will be visible to hub height, introducing new distant elements set on the distant ridgeline of the Southern Uplands in the foreground of Windy Standard and Extension Windfarm and in the context of expansive views across the surrounding countryside.

Overall Magnitude

- 7.10.31. The change in visual amenity as a result of the proposed development will be locally Slight in magnitude from the southern exposed edges of the settlement. Elsewhere the change will be Negligible or None.

Significance of Effect

- 7.10.32. The change in visual amenity as a result of the proposed development on the **High** sensitivity receptors will be locally **Slight** in magnitude. The resulting level of effect will be **Moderate** and therefore **Not Significant**.

New Cumnock

- 7.10.33. The town of New Cumnock lies to the south of the confluence of the River Nith and the Afton Water. The town is located c.5.2km north of the nearest turbine of the proposed development and is situated within an undulating agricultural landscape which allows open views across the wide upland basin of the River Nith. The settlement is influenced by existing windfarm development at Hare Hill 2.5km to the southeast. Locally the large single turbine at High Park on Dalhanna Hill is visible to the south of the settlement.

Determination of Visual Sensitivity

Susceptibility to Change

- 7.10.34. The susceptibility of residents is considered to be High.

Value attached to Settlement and Views

- 7.10.35. The settlement is set within the Glen Afton and Glenmuir Sensitive Landscape Character Area.

Overall Sensitivity

- 7.10.36. Viewers within New Cumnock are considered to be of High sensitivity to changes resulting from the proposed development.

Determination of Magnitude of Change

Geographical Influence from Predicted Visibility

- 7.10.37. Theoretical visibility of up to 21 turbines is indicated in the western and northern areas of the town at a separation distance of c. 5 km with no visibility indicated to the east of the settlement. Topographic containment of the proposed development limits theoretical visibility to the northern and western areas of the town.

Scale and Nature of Change to Views from Settlement

- 7.10.38. New Cumnock is set within open rolling countryside and where views are obtained to the turbines, they will be seen beyond the hills to the south of the settlement, on the horizon at a distance of 5.2 km. Areas indicating visibility are to the north and west of the town and thus the intervening built form will limit many views to the proposed development which lies to the south.
- 7.10.39. The town already has views of the windfarm development at Hare Hill which lies 3 km to the southeast and thus where visible the proposed development will introduce new vertical elements into the landscape from this location but these will be perceived in the context of the existing wind energy development. Furthermore, the proposed development will be seen in the context of extensive plantation forestry

and the legacy of open cast mining seen in the surrounding landscape, such as that at Auchincross.

- 7.10.40. **Viewpoint 4, Figure 7.3.4 Volume III** is indicative of the nature of views that may be experienced from the elevated southern edge of New Cumnock. The photomontage indicates that all 21 turbines will be visible, three to blade only, introducing new elements set on forested ridgeline of the Southern Uplands.
- 7.10.41. **Viewpoint 6, Figure 7.3.6 Volume III** is indicative of the nature of views that may be experienced from the northern side of New Cumnock at Pathead/Mansfield. The photomontage indicates that 19 turbines will be visible, six to blades only, seen as part of panoramic views to the Southern Uplands.

Overall Magnitude

- 7.10.42. The change in visual amenity as a result of the proposed development will be Slight in magnitude.

Significance of Effect

- 7.10.43. The change in visual amenity as a result of the proposed development on the **High** sensitivity receptors will be **Slight** in magnitude. The resulting level of effect will be **Moderate** and therefore **Not Significant**.

Summary of Effects on Settlements

- 7.10.44. **Table 12** below lists and summarises effects on the settlements assessed above. It sets out their sensitivity to change, the magnitude of change that would arise as a result of the proposed development and the level of resultant effects and their significance in relation to views from these settlements.

Table 7.12 Effects on Settlements

SETTLEMENT	SENSITIVITY TO CHANGE	MAGNITUDE OF CHANGE	LEVEL OF EFFECT	SIGNIFICANCE
Bankglen	High	Slight	Moderate	Not Significant
Burnside	High	Slight	Moderate	Not Significant
Cumnock	High	Slight	Moderate	Not Significant
New Cumnock	High	Slight	Moderate	Not Significant

Assessment of Effects on the Visual Amenity of Route Corridors

- 7.10.45. This section of the LVIA provides an assessment of the proposed development from vehicular and non-vehicular route corridors within the Study Area, including roads, railways, airports, designated cycle routes and long-distance paths. Route corridors have been identified in **Appendix 7.4 Volume IV** as having the potential for significant visual effects.
- 7.10.46. In accordance with the criteria outlined in the detailed methodology in **Appendix 7.1 Volume IV**, road and rail receptors in the Study Area are generally considered to be of medium sensitivity to the proposed development although vehicle users of routes promoted or noted for scenic value may be of high sensitivity. There may also be value attached to specific views along the routes, or particular stretches where they pass through or overlook designated landscapes.

- 7.10.47. Fieldwork and analysis of the mapping and ZTV indicates that, from most transport corridors, visibility of the proposed development is limited due to screening by landform and vegetation, particularly since most of the transport routes follow the bottom of the glens and dales, which are contained by topography thereby limiting the potential for views to Pencloe Windfarm.
- 7.10.48. Three roads and one railway within the Study Area have been identified **Appendix 7.4 Volume IV** to have theoretical visibility of proposed development which may result in significant effects. These are:
- A76;
 - B74;
 - Afton Road and
 - Glasgow South Western Line.
- 7.10.49. Effects on these route corridors are considered in detail below.

A76

- 7.10.50. The A76 runs on a northwest – southeast axis to the north of the proposed development passing through Kilmarnock, Cumnock, New Cumnock and Nithsdale. At its closest point (at New Cumnock) it passes 5.9 km north of the proposed development.

Determination of Visual Sensitivity

Susceptibility to Change

- 7.10.51. The susceptibility of vehicle users along this A-road is considered to be medium.

Value attached to Route Corridor and Views

- The route is not a nominated scenic or tourist route.
- The route passes through the Thornhill Uplands Regional Scenic Area to the south of Sanquar however no theoretical visibility is displayed over this section of the route.
- The local landscape designation of Glenmuir and Afton Sensitive Landscape Character Area covers the route to the east of New Cumnock and to the north west at Catrine.

Overall Sensitivity

- 7.10.52. Vehicle users on the A76 are considered to be of medium sensitivity to change resulting from the proposed development.

Determination of Magnitude of Change

Geographical Influence from Predicted Visibility

- 7.10.53. Theoretical visibility of up to 21 turbines is indicated intermittently across the western part of the route from Kilmarnock to New Cumnock at a distance of c. 33km to 6km.

Scale and Nature of Change to Views from Route

- 7.10.54. North of New Cumnock the road passes through a relatively flat landscape where views will be of an open nature and panoramic. Where visible, the proposed development will be seen on the skyline of the Southern Uplands to the south. Southbound travellers on the section of the route between Cumnock and New

Cumnock will experience views to the proposed development and these will be of a similar nature to **Viewpoint 8, Figure 7.3.8 Volume III**. Long distance views to the existing turbines of Hare Hill, High Park single turbine and Windy Standard are already obtained from this section of the road and the consented Afton and Hare Hill Extension Windfarms will also be visible. The proposed development will be seen in front of Afton and Windy Standard, adding new vertical elements within the context of the existing windfarms. Views for road users will be transitory and across a distance of between 6 km and 11.6 km, however for southbound travellers on this section of the route, where the turbines are visible they will appear on the horizon in the direction of travel of the route corridor and thus form a new noticeable element in views.

- 7.10.55. Elsewhere where theoretical visibility is indicated along the A76 the long separation distance of over 15 km will result in the turbines to be perceived as minor elements within the landscape.
- 7.10.56. The turbines will be experienced in the context of views to the existing windfarms of Hare Hill, High Park single turbine and Windy Standard and the consented Afton and Hare Hill Extension Windfarms.

Overall Magnitude

- 7.10.57. There will be a Moderate magnitude of change to views for road users from the A76.

Significance of Effect

- 7.10.58. There will be a **Moderate** magnitude of change to views for road users from the A76 as the route passes from Cumnock to New Cumnock. The predicted level of effect on road users who have a **Medium** sensitivity is considered to be **Moderate** and **Not Significant**.

B741

- 7.10.59. The B741 runs to the north of the proposed development linking New Cumnock to Dalmellington. At its closest point (at Dalleagles) it passes c.4 km north of the proposed development.

Determination of Visual Sensitivity

Susceptibility to Change

- 7.10.60. The susceptibility of road users along this B-road is considered to be medium.

Value attached to Route Corridor and Views

- The route is not a nominated scenic or tourist route.
- The route passes through the local landscape designation of the Glen Afton and Glenmuir Sensitive Landscape Character Area for c. 5 km of the route to the west of New Cumnock.

Overall Sensitivity

- 7.10.61. Vehicle users on the B741 are considered to be of medium sensitivity to change resulting from the proposed development.

Determination of Magnitude of Change

Geographical Influence from Predicted Visibility

- 7.10.62. Almost no theoretical visibility is indicated on the B741 excepting a c.4 km stretch of the route with visibility of up to 21 turbines to the west of New Cumnock. This stretch lies c. 4 km from the proposed development.

Scale and Nature of Change to Views from the Route Corridor

- 7.10.63. The B741 is set within mostly open countryside and where theoretical visibility is indicated, views will often be long distance and panoramic, although roadside vegetation and built form will limit views from some locations. Where visible the proposed development will be seen in oblique views to the rising terrain, appearing beyond the hills to the south, with the turbines seen against the skyline at a distance of over 4 km. Views for road users will be transitory and travellers will focus on views to the east and west in the direction of travel. At an average speed of 50 mph the proposed development will be seen in oblique views to the south for approximately 2 minutes. The turbines will be seen partially as new large scale elements in the landscape, visible in oblique views away from the principal direction of travel from the B741. A representative viewpoint is included from the B841 in **Viewpoint 5, Figure 7.3.5 Volume III**, from Burnside.
- 7.10.1. The turbines will be experienced in the context of views from the B741 to the existing windfarms of Hare Hill, High Park single turbine and Windy Standard and the consented Afton and Hare Hill Extension Windfarms.

Overall Magnitude

- 7.10.2. The change in visual amenity as a result of the proposed development will be Slight in magnitude.

Significance of Effect

- 7.10.3. There will be a **Slight** magnitude of change to views for road users from the B741 as the route passes to the west of New Cumnock. The predicted level of effect on road users who have a **Medium** sensitivity is considered to be **Moderate/Minor** and **Not Significant**.

Afton Road

- 7.10.4. This minor road runs to the north and east of the proposed development following the Afton Water along Glen Afton. The closest point with theoretical visibility to the turbines is at Burnfoot/Glenafton Park, 2.5 km to the north of the closest turbine. The existing Hare Hill Windfarm is seen to the east of the road corridor over 3.1 km at the closest point and views will also be obtained from some locations to the consented Afton and Hare Hill Extension.

Determination of Visual Sensitivity

Susceptibility to Change

- 7.10.5. The susceptibility of road users along this minor road is considered to be medium.

Value attached to Route Corridor and Views

- The route is not a nominated scenic or tourist route.
- The route passes through the local landscape designation of the Glen Afton and Glenmuir Sensitive Landscape Character Area.

Overall Sensitivity

- 7.10.6. Vehicle users on the Afton Road are considered to be of medium sensitivity to change resulting from the proposed development.

Determination of Magnitude of Change

Geographical Influence from Predicted Visibility

- 7.10.7. Theoretical visibility is indicated over a 3.5 km length of the northern section of the Afton Road from New Cumnock to Burnfoot/Glen Afton Park, visibility is indicated of up to 21 turbines close to New Cumnock, reducing to 6-10 turbines between Laight Farm and Burnfoot/Glen Afton Park.

Scale and Nature of Change to Views from the Route Corridor

- 7.10.8. The Afton Road is set within a mixture of open fields and woodland with a strong sense of enclosure in the section of the route covering the upper part of Glen Afton. Theoretical visibility is strongest in the more open northern section of the road with the topography of the steep sided Glen Afton providing a visual barrier along the southern section of the road.
- 7.10.9. Along the northern section of the road, where theoretical visibility is indicated, views will be over a distance of c. 5 km and the turbines will be seen against the skyline. Representative viewpoints are included from the northern section of Afton Road at **Viewpoint 3, Figure 7.3.3 Volume III** and between Burnfoot/Glen Afton Park and Pencloe Farm at **Viewpoint 1, Figure 7.3.1 Volume III**.
- 7.10.10. The proposed development will be seen in views for southbound road users travelling towards the turbines, with the turbines seen on the skyline in the direction of travel, behind the hills on the horizon. Views to the turbines will be partial and from some locations filtered by either built form, intervening vegetation and the rolling nature of the road profile. At Laight Farm the road enters a wooded corridor beside the Afton Water and views are heavily filtered.
- 7.10.11. The rising profile of Ashmark Hill on the western edge of Glen Afton provides increasing containment with southwards progress along the Glen, significantly reducing the extent of the windfarm which remains visible. The turbines are seen to be set back from the rising foreground hills and are seen within the distant uplands. The lower parts of the towers are contained from view and with progress south the turbines are increasingly contained from view by the rising foreground hills.
- 7.10.12. Views to the proposed development will be transitory over a 3.5 km stretch of the road and at an average speed of 30 mph the proposed development will be visible intermittently for approximately 4 minutes. The turbines will add new vertical elements to the forested edge of the Southern Uplands from the northern section of the Afton Road and will be experienced in the context of views to the existing windfarms of Hare Hill, High Park single turbine and Windy Standard and the consented Afton and Hare Hill Extension.

Overall Magnitude

- 7.10.13. The change in visual amenity as a result of the proposed development will be moderate in magnitude.

Significance of Effect

- 7.10.14. There will be a **Moderate** magnitude of change to views for road users from the Afton Road. The predicted level of effect on road users who have a **Medium** sensitivity is considered to be **Moderate** and **Not Significant**.

Railways

Glasgow South Western Line

- 7.10.15. Running on a broadly northwest – southeast axis the Glasgow South Western Line runs to the north of the proposed development passing through Kilmarnock, Auchinleck, New Cumnock, Kirkconnel and Sanquhar. At its closest point it passes c. 6 km north of the proposed development at New Cumnock.

Determination of Visual Sensitivity

Susceptibility to Change

- 7.10.16. The susceptibility of passengers using the railway is considered to be medium.

Value attached to Route Corridor and Views

- The route is not a nominated scenic or tourist route.
- The route passes through the Thornhill Uplands Regional Scenic Area to the south of Sanquhar however no theoretical visibility is displayed over this section of the route.
- The local landscape designation of the Glen Afton and Glenmuir Sensitive Landscape Character Area covers the route to the east of New Cumnock and in the northwest at Catrine.

Overall Sensitivity

- 7.10.17. Passengers using the Glasgow South Western Line are considered to be of medium sensitivity to change resulting from the proposed development.

Determination of Magnitude of Change

Geographical Influence from Predicted Visibility

- 7.10.18. Theoretical visibility of up to 21 turbines is indicated intermittently across the western part of the route from Kilmarnock to New Cumnock at a distance of c. 35 km to 7 km. There is no theoretical visibility from the route to the east of New Cumnock.

Scale and Nature of Change to Views from Route

- 7.10.19. To the northwest of New Cumnock the railway passes through a gently rolling landscape and the route is frequently in cutting. This will limit many views, although a short section of the route is in embankment approximately 1 km to the west of New Cumnock close to Loch o' th' Lowes and here views to the proposed development will be experienced by passengers from the southern side of the train. Where visible, the proposed development will be seen on the skyline, located within the hills to the south. Travellers will experience oblique views to the proposed development which will be seen in front of the existing Windy Standard Windfarm and the consented Afton Windfarm, and beyond the turbines of Hare Hill, the consented Hare Hill Extension and the single turbine of High Park adding new vertical elements to the summits of the hills to the south. Views for rail travellers will be both transitory and the turbines will be seen across a distance of over 6 km.

Overall Magnitude

- 7.10.20. There will be a Slight magnitude of change to views for passengers using the Glasgow South Western Line.

Significance of Effect

7.10.21. There will be a **Slight** magnitude of change to views for passengers using the Glasgow South Western Line. The predicted level of effect on passengers using the Glasgow South Western Line who have a **Medium** sensitivity is considered to be **Moderate/Minor** and **Not Significant**.

Summary of Effects on Route Corridors

7.10.22. **Table 7.13** lists and summarises effects on the Route Corridors assessed above. It sets out their sensitivity to change, the magnitude of change that would arise as a result of the proposed development and the level of resultant effects and their significance in relation to views from these Route Corridors.

Table 7.13 Effects on Route Corridors

Route Corridor	Sensitivity To Change	Magnitude Of Change	Level Of Effect	Significance
A76	Medium	Moderate	Moderate	Not Significant
B741	Medium	Slight	Moderate/Minor	Not Significant
Afton Road	Medium	Moderate	Moderate	Not Significant
Glasgow South Western Line	Medium	Slight	Moderate/Minor	Not Significant

Assessment of Effects on Viewpoints

7.10.23. The viewpoint assessment has been carried out to identify and evaluate the potential effects on visual amenity arising from the proposed development at specific representative locations in the Study Area. The selection of viewpoints is discussed in **Section 7.6**.

7.10.24. The predicted views from each of the 24 viewpoint locations are illustrated using the wireframes or photomontages in **Figures 7.3.1 to 7.3.24, Volume III** which are accurate in terms of the positioning, spatial distribution and size of the turbines.

7.10.25. For the purposes of assessing the effects on visual amenity, the sensitivity of the receptors is as defined **Table 7.1.4**, 'Definition of Visual Receptor Sensitivity' of the methodology in **Appendix 7.1 Volume IV**.

7.10.26. The following detailed analysis of the 24 viewpoints includes a description of the existing and predicted view, an analysis of the magnitude of change and effects on visual amenity. A summary of the effects is provided in **Table 7.14**.

7.10.27. As set out in **Section 7.6** above, two of the 24 viewpoints originally selected were subsequently demonstrated to afford no theoretical visibility of the proposed development, these were:

- Viewpoint 19 – Minor road south of Stinchar Falls and
- Viewpoint 24 – Doon Castle beside Loch Doon.

7.10.28. Although receptors at these viewpoints will be unaffected by any visibility of the proposed development, these locations were of particular interest to SNH during the scoping consultation. The viewpoint photography and wireframes have therefore been retained for these viewpoints in the run of figures in **Volume III** to demonstrate the absence of visibility. The baseline descriptions of these viewpoints are also included in **Appendix 7.5 Volume IV** as background information; however, as there will be no effects, they have not been addressed in the main viewpoint assessment below, as the incorporation of viewpoints that would clearly have no theoretical visibility is generally deemed to be unrepresentative. This is in line with recommended good practice in the selection of viewpoints, which are meant to represent locations from which there would be theoretical visibility (although actual visibility would potentially be affected by local screening or filtering from buildings, vegetation etc.).

7.10.29. The following detailed analysis of the remaining 22 viewpoints includes a description of the existing and predicted view, an assignment of receptor sensitivity (including confirmation of receptor susceptibility and the value applied to the viewpoint), an analysis of the magnitude of change and an assessment of the level of predicted effects on visual amenity and a determination of their significance. The supporting figures include: a viewpoint location plan; existing photographic view with wireframes illustrating the position of all built and consented windfarms; some viewpoints are also supported by photomontage visualisations. Visualisations have been prepared in accordance with the requirements of SNH's Visual Representation of Windfarms Good Practice Guidance as described in **Appendix 7.1 Volume IV**.

Duration and Reversibility of the Visual Effects

7.10.30. The magnitude of changes that would be experienced by visual receptors as a result of the proposed development relates in part to the duration of effects and their permanence/ reversibility. The effects will continue for the permitted life of the windfarm, which is set at 25 years. Following this time period, in the absence of a renewed planning permission, the turbines will be removed and the landscape reinstated with the majority of proposed changes being fully reversible upon decommissioning.

7.10.31. As the duration and reversibility of the effects of the proposed development will be common to all visual receptors, they have been implicitly considered with regard to the likely magnitude of change in all views, but are not repeated with regard to each viewpoint to avoid undue repetition.

Viewpoint 1: Near entrance to Pencloe Farm, Glen Afton

Location and Rationale for Selection

7.10.32. Viewpoint 1 is located close to the entrance to Pencloe Farm, 2.92 km to the north of the closest turbine of the proposed development. The viewpoint was selected as being representative of residents along this section of the glen, in particular those at Pencloe Farm who will experience similar views on the approach to and at the property, as well as road users (mainly southbound) along the minor road. **Figure 7.3.1 Volume III** shows: a) the viewpoint location; b) the existing view and a wireframe of the proposed development (including any other built/ consented windfarms within the view); c) a 75° panoramic photomontage of the proposed development and d) a 40° enlargement of the photomontage.

Description of Existing View

7.10.33. The existing view looks southwest towards the proposed development and shows a view across rising rolling terrain with plantation forestry across the skyline. Pastures enclosed by stone walls form a patchwork of fields. The buildings of Pencloe Farm are visible to the left of the image, set with mature deciduous trees, with a dense tree

belt along Carcow Burn to the right. The north eastern edge of Carsphairn Forest is seen on the distant ridgeline. The consented wind development at Afton will be visible from this viewpoint, as indicated on the wireframe, with the turbines of Afton seen beyond the ridgeline.

Visual Sensitivity

7.10.34. The overall sensitivity of receptors at this location is considered to be **High** for residents and **Medium** for road users. The factors that have contributed to this judgement are as follows:

Susceptibility to Change: **Medium** for road users and **High** for residents.

- Awareness of views from residential properties along this stretch of road, including the adjacent Burnfoot and Glenafton Park.
- Southbound road users will be focussed on views along the minor road and the prevailing landscape.

Value attached to View: Medium

- Viewpoint within and overlooking the Glen Afton and Glenmuir Sensitive Landscape Character Area.

Magnitude of Change

7.10.35. The effects on visual receptors have been evaluated according to the nature of the change to the view in terms size, scale and character; the geographical extent of the predicted visibility and its duration as part of the overall visual experience of the receptor as follows:

7.10.36. *Size or Scale (including nature of influence on the character of the view)*

- The proposed development will be partially visible, rising above the height of intervening rolling hills and will be seen in open views from the minor road and at the entrance to Pencloe Farm. The proposed windfarm occupies 30.7° of the view.
- The proposed development will form a new element within the relatively open landscape introducing new vertical elements on the horizon, set within the mantle of forestry plantations on the horizon.
- The predicted wireframe shows two clusters of turbines, six to the left of the rising ridge of Meikle Hill and nine to the right of the ridge. The predicted montage illustrates that of these two arrays only the hub and blade tips of one turbine and blade tips of three will be visible above the plantation woodland and the dense tree belt along Carcow Burn.
- The predicted wireframe shows eleven turbines of the consented scheme of Afton beyond the ridgeline. The Pencloe turbines will be perceived as an extension of this group. Following the construction of Afton, wind development will have an influence on the character of the landscape from this location and the turbines of Pencloe Windfarm will add further elements within this context.

- For vehicle users, the views of the turbines will be for a short duration, along the minor road. For residents at Pencloe Farm, there will be partial views to the turbines on the horizon, from the approach to the property. From Pencloe Farm it is anticipated that intervening landform and surrounding tree belts will screen direct views to the turbines.
- The view along Glen Afton is characterised by diverse and changing foreground interest, with views focussed along the floor of the glen, channelled by the adjacent rising ground. Views to the turbines are oblique to the rising terrain and foreground elements interrupt direct views to the turbines. As such the effect of the proposed development is reduced.
- The turbines are seen within the distant upland forested component of the view and are seen to be consistent with the extensive large scale of the plantations.

7.10.37. *Geographical Extent (including influence on focus of the view)*

- The view to the proposed development, which lies to the south at 195° to the viewpoint, will be seen by local residents and southbound road users along the minor road.
- The proposed development will be seen over a short separation distance of 2.92 km to the nearest turbine.
- The change to the view occurs within a small portion of the south facing aspect, which is focussed on enclosed pastoral fields set on rolling hills with riverine woodland and tree clumps and dense plantation on hill tops.

7.10.38. *Judgement on Magnitude of Change*

- Based on factors considered above, the overall magnitude of change to this viewpoint is considered to be **Slight**.

7.10.39. *Level and Significance of Effect*

7.10.40. The combination of the individual judgements of **High** sensitivity for residents and **Medium** sensitivity for road users and **Slight** magnitude of change are considered to result in a **Moderate** effect for residents and a **Moderate/Minor** level of effect for road users. In the context of this assessment this is considered to be **Not Significant** for residents and road users.

Viewpoint 2: Summit of Blackcraig Hill

Location and Rationale for Selection

7.10.41. Viewpoint 2 is located at the summit of Blackcraig Hill, 3.17 km to the east of the closest turbine of the proposed development. The viewpoint was selected as being representative of walkers on Blackcraig Hill who will experience this view along the western slope and at the summit, which is at an elevation of 700m AOD. **Figure 7.3.2 Volume III** shows: a) the viewpoint location; b) the existing view and a wireframe of the proposed development (including any other built/ consented windfarms within the view); c) a 75° panoramic photomontage of the proposed development and d) a 40° enlargement of the photomontage.

Description of Existing View

- 7.10.42. The existing view looks west towards the application site and in the foreground grasses and rocky outcrops cover the western slope of Blackcraig Hill. Beyond are the smooth rolling hills of the northern edge of the Southern uplands, with a mix of upland grasslands and the geometric blanket of forestry plantations within the Carsphairn Forest. To the left of the image are turbines forming Windy Standard and the area of the consented Windy Standard Extension. The bald moorland summit of Struther's Brae, 540m AOD, is seen in the middle ground rising above Glen Afton, with the Lochingerroch Plantations to the right. Beyond the gently rising, subtle ridges of Meikle Hill, Auchinally Hill and Milray Hill rise from east to west respectively, mantled in dense forestry plantation. The near horizon is marked by the open moorland summit of Enoch Hill, 569m AOD.
- 7.10.43. From this viewpoint Hare Hill and the consented Hare Hill Extension Windfarms will be prominent in views to the north, Sanquhar Community Windfarm and Whiteside Hill Windfarm will be prominent to the east and Afton and Windy Standard and Extension Windfarm will be prominent to the south, whilst numerous further windfarms will be visible as distant clusters on the horizon to the north, east and south east.

Visual Sensitivity

- 7.10.44. The overall sensitivity of receptors at this location is considered to be **High** for walkers. The factors that have contributed to this judgement are as follows:

Susceptibility to Change: **High** for walkers.

- Awareness of panoramic views at the summit and enjoyment of the wider landscape will be high for walkers.

Value attached to View: Medium

- Viewpoint within and overlooking the Glen Afton and Glenmuir Sensitive Landscape Character Area.

Magnitude of Change

- 7.10.45. The effects on visual receptors have been evaluated according to the nature of the change to the view in terms size, scale and character; the geographical extent of the predicted visibility and its duration as part of the overall visual experience of the receptor as follows:
- 7.10.46. *Size or Scale (including nature of influence on the character of the view)*
- The predicted wireframe and photomontage indicates that all 21 turbines will be visible from this location. They will be seen as a coherent, open cluster of development, located generally below the ridgeline of immediate group of hills. The proposed windfarm occupies 31.9° of the view from the viewpoint, forming a new focal point from this location.

- The proposed turbines will introduce new large scale vertical components across the three interlocking forested ridges, appearing as new arrays of wind turbines to the north of Windy Standard Extension. All 21 turbines will be almost fully visible, in contrast with the prevailing forestry and in proportion to the scale of the underlying forestry blocks and compatible with the existing forestry and windfarm land uses.
- From this viewpoint the cut platforms for the crane hardstandings will be visible, as illustrated in the photomontages, contrasting with the moorland, along with the other associated infrastructure elements such as the control and substation building and the access and site tracks.
- Sections of forestry will be clear felled as part of the windfarm development, followed by extensive re-planting of new woodland and forestry, in accordance with the forestry management plan. In this regard the changes to the landscape are consistent with the expectation of change within areas of large scale managed forestry.

7.10.47. *Geographical Extent (including influence on focus of the view)*

- The view to the proposed development, which lies to the west at 270° to the viewpoint, will be seen by walkers at the summit of the hill and from sections of the ascent and descent via Quintin Knowe to the north.
- The proposed development will be seen over a short separation distance of 3.17 km to the nearest turbine.
- The change to the view occurs within the west facing aspect, which is focussed on open views over the geometric forestry plantations of Carsphairn Forest.

7.10.48. *Judgement on Magnitude of Change*

7.10.49. Based on factors considered above, the overall magnitude of change to this viewpoint is considered to be Moderate.

7.10.50. *Level and Significance of Effect*

The combination of the individual judgements of **High** sensitivity for walkers and **Moderate** magnitude of change are considered to result in a **Major/Moderate** effect for walkers. In the context of this assessment this is considered to be **Significant**.

Viewpoint 3: Afton Cemetery, New Cumnock

Location and Rationale for Selection

7.10.51. Viewpoint 3 is located adjacent to Afton Road and Afton Cemetery in New Cumnock, 5.34 km north of the closest turbine of the proposed development. The viewpoint provides an appropriate position to represent the potential effects of the proposed development upon visitors to the cemetery and road users travelling southbound from New Cumnock. **Figure 7.3.3 Volume III** shows: a) the viewpoint location; b) the existing view and a wireframe of the proposed development (including any other built/ consented windfarms within the view); c) a 75° panoramic photomontage of the proposed development and d) a 40° enlargement of the photomontage.

7.10.52. From this viewpoint Hare Hill Windfarm and the consented Hare Hill Extension are seen in views to the southeast and Windy Standard and Extension and the consented Afton Windfarms are seen to the south, in the centre of the image, as illustrated in the wireframe in **Figure 7.3.3b Volume III**.

Description of Existing View

7.10.53. The existing view looks south towards the northern edge of the Southern Uplands and the Carsphairn Forest. In the foreground are fields set to pasture enclosed by stone walls and timber post and wire fencing and punctuated by treebelts, tree clumps and single trees. Scattered farms are visible within the landscape, including Laight and Ashmark, sheltered in the lee of Ashmark Hill. To the left of the image Afton Road is seen leading south to Glen Afton and beyond wide tree belts run beside the Afton Water. The north western slope of Dalhanna Hill, 359 m AOD, rises beyond Afton Cemetery which is enclosed by a red sandstone wall.

Visual Sensitivity

7.10.54. The overall sensitivity of receptors at this location is considered to be Medium for road users and High for visitors to the cemetery. The factors that have contributed to this judgement are as follows:

Susceptibility to Change: **Medium** for road users and **High** for visitors to the cemetery.

- Road users will be focussed on views along the road, particularly southbound and to views of the prevailing landscape and are likely to be medium.
- The viewpoint is taken from the cemetery car park and visitors to the cemetery will be aware of the views to the surrounding landscape and will be of high sensitivity to change.

Value attached to View: Medium

- The viewpoint is located within the Glen Afton and Glenmuir Sensitive Landscape Area.

Magnitude of Change

7.10.55. The effects on visual receptors have been evaluated according to the nature of the change to the view in terms size, scale and character; the geographical extent of the predicted visibility and its duration as part of the overall visual experience of the receptor as follows:

7.10.56. *Size or Scale (including nature of influence on the character of the view)*

- The predicted wireframe and photomontage shows that, from this viewpoint, the proposed development will be seen as a clustered array rising above the distant skyline ridge of the Southern Uplands within the green forested mantle of the Carsphairn Forest. The proposed windfarm occupies 21.3° of the view, set within the rolling hills, to the right of the image and set apart from the notch of Glen Afton.

- The predicted wireframe shows the turbines of the consented scheme of Afton in the distance to the left of the Pencloe turbines. From this location the Pencloe turbines will be perceived as an extension of this group. Following the construction of Afton, wind development will have an influence on the character of the landscape from this location and the turbines of Pencloe Windfarm will add further elements within this context.
- The proposed turbines will introduce new vertical components, extending across and will be seen to be proportion with the predominantly horizontal upland landscape. All 21 turbines will be visible from this location with five almost fully visible, twelve partly visible to the hub and blades and four with the blades only. The majority of proposed turbines will be seen against the skyline, below the height of Dalhanna Hill.
- For southbound vehicle users, views of the turbines will be seen intermittently and for a short duration only of the journey along Afton Road.

7.10.57. *Geographical Extent (including influence on focus of the view)*

- The view to the proposed development, which lies to the south at 186° to the viewpoint, will be seen by visitors to Afton Cemetery and southbound road users along the minor road.
- The proposed development will be seen over a medium separation distance of 5.34 km to the nearest turbine.
- The change to the view occurs within the south facing aspect, which is focussed on pastoral fields in valley areas and lower hill slopes, surrounded by rolling hills and will be experienced in the context of wider panoramic views across the basin of the upper Nithsdale.

7.10.58. *Judgement on Magnitude of Change*

Based on factors considered above, the overall magnitude of change to this viewpoint is considered to be Moderate.

7.10.59. *Level and Significance of Effect*

The combination of the individual judgements of **Medium** sensitivity for road users and **High** sensitivity for visitors to the cemetery and a **Moderate** magnitude of change are considered to result in a **Moderate** effect for road users and a **Major/Moderate** level of effect for visitors. In the context of this assessment this is considered to be **Not Significant** for road users and **Significant** for visitors.

Viewpoint 4: Connel View, southern edge of New Cumnock

Location and Rationale for Selection

- 7.10.60. Viewpoint 4 is located on Connel View, towards the southern edge of New Cumnock, 5.39 km north of the proposed development, to the closest turbine. The viewpoint provides an appropriate position to represent the potential effects of the proposed development upon residents located towards the south western edge of New Cumnock. **Figure 7.3.4 Volume III** shows: a) the viewpoint location; b) the existing view and a wireframe of the proposed development (including any other built/consented windfarms within the view); c) a 75° panoramic photomontage of the proposed development and d) a 40° enlargement of the photomontage.

Description of Existing View

- 7.10.61. The existing view looks south southwest towards the site of the proposed development and shows a long distance view across undulating landform with Dalhanna Hill to the left of the image and the hills along the northern edge of the Southern Uplands and Carsphairn Forest rising to the right of the image. Fields enclosed by stone walls and timber post and wire fencing are generally set to pasture with small stands of conifers and belts of woodland following the course of the Afton Water into Glen Afton in the centre of the image. Treebelts and groups of trees surround the setting of the scattered farms. The edge of the Carsphairn Forest is visible in the distance, where hill tops and slopes are covered by dense forestry plantations.
- 7.10.62. From this viewpoint Hare Hill and also the consented Hare Hill Extension Windfarms are seen in views to the southeast and Windy Standard and Extension Windfarm are seen in the distance to the south.

Visual Sensitivity

- 7.10.63. The overall sensitivity of receptors at this location is considered to be High for residents. The factors that have contributed to this judgement are as follows:

Susceptibility to Change: **High** for residents.

- Awareness of views along Glen Afton are likely to be high for residents.

Value attached to View: Medium

- The viewpoint is within the Glen Afton and Glenmuir Sensitive Landscape Character Area.

Magnitude of Change

- 7.10.64. The effects on visual receptors have been evaluated according to the nature of the change to the view in terms size, scale and character; the geographical extent of the predicted visibility and its duration as part of the overall visual experience of the receptor as follows:
- 7.10.65. *Size or Scale (including nature of influence on the character of the view)*
- The predicted wireframe and photomontage shows the proposed development from this viewpoint as a new windfarm cluster set within the distant forested uplands and seen on the distant skyline ridge. The proposed windfarm occupies 20.3° of the view, forming a major component of the view from this location.
 - The turbines will form noticeable new vertical elements on the skyline, seen in the backdrop of views across the prevailing relatively open foreground landscape. The turbines will be seen as a coherent addition to the forested upland, in proportion to the horizontal form of the rising backdrop of hills.
 - The predicted wireframe shows an evenly spaced array with 20 turbines, seen against the skyline with fifteen of the turbines visible to hub height and five visible to blades only.

7.10.66. *Geographical Extent (including influence on focus of the view)*

- The view to the proposed development, which lies to the south at 191° to the viewpoint, will be seen in filtered views through garden vegetation, by residents of Connel View on the exposed southern edge of New Cumnock. Built form will contain views to properties further north within the settlement.
- The proposed development will be seen over a medium separation distance of 5.39 km to the nearest turbine.
- The change to the view occurs within the south facing aspect only, which is focussed on the foreground of rolling pastoral fields and lower hill slopes.

7.10.67. *Judgement on Magnitude of Change*

Based on factors considered above, the overall magnitude of change to this viewpoint is considered to be Moderate for residents.

7.10.68. *Level and Significance of Effect*

The combination of the individual judgements of **High** sensitivity for residents and a **Moderate** magnitude of change is considered to result in a **Major/Moderate** effect for residents. In the context of this assessment this is considered to be **Significant** for residents.

Viewpoint 5: Burnside, B741

Location and Rationale for Selection

7.10.69. Viewpoint 5 is located on the B741, near Burnside Farm, approximately 3.3 km southwest of New Cumnock, 4.57 km to the north of the closest turbine of the proposed development. The viewpoint provides an appropriate position to represent the potential effects of the proposed development upon residents at Burnside Farm and road users on the B741. **Figure 7.3.5 Volume III** shows: a) the viewpoint location; b) the existing view and a wireframe of the proposed development (including any other built/ consented windfarms within the view); c) a 75° panoramic photomontage of the proposed development and d) a 40° enlargement of the photomontage.

Description of Existing View

7.10.70. The viewpoint looks southeast towards the proposed application site and shows small cluster of houses at Burnside, set back from the road and surrounded by open fields of pasture. The setting of the village is exposed with very limited vegetation, limited to scattered trees associated with residential properties and a small block of woodland visible on the distant ridgeline. Views to the south are oblique to the rising terrain and the main aspect for the properties in the village is to the north across the upland basin of the River Nith.

7.10.71. From this viewpoint Hare Hill and also the consented Hare Hill Extension Windfarms are seen in views to the southeast and Windy Standard and Extension Windfarm are seen in the distance to the south, Whitelee is seen as a minor element in views to the north.

Visual Sensitivity

7.10.72. The overall sensitivity of receptors at this location is considered to be High for residents and Medium for road users. The factors that have contributed to this judgement are as follows:

Susceptibility to Change: **High** for residents and **Medium** for road users.

- Awareness of views for residents at Burnside.
- Awareness of views along the B741 and the prevailing landscape are likely to be medium for road users.

Value attached to View: Medium

- The viewpoint is within a Sensitive Landscape Character Area.

Magnitude of Change

7.10.73. The effects on visual receptors have been evaluated according to the nature of the change to the view in terms size, scale and character; the geographical extent of the predicted visibility and its duration as part of the overall visual experience of the receptor as follows:

Size or Scale (including nature of influence on the character of the view)

- The predicted wireframe and photomontage show the proposed development from this viewpoint is seen in partial views within the hills to the south. The proposed windfarm theoretically occupies 24.2° of the view.
- The wireframe shows that the proposed turbines will introduce new vertical components into the landscape. A total of 14 turbines will be theoretically visible from this location with four turbines partially visible to hub height and 10 turbines visible to parts of their blades only. The proposed turbines will be seen beyond the ridgeline of hills to the south, against the skyline.
- The montage shows that the hubs and blades of four of the turbines will be visible from this location, seen on the horizon beyond the rooftops of Burnside.
- For vehicle users, views of the turbines will be experienced over only a short duration from the B741.

Geographical Extent (including influence on focus of the view)

- The proposed development, which lies to the southeast at 161° to the viewpoint, will be partially seen by residents at Burnside and road users using the B741.
- The proposed development will be seen over a medium separation distance of 4.57 km to the nearest turbine and across a very limited portion of local horizon.
- The change to the view occurs within the south facing aspect, in oblique views to the rising terrain. The principal views from the settlement are orientated to the north away from the proposed development.

Judgement on Magnitude of Change

Based on factors considered above, the overall magnitude of change to this viewpoint is considered to be Slight given the partial nature of the view and the location of the proposed development away from the principal orientation of views.

Level and Significance of Effect

The combination of the individual judgements of **High** for residents and **Medium** sensitivity for road users and a **Slight** magnitude of change are considered to result in a **Moderate** effect for residents and a **Moderate/Minor** level of effect for road users. In the context of this assessment this is considered to be **Not Significant** for residents and road users.

Viewpoint 6: Mansfield/Pathhead, New Cumnock

Location and Rationale for Selection

- 7.10.74. Viewpoint 6 is located on Mansfield Road, in the small settlement of Mansfield, 1.3 km north of New Cumnock, 7.2 km north of the closest turbine of the proposed development. The viewpoint provides an appropriate location to represent the potential effects of the proposed development upon residents at Mansfield and road users travelling along Mansfield Road. **Figure 7.3.6 Volume III** shows: a) the viewpoint location; b) the existing view and a wireframe of the proposed development (including any other built/ consented windfarms within the view); c) a 75° panoramic photomontage of the proposed development and d) a 40° enlargement of the photomontage.
- 7.10.75. From this viewpoint Hare Hill and also the consented Hare Hill Extension Windfarms are seen in views to the southeast beyond the image frame, High Park single turbine is fully visible and Windy Standard and Extension Windfarm are partially seen in the distance to the south.

Description of Existing View

- 7.10.76. The existing view looks south towards the proposed development and shows a long distance view across the surrounding farmland to the rising edge of the Southern Uplands to the south. In the foreground timber post and wire fence enclosed fields set to pasture are traversed by the embankment of the railway line, lined with tall grass and scrub, with the settlement of New Cumnock and pastoral fields bounded by stone walls beyond. From this viewpoint, New Cumnock is sheltered by the northern slope of Dalhanna Hill with the single turbine of High Park visible on the hill against the skyline, more distant hills to the right of the image are covered in the dense plantations of Carsphairn Forest. To the left, beyond the edge of the image, Hare Hill Windfarm appears above the ridgeline.

Visual Sensitivity

- 7.10.77. The overall sensitivity of receptors at this location is considered to be High for residents and Medium for road users. The factors that have contributed to this judgement are as follows:

Susceptibility to Change: **High** for residents and **Medium** for road users.

- Awareness of views from Mansfield are likely to be high for residents.

- Awareness of views along the minor road, particularly towards the west and to views of the prevailing landscape are likely to be medium for road users.

Value attached to View: Medium

- The viewpoint is located within the Glen Afton and Glenmuir Sensitive Landscape Character Area.

Magnitude of Change

7.10.78. The effects on visual receptors have been evaluated according to the nature of the change to the view in terms size, scale and character; the geographical extent of the predicted visibility and its duration as part of the overall visual experience of the receptor as follows:

Size or Scale (including nature of influence on the character of the view)

- The predicted wireframe and photomontage show that the proposed development is partially screened by Dalhanna Hill, with the northern portion of the array seen in the distance on distant skyline of the Southern Uplands. The proposed windfarm occupies 15.4° of the view.
- The proposed development will introduce new vertical elements clustered within the edge of the Carsphairn Forest, seen within the distant uplands and extending across small component of the encircling hills, framing the upland basin of upper Nithsdale.
- The predicted wireframe and photomontage show an evenly spaced array of 19 turbines is visible. The turbines will appear within the rolling hills to the south of New Cumnock, seen against the skyline with twelve of the turbines visible to hub height and seven turbines visible to parts of their blades only.

Geographical Extent (including influence on focus of the view)

- The view to the proposed development, which lies to the south at 193° to the viewpoint, will be seen by residents in filtered south facing views from the settlement and for road users in filtered views through roadside hedgerows, at a right angle to the direction of travel.
- The proposed development will be seen over a medium separation distance of 7.20 km to the nearest turbine.
- The change to the view occurs within a small component of the south facing panorama and within the context of 360° views to the encircling hills.
- The turbines will be experienced in the context of views to the existing windfarms of Hare Hill, High Park single turbine and Windy Standard and also the consented Hare Hill Extension.

Judgement on Magnitude of Change

Based on factors considered above, the overall magnitude of change to this viewpoint is considered to be Slight.

Level and Significance of Effect

The combination of the individual judgements of **High** sensitivity for residents and **Medium** sensitivity for road users and a **Slight** magnitude of change is considered to result in a **Moderate** effect for residents and a **Moderate/Minor** level of effect for road users. In the context of this assessment this is considered to be **Not Significant** for residents and road users.

Viewpoint 7: Minor Road near Mounthope Farm

Location and Rationale for Selection

7.10.79. Viewpoint 7 is located close on a minor road, north of Mounthope Farm and approximately 2.2 km northeast of New Cumnock and 8.50 km northeast of the closest turbine of the proposed development,. The viewpoint provides an appropriate position to represent the potential effects of the proposed development upon residents at Mounthope Farm and road users. **Figure 7.3.7 Volume III** shows: a) the viewpoint location; b) the existing view and a wireframe of the proposed development (including any other built/ consented windfarms within the view); c) a 75° panoramic photomontage of the proposed development and d) a 40° enlargement of the photomontage.

Description of Existing View

7.10.80. The existing view looks south towards the proposed development. In the foreground is the minor road connecting scattered farms to Mansfield Road passing through an open upland grazing land framed by stone walls and timber post and wire fencing. Beyond the the wall defining the near horizon the patchwork of fields across upper Nithsdale are seen extending across the lower hill slopes and valley sides, with narrow incised burns and associated woodland. The fields give way to open moorland on the higher slopes.

7.10.81. Along the ridgeline, to the left of the image are the turbines of Hare Hill Windfarm whilst in the centre of the image High Park single turbine can be seen on the skyline with the more distant turbines of Windy Standard just discernable beyond. The consented wind development of Afton will be visible from this viewpoint, as indicated on the wireframe, with the turbines of Afton seen on the distant horizon to the right of Windy Standard.

Visual Sensitivity

7.10.82. The overall sensitivity of receptors at this location is considered to be High for residents and Medium for road users. The factors that have contributed to this judgement are as follows:

Susceptibility to Change: **High** for residents and **Medium** for road users.

- Awareness of views from Mounthope Farm is likely to be high for residents.
- Awareness of views along the minor road and the prevailing landscape is likely to be medium for road users.

Value attached to View: Medium

- The viewpoint is located within and overlooking the Glen Afton and Glenmuir Sensitive Landscape Character Area.

Magnitude of Change

7.10.83. The effects on visual receptors have been evaluated according to the nature of the change to the view in terms size, scale and character; the geographical extent of the predicted visibility and its duration as part of the overall visual experience of the receptor as follows:

Size or Scale (including nature of influence on the character of the view)

- The predicted wireframe and photomontage shows all the turbines of the proposed development are visible from this viewpoint as an extended array seen in the same field of view as Windy Standard, Afton, High Park single turbine and Hare Hill Windfarms and Extension. The proposed windfarm occupies 13.2° of the view.
- The proposed development will constitute a relatively prominent new feature within the open landscape introducing new vertical elements into the northern edge of the Southern Uplands.
- The predicted wireframe shows an evenly spaced array seen against the skyline with twenty of the turbines visible to hub height and one turbine visible to part of the blade only.
- The turbines will be mostly seen against the skyline and within the upland forested landscape, in proportion to the scale of the underlying hills.

Geographical Extent (including influence on focus of the view)

- The view to the proposed development, which lies to the south at 197° to the viewpoint and similar views will be seen by residents in the scattered properties served from the minor road above upper Nithsdale.
- The proposed development will be seen over a medium separation distance of 8.50 km to the nearest turbine.
- The change to the view occurs within a small component of the southwestern aspect and within the context of expansive panoramic views to the encircling hills.
- The turbines will be experienced in the context of views to the existing windfarms of Hare Hill, High Park single turbine and Windy Standard and also the consented Afton and Hare Hill Extension.

Judgement on Magnitude of Change

Based on factors considered above, the overall magnitude of change to this viewpoint is considered to be Slight.

Level and Significance of Effect

The combination of the individual judgements of **High** for residents and **Medium** sensitivity for road users and a **Slight** magnitude of change are considered to result in a **Moderate** effect for residents and a **Moderate/Minor** level of effect for road users. In the context of this assessment this is considered to be **Not Significant** for residents and road users.

Viewpoint 8: Layby A76, near Calton Farm

Location and Rationale for Selection

7.10.84. Viewpoint 8 is located at a layby on the A76, near Calton Farm, between the settlements of Cumnock and New Cumnock, 10.0 km north of the closest turbine of the proposed development. The viewpoint provides an appropriate position to represent the potential effects of the proposed development upon road users travelling along the A76. **Figure 7.3.8 Volume III** shows: a) the viewpoint location; b) the existing view and a wireframe of the proposed development (including any other built/ consented windfarms within the view); c) a 75° panoramic photomontage of the proposed development and d) a 40° enlargement of the photomontage.

Description of Existing View

7.10.85. The existing view looks south along the road corridor, which passes through an open rolling pastoral landscape of fields enclosed by hedgerows and tree belts. A cutting in the foreground contains the view to the right of the image, focussing the view to the distant rising edge of the Southern Uplands, mantled with the forestry plantations of the Carsphairn Forest.

7.10.86. The turbines of Afton, Windy Standard and Windy Standard Extension are visible above the distant ridgeline and Hare Hill and Extension Windfarms are theoretically visible to the left of the image.

Visual Sensitivity

7.10.87. The overall sensitivity of receptors at this location is considered to be Medium for road users. The factors that have contributed to this judgement are as follows:

Susceptibility to Change: **Medium** for road users.

- Awareness of views along the A76 and the prevailing landscape are likely to be medium for road users.

Value attached to View: Low

- The viewpoint is not within or overlooking a designated landscape.

Magnitude of Change

7.10.88. The effects on visual receptors have been evaluated according to the nature of the change to the view in terms size, scale and character; the geographical extent of the predicted visibility and its duration as part of the overall visual experience of the receptor as follows:

Size or Scale (including nature of influence on the character of the view)

- The predicted wireframe and photomontage shows the proposed development from this viewpoint as three adjacent arrays, following the falling ridgelines and seen on the distant skyline. The proposed windfarm occupies 13.4° of the view.
- The proposed development will constitute a relatively prominent feature within the open landscape introducing additional vertical elements within the upland forestry and in the context of the existing windfarm development.

- The predicted wireframe shows three evenly spaced, coherent arrays with all of the turbines visible. The turbines will appear in balance and proportion with the scale of the Southern Uplands.
- The montage shows that in reality six of the turbines will be filtered from view by intervening roadside vegetation. The turbines will be mostly seen against the skyline and will contrast with blue skies in clear weather and blend more into the background with duller conditions.
- For southbound vehicle users, views of the turbines will be of short duration along the A76.

Geographical Extent (including influence on focus of the view)

- The view to the proposed development, which lies to the south at 173° to the viewpoint, will be seen intermittently by road users along this winding section of the A76, with views frequently contained by landscape and vegetation cover.
- The proposed development will be seen over a long separation distance of 10.00 km to the nearest turbine.
- The change to the view occurs within the south southeast facing aspect, with views of pastoral fields and the distant plantation topped Southern Uplands channelled by roadside vegetation. For southbound travellers, attention will be intermittently drawn to the proposed development, as a direction of the route changes.

Judgement on Magnitude of Change

Based on factors considered above, the overall magnitude of change to this viewpoint is considered to be Moderate for road users.

Level and Significance of Effect

- 7.10.89. The combination of the individual judgements of **Medium** sensitivity for road users and **Moderate** magnitude of change, is considered to result in a **Moderate** effect for road users. In the context of this assessment this is considered to be **Not Significant**.

Viewpoint 9: Minor road near Auchincross Farm

Location and Rationale for Selection

- 7.10.90. Viewpoint 9 is located on a minor road near Auchincross Farm, 4 km west of New Cumnock and 7.77 km northwest of the closest turbine of the proposed development. The viewpoint provides an appropriate position to represent the potential effects of the proposed development upon road users on the network of minor roads between Cumnock and New Cumnock. **Figure 7.3.9 Volume III** shows: a) the viewpoint location; b) the existing view and a wireframe of the proposed development (including any other built/ consented windfarms within the view); c) a 75° panoramic photomontage of the proposed development and d) a 40° enlargement of the photomontage.

Description of Existing View

- 7.10.91. The existing view looks southeast towards the proposed application site looking across the broad upland basin at New Cumnock to the northern edge of the Southern Uplands. The profile of the site is visible as three adjacent ridges rising gently to smooth hills, mantled with extensive forestry plantations. The higher and more distinctive Blackcraig Hill rises to the left of the image. Pastoral fields enclosed by stone walls and timber post and wire fencing and scattered farmsteads are visible throughout the basin as well as the cluster of residential properties at Burnside.
- 7.10.92. Turbines forming the Windy Standard and Windy Standard Extension Windfarms are visible above dense forestry within the centre of the view and those forming Hare Hill Windfarm are visible beyond the left hand edge of the image. The consented windfarms at Afton and Hare Hill Extension will also be visible from this viewpoint, as indicated on the predicted wireframe.

Visual Sensitivity

- 7.10.93. The overall sensitivity of receptors at this location is considered to be Medium for road users. The factors that have contributed to this judgement are as follows:

Susceptibility to Change: **Medium** for road users.

- Awareness of views along the minor road and the prevailing landscape are likely to be medium for road users.

Value attached to View: Medium

- The viewpoint looks across the Glen Afton and Glenmuir Sensitive Landscape Character Area.

Magnitude of Change

- 7.10.94. The effects on visual receptors have been evaluated according to the nature of the change to the view in terms size, scale and character; the geographical extent of the predicted visibility and its duration as part of the overall visual experience of the receptor as follows:

Size or Scale (including nature of influence on the character of the view)

- The predicted wireframe and photomontage shows the proposed development from this viewpoint is located within the undramatic hills to the southeast, located to the west of Glen Afton and away from prominent profile of Blackcraig Hill. The proposed windfarm theoretically occupies 18.3° of the view.
- The wireframe shows that the proposed turbines will introduce new vertical components into the landscape. All of the turbines will be theoretically visible from this location, with thirteen to full height and eight partially seen with hubs and blades visible.
- The proposed turbines will be seen as three adjacent arrays, carefully designed to reflect the underlying flow of the landscape and in proportion to the scale of the underlying hills.
- The turbines will be mostly seen against the skyline, in the context of the existing Windy Standard and consented Afton turbines.

- For vehicle users, views of the turbines will be of a short duration.

Geographical Extent (including influence on focus of the view)

- The view to the proposed development, which lies to the southeast at 157° to the viewpoint and will be seen by southbound road users along the minor road.
- The proposed development will be seen over a medium separation distance of 7.77 km to the nearest turbine.
- The change to the view occurs within the southeast facing aspect and within the less dramatic portion of the encircling hills, maintaining the more distinct hills and flowing pastoral lowlands as the focus of the view.

Judgement on Magnitude of Change

Based on factors considered above, the overall magnitude of change to this viewpoint is considered to be Moderate for road users.

Level and Significance of Effect

- 7.10.95. The combination of the individual judgements of **Medium** sensitivity for road users and **Moderate** magnitude of change are considered to result in a **Moderate** level of effect for road users. In the context of this assessment this is considered to be **Not Significant**.

Viewpoint 10: Minor Road at Guffock Hill above Nithsdale

Location and Rationale for Selection

- 7.10.96. Viewpoint 10 is located on a minor road at Guffock Hill, which leads north from the A76, 5.5 km northwest of Sanquhar, 15.47 km northeast to the closest turbine of the proposed development. The viewpoint provides an appropriate position to represent the potential effects of the proposed development upon visitors to the Southern Uplands above Nithsdale. **Figure 7.3.10 Volume III** shows: a) the viewpoint location; b) the existing view and a wireframe of the proposed development (including any other built/ consented windfarms within the view); c) a 75° panoramic photomontage of the proposed development and d) a 40° enlargement of the photomontage.

Description of Existing View

- 7.10.97. The existing view looks southwest towards the settlements of New Cumnock and Kirkconnel and to the Carsphairn Forest beyond. The foreground view is across moorland on the south western slope of Guffock Hill to the Southern Uplands beyond, Blackcraig Hill is prominent in the centre of the image. The turbines of Windy Standard and Extension and Hare Hill Windfarms are visible on hill tops and along the distant ridgeline together with the consented windfarms at Afton and Hare Hill Extension. The consented Saquhar Community and Whiteside Hill Windfarms will be visible to the left of the image.

Visual Sensitivity

- 7.10.98. The overall sensitivity of receptors at this location is considered to be Medium for road users. The factors that have contributed to this judgement are as follows:

Susceptibility to Change: **Medium** for road users.

- Awareness of views along the minor road and the prevailing landscape are likely to be medium for road users.

Value attached to View: Low

- Viewpoint not within or overlooking a designated landscape.

Magnitude of Change

7.10.99. The effects on visual receptors have been evaluated according to the nature of the change to the view in terms size, scale and character; the geographical extent of the predicted visibility and its duration as part of the overall visual experience of the receptor as follows:

Size or Scale (including nature of influence on the character of the view)

- The predicted wireframe and photomontage illustrate that the proposed development will be partially visible within the hills to the southwest from this viewpoint. The proposed windfarm theoretically occupies 2.7° of the view and will form a minor new element within the landscape.
- The wireframe shows that the proposed turbines will introduce small scale vertical components into the landscape. Five of the turbines will be theoretically visible from this location with two of the turbines visible to hub height and three with only blades visible.
- The proposed turbines will be seen within a dip in the hills, on the horizon and against the skyline, seen within and as part of the existing wind development.
- The turbines will be seen against the skyline and will contrast with blue skies in clear weather, blending further into the background with duller conditions.
- For vehicle users, views of the turbines will be of a short duration.

Geographical Extent (including influence on focus of the view)

- The view to the proposed development, which lies to the southwest at 240° to the viewpoint, will be seen by travellers along the minor road.
- The proposed development will be seen over a long separation distance of 15.47 km to the nearest turbine.
- The change to the view occurs within the southwest facing aspect, which is focussed on the long distance panorama of rolling hills and Nithsdale.

Judgement on Magnitude of Change

Based on factors considered above, the overall magnitude of change to this viewpoint is considered to be Negligible for road users.

Level and Significance of Effect

The combination of the individual judgements of **Medium** sensitivity for road users and a **Negligible** magnitude of change are considered to result in a **Minor** level of effect for road users. In the context of this assessment this is considered to be **Not Significant**.

Viewpoint 11: Southern Upland Way at the summit of Benbrack

Location and Rationale for Selection

7.10.100. Viewpoint 11 is located on the Southern Upland Way at the summit of Benbrack, southwest of New Cumnock, 10.70 km southeast of the closest turbine of the proposed development. The viewpoint provides an appropriate position to represent the potential effects of the proposed development upon walkers on the Southern Upland Way at the summit of Benbrack. **Figure 7.3.11 Volume III** shows: a) the viewpoint location; b) the existing view and a wireframe of the proposed development (including any other built/ consented windfarms within the view); c) a 75° panoramic photomontage of the proposed development and d) a 40° enlargement of the photomontage.

Description of Existing View

7.10.101. The existing view looks northwest across the western edge of the extensive Carsphairn Forest. In the foreground is grassland on the summit of and north western slope of Benbrack with broad rounded hills beyond including Dodd Hill and Ewe Hill. Extensive forestry plantations are visible in the central frame, rising geometrically in the glen below between the south western slope of Ewe Hill and Mid Rig. Smaller patches of woodland and forestry are located throughout the view.

7.10.102. On the summit of Windy Standard hill on the horizon are the turbines of Windy Standard and Windy Standard Extension Windfarms to the left and also Hare Hill Windfarm is visible to the right of the image. The consented windfarms at Afton and Hare Hill Extension will also be visible on the horizon, as indicated on the predicted wireframe.

Visual Sensitivity

7.10.103. The overall sensitivity of receptors at this location is considered to be High for walkers. The factors that have contributed to this judgement are as follows:

Susceptibility to Change: **High** for walkers.

- Awareness of views along the Southern Upland Way, at the summit of Benbrack and the prevailing landscape are likely to be high for walkers.

Value attached to View: Low

- Viewpoint not within or overlooking a designated landscape.

Magnitude of Change

7.10.104. The effects on visual receptors have been evaluated according to the nature of the change to the view in terms size, scale and character; the geographical extent of the predicted visibility and its duration as part of the overall visual experience of the receptor as follows:

7.10.105. *Size or Scale (including nature of influence on the character of the view)*

- The predicted wireframe and photomontage illustrate partial views to the proposed development from this viewpoint, located within the hills to the northwest. The proposed windfarm theoretically occupies 2.3° of the view and will form a minor new element within the landscape.
- The wireframe shows that the proposed turbines will introduce small scale vertical components into the landscape. Eight of the turbines will be theoretically visible from this location with three of the turbines visible to hub height and five with only blades visible.
- The proposed turbines will be seen on the horizon within a dip in the hills and will be seen within the context of the existing windfarm developments and forestry uses. The turbines will be seen against the skyline and will contrast with blue skies in clear weather, blending further into the background with duller conditions.
- For walkers on the Southern Upland Way, views of the turbines will be of a short duration whilst they cross the summit area of Benbrack.

Geographical Extent (including influence on focus of the view)

- The view to the proposed development, which lies to the northwest at 323° to the viewpoint, will be seen by walkers along the Southern Upland Way, the summit and summit approaches of Benbrack.
- The proposed development will be seen over a long separation distance of 10.70 km to the nearest turbine.
- The change to the view occurs within the northwest facing aspect, in the context of existing windfarms and forestry plantations and will be experienced as part of expansive panoramic views across the Southern Uplands.

Judgement on Magnitude of Change

Based on factors considered above, the overall magnitude of change to this viewpoint is considered to be Negligible for walkers.

Level and Significance of Effect

The combination of the individual judgements of **High** sensitivity for walkers and **Negligible** magnitude of change are considered to result in a **Moderate/Minor** level of effect for walkers. In the context of this assessment this is considered to be **Not Significant**.

Viewpoint 12: Summit of Cairnsmore of Carsphairn

Location and Rationale for Selection

7.10.106. Viewpoint 12 is located on the summit of Cairnsmore of Carsphairn, overlooking the southern edge of the Carsphairn Forest, 7.37 km south of the closest turbine of the proposed development. The viewpoint provides an appropriate position to represent the potential effects of the Pencloe Windfarm upon recreational users, particularly walkers. **Figure 7.3.12 Volume III** shows: a) the viewpoint location; b) the existing view and a wireframe of the proposed development (including any other built/

consented windfarms within the view); c) a 75° panoramic photomontage of the proposed development and d) a 40° enlargement of the photomontage.

Description of Existing View

7.10.107. The existing view looks north towards the application site and shows a long distance view across the northern edge of the Southern Uplands and the Ayrshire Basin beyond. In the foreground the broad summit of Cairnsmore of Carsphairn is visible covered by grass and rocky outcrops. The Carsphairn Forest is seen beyond extending across the hilly terrain of the northern edge of the Southern Uplands. Beyond are small scattered settlements including Cumnock and farmsteads and dispersed patches of woodland plantation within valley areas. To the right of the existing view are the windfarms at Windy Standard and Windy Standard Extension in the middle ground and Hare Hill Windfarm beyond. The consented windfarms at Afton and Hare Hill Extension will also be visible from this viewpoint, as indicated on the predicted wireframe. Blackcraig Hill is seen as the prominent peak rising to the right of the image.

Visual Sensitivity

7.10.108. The overall sensitivity of receptors at this location is considered to be High for walkers. The factors that have contributed to this judgement are as follows:

Susceptibility to Change: **High** for walkers.

- Awareness of views at the summit of and along the northern slope of Cairnsmore of Carsphairn and the prevailing landscape are likely to be high for walkers.

Value attached to View: Medium

- Viewpoint within the Galloway Hills Regional Scenic Area and overlooking the Glen Afton and Glenmuir Sensitive Landscape Character Area.

Magnitude of Change

7.10.109. The effects on visual receptors have been evaluated according to the nature of the change to the view in terms size, scale and character; the geographical extent of the predicted visibility and its duration as part of the overall visual experience of the receptor as follows:

Size or Scale (including nature of influence on the character of the view)

- The predicted wireframe and photomontage shows the proposed development will be clearly seen from this viewpoint to the north. The proposed windfarm theoretically occupies 17.5° of the view and will form a new element within the landscape.
- The wireframe shows that the proposed turbines will introduce new vertical components into the landscape. All of the turbines will be theoretically visible from this location.
- The proposed turbines will be seen located within the hills below the viewpoint with the turbines viewed against a backdrop of moorland and forestry.

- The wireframe and montage show that, from this location, several existing windfarm developments are visible and the proposed development will be seen within this context. The turbines will be seen to the left of and beyond the turbines of Windy Standard and Windy Standard Extension and as a group will appear indistinguishable from them. Due to the perspective effect the turbines will appear at a broadly common scale.
- The cut platforms for the crane hardstandings will be partially visible from this viewpoint, contrasting with the moorland, along with the other associated infrastructure elements such as the control and substation building and the access and site tracks.
- For walkers, views of the turbines will be of a short duration.

Geographical Extent (including influence on focus of the view)

- The view to the proposed development, which lies to the north at 8° to the viewpoint, will be seen by walkers at the summit of and along the northern slope of Cairnsmore of Carsphairn.
- The proposed development will be seen over a medium separation distance of 7.37 km to the nearest turbine.
- The change to the view occurs within the north facing aspect, with views of an expansive upland area with existing windfarm development and forestry plantations on the hill tops and upper slopes across the northern sector of the view. The view will be seen in the context of expansive 360° views from the summit of Cairnsmore of Carsphairn and will form a relatively minor element in the wider panorama.

Judgement on Magnitude of Change

Based on factors considered above, the overall magnitude of change to this viewpoint is considered to be Slight for walkers.

Level and Significance of Effect

The combination of the individual judgements of **High** sensitivity for walkers and **Slight** magnitude of change are considered to result in a **Moderate** level of effect for walkers. In the context of this assessment this is considered to be **Not Significant**.

Viewpoint 13: Minor Road at Lamford

Location and Rationale for Selection

7.10.110. Viewpoint 13 is located on a minor road, along the northern slope of Lamford Hill, to the southwest of New Cumnock, 8.25 km southwest to the closest turbine of the proposed development. The viewpoint provides an appropriate position to represent the potential effects of the proposed development upon road users. **Figure 7.3.13 Volume III** shows: a) the viewpoint location; b) the existing view and a wireframe of the proposed development (including any other built/ consented windfarms within the view); c) a 75° panoramic photomontage of the proposed development and d) a 40° enlargement of the photomontage.

Description of Existing View

7.10.111. The existing view looks northeast towards the proposed development and shows a medium distance view towards the north eastern edge of the Carsphairn Forest. Interlocking hills, covered in a mix of grassland and forestry plantations frame views to the valley of the Water of Deugh. Extensive areas of woodland plantation extend across the hills with areas of recently felled trees and young plantation on hill slopes to the right of the image. Within the centre of the view, above the distant ridgeline the turbines forming part of Windy Standard Windfarm and Extension and Afton will be seen.

Visual Sensitivity

7.10.112. The overall sensitivity of receptors at this location is considered to be Medium for road users. The factors that have contributed to this judgement are as follows:

Susceptibility to Change: **Medium** for road users.

- Awareness of views along the minor road and the prevailing landscape are likely to be medium for road users.

Value attached to View: Low

- Viewpoint not within or overlooking a designated landscape.

Magnitude of Change

7.10.113. The effects on visual receptors have been evaluated according to the nature of the change to the view in terms size, scale and character; the geographical extent of the predicted visibility and its duration as part of the overall visual experience of the receptor as follows:

Size or Scale (including nature of influence on the character of the view)

- The predicted wireframe and photomontage shows the proposed development from this viewpoint to the northeast. The proposed windfarm theoretically occupies 13.0° of the view and will appear within the existing context of Windy Standard and Windy Standard Extension Windfarms.
- The wireframe shows that the proposed turbines will introduce new vertical components into the landscape. Nineteen of the turbines will be theoretically visible from this location, with thirteen of the turbines visible to hub height and six visible to blades only.
- The proposed turbines will be seen on the horizon. Views to lower parts of the turbines will be screened by intervening forestry blocks.
- The turbines will be seen against the skyline and will contrast with blue skies in clear weather, blending further into the background with duller conditions.
- From this location the proposed development will be seen within this context of existing wind development, within a managed commercial forestry setting and will appear to be seen as part of the Windy Standard Extension and Afton Windfarms.
- For road users, views of the turbines will be of a short duration.

Geographical Extent (including influence on focus of the view)

- The view to the proposed development, which lies to the northeast at 44° to the viewpoint, will be seen by northbound road users from the minor road.
- The proposed development will be seen over a medium separation distance of 8.25 km to the nearest turbine.
- The change to the view occurs within the northeast facing aspect, with views from the road framed by the adjacent hills.

Judgement on Magnitude of Change

Based on factors considered above, the overall magnitude of change to this viewpoint is considered to be Slight for road users.

Level and Significance of Effect

The combination of the individual judgements of **Medium** sensitivity for road users and **Slight** magnitude of change are considered to result in a **Moderate/Minor** level of effect for road users. In the context of this assessment this is considered to be **Not Significant** for road users.

Viewpoint 14: Penders Wynd, Netherthird, Cumnock

Location and Rationale for Selection

7.10.114. Viewpoint 14 is located on the A76 at Netherthird, on the southern edge of Cumnock, 11.51 km north of the closest turbine of the proposed development. The viewpoint provides an appropriate position to represent the potential effects of the Pencloe Windfarm upon eastbound travellers on the A76 and residents at the edge of the settlement. **Figure 7.3.14 Volume III** shows: a) the viewpoint location; b) the existing view and a wireframe of the proposed development (including any other built/ consented windfarms within the view); c) a 75° panoramic photomontage of the proposed development and d) a 40° enlargement of the photomontage.

Description of Existing View

7.10.115. The existing view looks south towards the proposed development and shows a medium distance view towards the northern edge of the Southern Uplands and the Carsphairn Forest. The lowlands in the foreground are a patchwork of pastoral fields framed by hedgerows, timber post and wire fencing and tree belts. Single trees and farmsteads are scattered throughout the gently rolling landform, with the distant hills rising in the background. To the left of the existing view, along the ridgeline are turbines forming Hare Hill Windfarm and Windy Standard (and Extension) are visible in the centre of the view. The predicted wireframe indicates that the consented Afton and Hare Hill Extension windfarms will also be visible from this viewpoint, with the turbines of Afton seen on the distant horizon to the left of Pencloe.

Visual Sensitivity

7.10.116. The overall sensitivity of receptors at this location is considered to be High for residents and Medium for road users. The factors that have contributed to this judgement are as follows:

Susceptibility to Change: **High** for residents and **Medium** for road users.

- Awareness of views from Penders Wynd are likely to be high for residents.
- Awareness of views across the prevailing landscape are likely to be medium for road users.

Value attached to View: Low

- Viewpoint not within or overlooking a designated landscape.

Magnitude of Change

7.10.117. The effects on visual receptors have been evaluated according to the nature of the change to the view in terms size, scale and character; the geographical extent of the predicted visibility and its duration as part of the overall visual experience of the receptor as follows:

Size or Scale (including nature of influence on the character of the view)

- The predicted wireframe and photomontage illustrate that the proposed development will be visible in distant views to the south. The proposed windfarm theoretically occupies 12.0° of the view.
- The wireframe shows that the proposed turbines will introduce new small scale vertical components into the landscape. All of the turbines will be theoretically visible from this location, with twenty of the turbines visible to hub height and one turbine visible to blades only.
- The proposed turbines will be seen on the horizon with their blades seen against the skyline contrasting with lighter skies, but the turbine towers will be seen to blend into the underlying forested hills.
- From this location the existing turbines of Windy Standard and Windy Standard Extension and the consented turbines of Afton will be distinguishable on the far horizon and the proposed development will be seen within this context, slightly to the fore of the existing wind development.
- For road users, views of the turbines will be of a short duration.

Geographical Extent (including influence on focus of the view)

- The view to the proposed development, which lies to the south at 167° to the viewpoint, will be seen by residents and road users along Penders Wynd, with similar views experienced from the adjacent A76.
- The proposed development will be seen over a long separation distance of 11.51 km to the nearest turbine and will comprise a distant new element within the landscape.
- The change to the view occurs within the south facing aspect on the northern edge of the distant Southern Uplands and Carsphairn Forest and will constitute only a minor component of the wider views across the prevailing pastoral fields and gently rolling hills.

Judgement on Magnitude of Change

7.10.118. Based on factors considered above, the overall magnitude of change to this viewpoint is considered to be Slight.

Level and Significance of Effect

7.10.119. The combination of the individual judgements of **High** for residents and **Medium** sensitivity for road users and a **Slight** magnitude of change are considered to result in a **Moderate** effect for residents and a **Moderate/Minor** level of effect for road users. In the context of this assessment this is considered to be **Not Significant** for residents and road users.

Viewpoint 15: Catrine Road, B705, Mauchline

Location and Rationale for Selection

7.10.120. Viewpoint 15 is located on Catrine Road and the B705 in Mauchline, northwest of Cumnock, 22.04 km northwest of the closest turbine of the proposed development. The viewpoint provides an appropriate position to represent the potential effects of the Pencloe Windfarm upon residents of Mauchline and east bound road users. **Figure 7.3.15 Volume III** shows: a) the viewpoint location and b) the existing view and a wireframe of the proposed development (including any other built/ consented windfarms within the view).

Description of Existing View

7.10.121. The existing view looks southeast towards the proposed development across the well vegetated, farmed lowlands of the Ayrshire Basin. Pastoral fields and arable fields are set within a framework of hedgerows, tree belts, woodland and forestry plantations. The woodlands beside the western edge of Ballochmyle Golf Course are seen to the left of the image and those beside the River Ayr are seen to the centre and right of the image. Farmsteads are scattered throughout the lowlands with the northern edge of the settlement at Ochiltree to the right. Rugged, distant hills with dense plantation on hill tops and slopes are located on the north western edge of the Southern Uplands.

7.10.122. The predicted wireframe shows the turbines of Windy Standard and Extension and the consented scheme of Afton in the centre of the image beyond the Pencloe turbines. Hare Hill, Hare Hill Extension, Sanquar Community and Whiteside Hill are indicated on the horizon to the right.

Visual Sensitivity

7.10.123. The overall sensitivity of receptors at this location is considered to be High for residents and Medium for road users. The factors that have contributed to this judgement are as follows:

Susceptibility to Change: **High** for residents and **Medium** for road users.

- Awareness of views from Catrine Road are likely to be high for residents.
- Awareness of views along Catrine Road and the prevailing landscape are likely to be medium for road users.

Value attached to View: Medium

- The viewpoint overlooks the Upper Ayr Sensitive Landscape Character Area.

Magnitude of Change

7.10.124. The effects on visual receptors have been evaluated according to the nature of the change to the view in terms size, scale and character; the geographical extent of the predicted visibility and its duration as part of the overall visual experience of the receptor as follows:

Size or Scale (including nature of influence on the character of the view)

- The predicted wireframe illustrates the proposed development will be visible in distant views from this viewpoint to the southeast. The proposed windfarm theoretically occupies 7.3° of the view and will form a relatively small proportion of the outlook.
- The wireframe shows that the proposed turbines will introduce new small scale vertical components into the landscape. All of the turbines will be theoretically visible from this location with all of the turbines visible to hub height.
- The proposed turbines will be seen on the horizon with their blades seen against the skyline contrasting with lighter skies but the turbine towers blending into the distant forested backdrop.
- From this location the existing turbines of Windy Standard and Windy Standard Extension and the consented turbines of Afton are theoretically visible on the far horizon and the proposed development will be seen within the context of this existing windfarm development.
- For road users, views of the turbines will be of a short duration.

Geographical Extent (including influence on focus of the view)

- The view to the proposed development, which lies to the southeast at 152° to the viewpoint, will be seen by residents and road users along Catrine Road.
- The proposed development will be seen over a long separation distance of 22.04 km to the nearest turbine and will comprise a distant new element within the landscape.
- The change to the view occurs within the south facing aspect, within the context of foreground views across a richly vegetated landscape of pastoral and arable fields, as a minor component of the view within the distant hills.

Judgement on Magnitude of Change

7.10.125. Based on factors considered above, the overall magnitude of change to this viewpoint is considered to be Negligible.

Level and Significance of Effect

7.10.126. The combination of the individual judgements of **High** for residents and **Medium** sensitivity for road users and a **Negligible** magnitude of change are considered to result in a **Moderate/Minor** effect for residents and **Minor** level of effect for road users. In the context of this assessment this is considered to be **Not Significant** for residents and road users.

Viewpoint 16: Summit of Corserine

Location and Rationale for Selection

7.10.127. Viewpoint 16 is located on the summit of Corserine, forming the highest peak in the Rhinns of Kells, 20.6 km southwest of the closest turbine of the proposed development. The viewpoint provides an appropriate position to represent the potential effects of the proposed development upon recreational users, particularly walkers. **Figure 7.3.16 Volume III** shows: a) the viewpoint location and b) the existing view and a wireframe of the proposed development (including any other built/ consented windfarms within the view).

Description of Existing View

7.10.128. The existing view looks northeast towards the proposed application site and shows an expansive long distance view across the northern Rhinns of Kells to the Carsphairn Forest and beyond. In the foreground is the grass and rocky outcrop covered broad summit ridge of Corserine gives way to views across the grass covered Rhinns of Kells, with forestry plantations beneath and then more distant views to the prominent summit of Carsphairn of Cairnsmore and the extensive plantations of the Carsphairn Forest to its left. Towards the centre of the image, the turbines of Windy Standard and Extension and Hare Hill Windfarms are visible with the more distant windfarms of Whiteside Hill to the right and Whitelee to the left. The predicted wireframe indicates that the consented Afton and Hare Hill Extension windfarms will also be visible from this viewpoint.

Visual Sensitivity

7.10.129. The overall sensitivity of receptors at this location is considered to be High for walkers. The factors that have contributed to this judgement are as follows:

Susceptibility to Change: **High** for walkers.

- Awareness of views at the summit of and along the north eastern slope of Corserine and the prevailing landscape are likely to be high for walkers.

Value attached to View: Medium

- The viewpoint is within and overlooks the Galloway Hills Regional Scenic Area.

Magnitude of Change

7.10.130. The effects on visual receptors have been evaluated according to the nature of the change to the view in terms size, scale and character; the geographical extent of the predicted visibility and its duration as part of the overall visual experience of the receptor as follows:

Size or Scale (including nature of influence on the character of the view)

- The predicted wireframe and photomontage illustrate the proposed development which is seen as a distant element to the northeast. The proposed windfarm theoretically occupies 5.9° of the view and will form a small proportion of the available panoramic view.
- The wireframe and photomontage show that the proposed turbines will introduce new small scale vertical components into the landscape. All of the

turbines will be theoretically visible from this location with all of the hubs showing.

- The proposed turbines will be seen set within the rolling hills to the northeast and seen against a distant moorland backdrop. The turbines will be seen in contrast with the existing soft hues of the moorland and dark forestry plantations.
- From this location the existing turbines of Windy Standard and Hare Hill and also the consented Afton and Hare Hill Extension are visible within the distant hills and the proposed development will be seen as an addition to this group and perceived within this context.
- For walkers, views of the turbines will be of a short duration.

Geographical Extent (including influence on focus of the view)

- The view to the proposed development, which lies to the northeast at 30° to the viewpoint, will be seen by walkers at the summit of Corserine and along the north eastern ridgeline.
- The proposed development will be seen over a long separation distance of 20.6 km to the nearest turbine.
- The change to the view occurs within the northeast facing aspect, as a minor component of the view and within the context of expansive 360° views.

Judgement on Magnitude of Change

7.10.131. Based on factors considered above, the overall magnitude of change to this viewpoint is considered to be Slight for walkers.

Level and Significance of Effect

7.10.132. The combination of the individual judgements of **High** sensitivity for walkers and **Slight** magnitude of change are considered to result in a **Moderate** level of effect for walkers. In the context of this assessment this is considered to be **Not Significant** for walkers.

Viewpoint 17: B743 at Crook Moss

Location and Rationale for Selection

7.10.133. Viewpoint 17 is located on the B743, 7 km northeast of Cumnock and 19.90 km north of the closest turbine of the proposed development. The viewpoint provides an appropriate position to represent the potential effects of the proposed development upon east and westbound road users. **Figure 7.3.17 Volume III** shows: a) the viewpoint location and b) the existing view and a wireframe of the proposed development (including any other built/ consented windfarms within the view).

Description of Existing View

7.10.134. The existing view looks south towards the proposed application site across large rough pastures enclosed by post and wire fencing in the foreground with the incised meandering upper River Ayr passing through the middleground and extensive forestry plantations beyond. In the distance are the undulating hills of the Southern Uplands

with distant views to Windy Standard and Windy Standard Extension, Hare Hill Windfarms and theoretical views to the consented Afton, Hare Hill Extension and Sanquhar Community windfarms.

Visual Sensitivity

7.10.135. The overall sensitivity of receptors at this location is considered to be Medium for road users. The factors that have contributed to this judgement are as follows:

Susceptibility to Change: **Medium** for road users.

- Awareness of views along the B743 and the prevailing landscape are likely to be medium for road users.

Value attached to View: Medium

- The viewpoint is located within and overlooks the Upper Ayr Sensitive Landscape Character Area.

Magnitude of Change

7.10.136. The effects on visual receptors have been evaluated according to the nature of the change to the view in terms size, scale and character; the geographical extent of the predicted visibility and its duration as part of the overall visual experience of the receptor as follows:

Size or Scale (including nature of influence on the character of the view)

- The predicted wireframe indicates that all 21 turbines, arranged in an array along northern slopes and hill tops, will be visible from this location. The proposed windfarm occupies a small 6.9° of the view from this location.
- The proposed turbines will introduce new small scale vertical components within a panoramic view. The predicted wireframe indicates partial views to the hubs and blade tips of the turbines which will be visible as distant new elements on the skyline in the context of the existing Hare Hill, Windy Standard and Windy Standard Extension turbines and also the consented Afton and Hare Hill Extension schemes.
- The proposed turbines will be seen on the horizon with their blades seen against the skyline contrasting with lighter skies and their lower parts generally blending into the distant moorland backdrop.
- For east and west bound road users, views of the turbines are anticipated to occur along parts of the B743 over c. 1 km of the route.

Geographical Extent (including influence on focus of the view)

- The view to the proposed development, which lies to the south at 180° to the viewpoint, will be seen by east and westbound road users along the B743.
- The proposed development will be seen over a long separation distance of 19.90 km to the nearest turbine.
- The change to the view occurs within the south facing aspect, away from the direction of travel.

Judgement on Magnitude of Change

7.10.137. Based on factors considered above, the overall magnitude of change to this viewpoint is considered to be Negligible for road users.

Level and Significance of Effect

7.10.138. The combination of the individual judgements of **Medium** sensitivity for road users and **Negligible** magnitude of change are considered to result in a **Minor** level of effect for road users. In the context of this assessment this is considered to **be Not Significant** for road users.

Viewpoint 18: Lowther Hill

Location and Rationale for Selection

7.10.139. Viewpoint 18 is located on the Southern Upland Way, towards the summit of Lowther Hill, 27.72 km east of the closest turbine of the proposed development. The viewpoint provides an appropriate position to represent the potential effects of the Pencloe Windfarm upon walkers. **Figure 7.3.18 Volume III** shows: a) the viewpoint location and b) the existing view and a wireframe of the proposed development (including any other built/ consented windfarms within the view).

Description of Existing View

7.10.140. The existing view looks west towards the proposed development and shows a long distance view across an undulating landform, with the broad Nithsdale visible in the distance before the terrain rises to the further hills and ridgelines in the distance. In the foreground the grass covered western upper slope of Lowther Hill is visible including the communications mast to the right of the image and the broad summit of East Mount Lowther to the left. Beyond the farmed lowlands of Nithsdale and the settlement of Sanquhar provide contrast. The flat topped Blackcraig Hill is prominent in the centre of the view with Windy Standard and Hare Hill seen to the south and north respectively. The predicted wireframe indicates that the consented Afton and Hare Hill Extension windfarms will also be visible on the horizon from this viewpoint.

Visual Sensitivity

7.10.141. The overall sensitivity of receptors at this location is considered to be High for walkers. The factors that have contributed to this judgement are as follows:

Susceptibility to Change: **High** for walkers.

- Awareness of views along the Southern Upland Way towards and at the summit of Lowther Hill and the prevailing landscape are likely to be high for walkers.

Value attached to View: High

- Viewpoint located on the route of the Southern Upland Way.
- Viewpoint within and overlooking the Thornhill Uplands Regional Scenic Area.
- Viewpoint on the western edge of Leadhills and the Lowther Hills Special Landscape Area.

Magnitude of Change

7.10.142. The effects on visual receptors have been evaluated according to the nature of the change to the view in terms size, scale and character; the geographical extent of the predicted visibility and its duration as part of the overall visual experience of the receptor as follows:

Size or Scale (including nature of influence on the character of the view)

- The proposed development will be partly visible from this location, occupying 4.3° of the view and forming an insignificant component of the view from this location.
- The proposed development will not constitute a noticeable feature within the open view, introducing new small scale vertical elements into the landscape that will be hard to distinguish even in good visibility. The wireframe shows that the blade tips of only three turbines will appear above the height of distant hills, visible against the skyline and below the height of surrounding hills and turbines at Hare Hill, Windy Standard and Extension windfarms and the consented Afton and Hare Hill Extension.
- Views of this nature are likely to be visible for a short duration with the proposed turbines forming a barely discernible change for walkers towards and at the summit of Lowther Hill.

Geographical Extent (including influence on focus of the view)

- The view to the proposed development, which lies to the west at 261° to the viewpoint, will be seen by walkers towards and at the summit of Lowther Hill.
- The proposed development will be seen over a very long separation distance of 27.72 km to the nearest turbine.
- The change to the view occurs within the west facing aspect within the context of expansive panoramic views.

Judgement on Magnitude of Change

7.10.143. Based on factors considered above, the overall magnitude of change to this viewpoint is considered to be Negligible for walkers.

Level and Significance of Effect

7.10.144. The combination of the individual judgements of **High** sensitivity for walkers and **Negligible** magnitude of change are considered to result in a **Minor** level of effect for walkers. In the context of this assessment this is considered to be **Not Significant**.

Viewpoint 19: Minor Road South of Stinchar Falls

7.10.145. This viewpoint was requested for inclusion within the assessment by SNH. No visibility is predicted from this viewpoint; therefore it has not been assessed further.

7.10.146. **Figure 7.3.19 Volume III** illustrates a) the viewpoint location and b) the predicted wireframe view. A baseline viewpoint description is included in **Appendix 7.5 Volume IV**.

Viewpoint 20: Afton Reservoir

Location and Rationale for Selection

7.10.147. Viewpoint 20 is located at the northern end of Afton Reservoir, 1.88 km east of the proposed development, to the closest turbine. The viewpoint provides an appropriate position to represent the potential effects of the proposed development upon walkers and visitors to the reservoir. **Figure 7.3.20 Volume III** shows: a) the viewpoint location; b) the existing view and a wireframe of the proposed development (including any other built/ consented windfarms within the view); c) a 75° panoramic photomontage of the proposed development and d) a 40° enlargement of the photomontage.

Description of Existing View

7.10.148. The existing view looks northwest towards the proposed development and shows a short distance view to a dense stand of plantation forestry located at the northern edge of Afton Reservoir with the access road seen below. Beyond the rising grassed side of Glen Afton further forestry plantations top the ridgeline, forming the eastern edge of the wider Carsphairn Forest. The predicted wireframe indicates that seven of the consented Afton turbines, will also be visible from this viewpoint, located on the side and ridgeline of Glen Afton, to the fore of Pencloe.

Visual Sensitivity

7.10.149. The overall sensitivity of receptors at this location is considered to be High for walkers and visitors. The factors that have contributed to this judgement are as follows:

Susceptibility to Change: **High** for walkers and visitors.

- Awareness of views from the northern edge of Afton Reservoir are likely to be high for walkers and visitors.

Value attached to View: Medium

- Viewpoint within the Glen Afton and Glenmuir Sensitive Landscape Character Area.

Magnitude of Change

7.10.150. The effects on visual receptors have been evaluated according to the nature of the change to the view in terms size, scale and character; the geographical extent of the predicted visibility and its duration as part of the overall visual experience of the receptor as follows:

Size or Scale (including nature of influence on the character of the view)

- The proposed windfarm theoretically occupies a 43.2° angle of view and the turbines will be seen as an array above the height of intervening hills, along the eastern edge of the Carsphairn Forest. The windfarm will form noticeable large scale vertical elements in views to the northwest.

- The predicted wireframe indicates that 11 turbines will be visible from this location, three will be seen with hubs and towers, four to hub height and the remaining four visible to parts of their blades only. The photomontage shows dense vegetation along the northern edge of Afton Reservoir will screen views with only two turbines visible to their towers and hubs with three visible to either hub or parts of their blades. The turbines will be seen against the skyline and will be viewed above the height of the viewpoint, beyond the ridgeline to the northwest.
- The predicted wireframe shows the turbines of the consented scheme of Afton located to the fore of the Pencloe turbines. From this location the Pencloe turbines will be perceived as an extension of the Afton scheme. Following the construction of Afton, wind development will have an influence on the character of the landscape from this location and the turbines of Pencloe Windfarm will add further elements within this context.
- For walkers and visitors to the reservoir, the view of the turbines will be of short duration whilst on the dam.

Geographical Extent (including influence on focus of the view)

- The view to the proposed development, which lies to the northwest at 309° to the viewpoint, will be seen by walkers and visitors to Afton Reservoir.
- The proposed development will be seen over a short separation distance of 1.88 km to the nearest turbine.
- The change to the view occurs within the northwest facing aspect, away from the principal view to the reservoir.

Judgement on Magnitude of Change

7.10.151. Based on factors considered above, the overall magnitude of change to this viewpoint is considered to be Slight.

Level and Significance of Effect

7.10.152. The combination of the individual judgements of **High** for walkers and visitors and a **Slight** magnitude of change are considered to result in a **Moderate** effect. In the context of this assessment this is considered to be **Not Significant** for walkers and visitors.

Viewpoint 21: A77 West of Maybole/ Crossraguel Abbey

Location and Rationale for Selection

7.10.153. Viewpoint 21 is located at Crossraguel Abbey, west of the settlement of Maybole and 31.71 km west of the closest turbine of the proposed development. The viewpoint provides an appropriate position to represent the potential effects of the proposed development upon visitors to the Abbey. **Figure 7.3.21 Volume III** shows: a) the viewpoint location and b) the existing view and a wireframe of the proposed development (including any other built/ consented windfarms within the view).

Description of Existing View

7.10.154. The existing view looks east towards the proposed application site and shows the extents of Crossraguel Abbey with open views towards pastoral fields on rolling hills beyond. Scattered farmsteads are located within the middle ground with the settlement of Maybole to the left of the image. Shelterbelt and woodlands are visible throughout the view with the rising edge of the Southern Uplands beyond and the mantle of the Carsphairn Forest. The predicted wireframe indicates that Dersalloch windfarm will be visible from this viewpoint, with Afton, Windy Standard and Windy Standard Extension seen beyond, on the distant horizon.

Visual Sensitivity

7.10.155. The overall sensitivity of receptors at this location is considered to be High for visitors to the abbey. The factors that have contributed to this judgement are as follows:

Susceptibility to Change: **High** for visitors to the Abbey.

- Distant views to the proposed development are anticipated from elevated locations at Crossraguel Abbey. Awareness of views from the abbey is likely to be high for visitors.

Value attached to View: Low

- Viewpoint not within or overlooking a designated landscape.

Magnitude of Change

7.10.156. The effects on visual receptors have been evaluated according to the nature of the change to the view in terms size, scale and character; the geographical extent of the predicted visibility and its duration as part of the overall visual experience of the receptor as follows:

Size or Scale (including nature of influence on the character of the view)

- The predicted wireframe shows the proposed development as a small cluster on the distant hills. The proposed windfarm occupies 2.9° of the view, forming a minor component of the view from this location.
- The proposed turbines will introduce small scale vertical components into the predominantly horizontal landscape. Thirteen turbines will be theoretically visible from this location, appearing as a general cluster above the height of distant hills and plantations. Five turbines will be visible to the hub and blades and eight to their blades only.
- The proposed development will not constitute a noticeable feature within the open view, introducing new small scale vertical elements into the landscape that will be hard to distinguish even in good visibility.
- For visitors to Crossraguel Abbey, views of the turbines will be of short duration from elevated locations facing east.

Geographical Extent (including influence on focus of the view)

- The view to the proposed development, which lies to the east at 94° to the viewpoint, will be seen by visitors to Crossraguel Abbey, forming a minor element in the overall view.
- The proposed development will be seen over a long separation distance of 31.71 km to the nearest turbine.
- The change to the view occurs within the east facing aspect, which is focussed on pastoral fields and rolling hills backed by more distinct hills topped by dense plantations.

Judgement on Magnitude of Change

Based on factors considered above, the overall magnitude of change to this viewpoint is considered to be Negligible for visitors to Crossraguel Abbey.

Level and Significance of Effect

The combination of the individual judgements of **High** sensitivity for visitors to the Abbey and a **Negligible** magnitude of change are considered to result in a **Moderate/Minor** effect. In the context of this assessment this is considered to be **Not Significant** for visitors to Crossraguel Abbey.

Viewpoint 22: Brown Carrick Hill

Location and Rationale for Selection

7.10.157. Viewpoint 22 is located at Brown Carrick Hill, southwest of the settlement of Ayr and 30.88 km west of the closest turbine of the proposed development. The viewpoint provides an appropriate position to represent the potential effects of the proposed development upon walkers and cyclists on National Cycle Route 7. **Figure 7.3.22 Volume III** shows: a) the viewpoint location and b) the existing view and a wireframe of the proposed development (including any other built/ consented windfarms within the view).

Description of Existing View

7.10.158. The existing view looks east towards the proposed development and shows a panoramic view from this elevated location. The immediate view shows a patchwork of rough grassland and moorland mainly enclosed by hedgerows. Beyond rolling hills are covered by pastoral fields punctuated by blocks of woodland. The predicted wireframe indicates that several distant built and consented windfarms will be visible on the far horizon; Hare Hill, Hare Hill Extension and Sanquar Community are seen to the north, Windy Standard, Windy Standard Extension and Afton to the centre of the image and Dersalloch to the south.

Visual Sensitivity

7.10.159. The overall sensitivity of receptors at this location is considered to be High for walkers and cyclists. The factors that have contributed to this judgement are as follows:

Susceptibility to Change: **High** for walkers and cyclists.

- Distant views to the proposed development are anticipated from elevated locations on the Brown Carrick Hills. Awareness of views from the hills is likely to be high for recreational walkers and cyclists on the NCR 7.

Value attached to View: Medium

- Viewpoint on the route of NCR 7.
- Viewpoint within the South Ayshire Scenic Areas.

Magnitude of Change

7.10.160. The effects on visual receptors have been evaluated according to the nature of the change to the view in terms size, scale and character; the geographical extent of the predicted visibility and its duration as part of the overall visual experience of the receptor as follows:

Size or Scale (including nature of influence on the character of the view)

- The predicted wireframe shows the proposed development from this viewpoint is only partially visible as a small cluster within the distant hills. The proposed windfarm occupies 2.3° of the view, forming a minor component of the view from this location.
- The proposed turbines will introduce small scale vertical components into the predominantly horizontal landscape. Five turbines will be theoretically visible from this location, appearing above the height of distant hills and plantations. The five turbines will be visible to the blade tips only and very difficult to distinguish within the panorama.
- The proposed development will not constitute a noticeable feature within the open view, introducing new small scale vertical elements into the landscape that will be hard to distinguish even in good visibility.
- For visitors to Brown Carrick Hill, views of the turbines will be of short duration from elevated locations facing east.

Geographical Extent (including influence on focus of the view)

- The view to the proposed development, which lies to the east at 107° to the viewpoint, will be seen by visitors and cyclists at Brown Carrick Hill forming a minor element in the overall view, which will only be distinguishable on days of clear visibility.
- The proposed development will be seen over a long separation distance of 31.71 km to the nearest turbine.
- The change to the view occurs within the east facing aspect, which is focussed on rough grassland and moorland with panoramic views in all directions, particularly to the sea to the west.

Judgement on Magnitude of Change

7.10.161. Based on factors considered above, the overall magnitude of change to this viewpoint is considered to be Negligible for walkers and cyclists at Brown Carrick Hill.

7.10.162. Level and Significance of Effect

7.10.163. The combination of the individual judgements of **High** sensitivity for walkers and cyclists and a **Negligible** magnitude of change are considered to result in a **Moderate/Minor** effect. In the context of this assessment this is considered to be **Not Significant** for walkers and cyclists.

Viewpoint 23: B7037 South of Galston

Location and Rationale for Selection

7.10.164. Viewpoint 23 is located at the B7037, southwest of the settlement of Kilmarnock and 25.44 km northwest of the closest turbine of the proposed development. The viewpoint provides an appropriate position to represent the potential effects of the proposed development upon southbound road users on the B7037. **Figure 7.3.23 Volume III** shows: a) the viewpoint location and b) the existing view and a wireframe of the proposed development (including any other built/ consented windfarms within the view).

Description of Existing View

7.10.165. The existing view looks southeast towards the proposed development and shows open views across a pastoral field enclosed by a gappy sheeter belt. Low rolling farmland comprising regular rectilinear arable fields bounded by hedgerows are seen in the middle distance. To the right and centre of the image, distant hills rise to the horizon.

7.10.166. The predicted wireframe indicates that several distant built and consented windfarms will be visible on the horizon. Hare Hill, Hare Hill Extension and Sanquar Community are seen on the hills to the east with Windy Standard, Windy Standard Extension and Afton to the centre of the image.

Visual Sensitivity

7.10.167. The overall sensitivity of receptors at this location is considered to be Medium for road users. The factors that have contributed to this judgement are as follows:

Susceptibility to Change: **Medium** for road users on the B7037.

- Awareness of views along the minor road and the prevailing landscape are likely to be medium for road users.

Value attached to View: Low

- Viewpoint not within or overlooking a valued landscape.

Magnitude of Change

7.10.168. The effects on visual receptors have been evaluated according to the nature of the change to the view in terms size, scale and character; the geographical extent of the predicted visibility and its duration as part of the overall visual experience of the receptor as follows:

Size or Scale (including nature of influence on the character of the view)

- The predicted wireframe shows the proposed development from this viewpoint, seen as a cluster within distant hills. The proposed windfarm occupies 5.7° of the view, forming a minor component of the view from this location.
- The proposed turbines will introduce small scale vertical components into the predominantly horizontal landscape. All of the turbines will be theoretically visible from this location, appearing as three clusters with all of the turbines visible to the hub and blades.
- The proposed turbines will be partially seen on the horizon with some blades seen against the skyline contrasting to the lighter skies, but some turbines and most of their lower parts generally blending into the distant moorland backdrop.
- From this location the existing turbines of Afton, Windy Standard and Windy Standard Extension are theoretically visible on the far horizon and the proposed development will be seen within this context, to the fore of this cluster of existing wind development.
- For southbound road users on the B7037, views of the turbines will be of short duration.

Geographical Extent (including influence on focus of the view)

- The view to the proposed development, which lies to the southeast at 161° to the viewpoint, will be seen by southbound road users of the B7037, forming a minor element in the overall view.
- The proposed development will be seen over a long separation distance of 25.44 km to the nearest turbine.
- The change to the view occurs within the southern facing aspect, which is focussed on pastoral and arable fields backed by distant rolling hills.

Judgement on Magnitude of Change

7.10.169. Based on factors considered above, the overall magnitude of change to this viewpoint is considered to be Negligible.

Level and Significance of Effect

7.10.170. The combination of the individual judgements of **Medium** sensitivity and a **Negligible** magnitude of change are considered to result in a **Minor** effect. In the context of this assessment this is considered to be **Not Significant** for road users on the B7037.

Viewpoint 24: Doon Castle beside Loch Doon

7.10.171. This viewpoint was requested for inclusion within the assessment by SNH. No visibility is predicted from this viewpoint; therefore it has not been assessed further.

7.10.172. **Figure 7.3.24 Volume III** illustrates a) the viewpoint location and b) the predicted wireframe view. A baseline viewpoint description is included in **Appendix 7.5 Volume IV**.

Table 7.14 Summary of Effects on Viewpoints

	Viewpoint Description	Sensitivity	Magnitude Of Change	Effect	Significance
1.	Viewpoint 1: Entrance to Pencloe Farm, Glen Afton	High – Residents Medium – Road Users	Slight	Moderate Moderate/Minor	Not Significant Not Significant
2.	Viewpoint 2: Summit of Blackcraig Hill	High - Walkers	Moderate	Major/Moderate	Significant
3.	Viewpoint 3: Afton Cemetery Car Park, New Cumnock	High – Visitors to Cemetery Medium – Road Users	Moderate	Major/Moderate Moderate	Significant Not Significant
4.	Viewpoint 4: Connel View, southern edge of New Cumnock	High – Residents	Moderate	Major/Moderate	Significant
5.	Viewpoint 5: Burnside, B741	High – Residents Medium – Road Users	Slight	Moderate Moderate/Minor	Not Significant Not Significant
6.	Viewpoint 6: Mansfield, Pathhead	High – Residents Medium – Road Users	Slight	Moderate Moderate/Minor	Not Significant Not Significant
7.	Viewpoint 7: Minor Road near Mounthope Farm	High – Residents Medium – Road Users	Slight	Moderate Moderate/Minor	Not Significant Not Significant
8.	Viewpoint 8: Layby A76, near Calton Farm	Medium – Road Users	Moderate	Moderate	Not Significant
9.	Viewpoint 9: Minor road near Auchincross Farm	Medium – Road Users	Moderate	Moderate	Not Significant
10.	Viewpoint 10: Minor Road at Guffock Hill above Nithsdale	Medium – Road Users	Negligible	Minor	Not Significant
11.	Viewpoint 11: Southern Upland Way at the summit of Benbrack	High - Walkers	Negligible	Moderate/Minor	Not Significant
12.	Viewpoint 12: Summit of Cairnsmore of Carsphairn	High - Walkers	Slight	Moderate	Not Significant
13.	Viewpoint 13: Minor Road at Lamford	Medium – Road Users	Slight	Moderate/Minor	Not Significant

	Viewpoint Description	Sensitivity	Magnitude Of Change	Effect	Significance
14.	Viewpoint 14: Penders Wynd, Netherthird, Cumnock	High – Residents Medium – Road Users	Slight	Moderate Moderate/Minor	Not Significant Not Significant
15.	Viewpoint 15: Catrine Road, B705, Mauchline	High – Residents Medium – Road Users	Negligible	Moderate/Minor Minor	Not Significant Not Significant
16.	Viewpoint 16: Summit of Corserine	High - Walkers	Slight	Moderate	Not Significant
17.	Viewpoint 17: B743 at Crook Moss	Medium – Road Users	Negligible	Minor	Not Significant
18.	Viewpoint 18: Lowther Hill	High - Walkers	Negligible	Minor	Not Significant
19.	Viewpoint 19: Minor Road South of Stinchar Falls	Medium – Road Users	None	None	Not Significant
20.	Viewpoint 20: Afton Reservoir	High - Walkers	Slight	Moderate	Not Significant
21.	Viewpoint 21: A77 West of Maybole/ Crossraguel Abbey	High - Visitors	Negligible	Moderate/Minor	Not Significant
22.	Viewpoint 22: Brown Carrick Hill	High – Walkers/Cyclists	Negligible	Moderate/Minor	Not Significant
23.	Viewpoint 23: B7037 South of Galston	Medium – Road Users	Negligible	Minor	Not Significant
24.	Viewpoint 24: Doon Castle beside Loch Doon	High - Visitors	None	None	Not Significant

7.11. Assessment of Cumulative Landscape and Visual Effects

- 7.11.1. The potential cumulative landscape and visual effects of Pencloe Windfarm have been considered in relation to other operational, consented and application stage projects within a 60km radius, as detailed in full in **Appendix 7.7 Volume IV**. The assessment has been undertaken with reference to **Figures 7.4.1-2: Cumulative Windfarm Location Plans**, **Figures 7.5.1-7.5.30: Cumulative Windfarm ZTV Plans** and **Figures 7.6.1-7.6.5: Cumulative Wireframes** from five representative viewpoints, as shown in Volume III.
- 7.11.2. The assessment considers in detail the contribution that the proposed development would make to the ‘cumulative baseline’ – i.e. the built and consented sites and the effects on landscape and visual receptors and the effects resulting from Pencloe Windfarm in combination with each of the sites at planning application stage. The key findings of the cumulative assessment are set out in **Section 7.13 Summary and Conclusions** below.

7.12. Assessment of Effects at Decommissioning and Post-Operational Stages

- 7.12.1. The decommissioning of the proposed development and the extent of restoration works will be agreed with East Ayrshire Council in consultation with appropriate statutory bodies.
- 7.12.2. At the end of the 25-year operational lifetime of the windfarm, the turbines and other structures will be removed and the landscape and longer-distance views of the application site would be returned to their present condition. Decommissioning is expected to be shorter than the construction phase with the dismantling of all above-ground structures and the reinstatement of disturbed ground taking around 12 months; however, below-ground structures are likely to be left in place to avoid further disturbance (with the exception of the top metre of the foundation base of each turbine). There will therefore be a temporary effect from the decommissioning activities on the application site, but this will be of relatively short duration. Some evidence of the past presence of Pencloe Windfarm will remain visible in short-range views during the post-decommissioning restoration period. Over the short-to-medium term the application site will be returned to forestry uses with the only structures remaining onsite being underground ones.
- 7.12.3. Accordingly, the decommissioning and post-operational phases are considered to have a short-term effect on the landscape and visual amenity of the locality, similar but less substantial than those effects described for the construction phase. This will be Not Significant.

7.13. Summary and Conclusions

Background

- 7.13.1. The application site for the 21-turbine proposed development is located to the south of New Cumnock in East Ayrshire, set within the northern edge of the Southern Uplands, to the west of Glen Afton.
- 7.13.2. The application site is set on Milray Hill, Auchincally Hill and Meikle Hill, a sequence of rolling hills which increase in height towards the southwest of the application site. Access is proposed from a single track road which runs south from New Cumnock along Glen Afton to Craigdarroch and Afton Reservoir. The landscape of the site itself is predominantly planted with commercial forestry plantations with some undeveloped areas of upland moorland mosaic of grass and heather.
- 7.13.3. Under the national landscape character classification system adopted by SNH, this landscape is located within the 'Southern Uplands with Forestry' Landscape Character Type identified in the Ayrshire Landscape Assessment. This landscape is characterised by the steep, smooth slopes of the southern Uplands which rise to smooth rounded summits. To the east the landscape descends to Glen Afton which cuts into the uplands, one of a series of distinctive glacial valleys with U-shaped cross sections.
- 7.13.4. An LVIA has been undertaken for the proposed development in order to identify significant effects on landscape and visual receptors, the receptors being identified through consultation with East Ayrshire Council and SNH and also through desk study/ field work.
- 7.13.5. The LVIA has assessed effects on the landscape fabric, landscape character and designations, and effects on visual amenity within a 35 km radius of the proposed development. These have primarily focussed upon the operational effects of the

proposed development, as these residual effects (incorporating relevant mitigation measures) are those with the greatest likelihood of significant effects. Construction and decommissioning/ post-operational effects have also been considered. Cumulative effects were also considered following the identification of other built/ consented/ proposed windfarms within the Study Area.

Summary of Effects on the Landscape Resource

- 7.13.6. Effects on Landscape Fabric
- 7.13.7. Effects on the fabric of the landscape will be limited in extent and will largely be reversible, at the end of the operational phase of the proposed development. Most of the access tracks and the buried concrete foundations will remain following decommissioning. The physical changes to the landscape, such as the construction of access tracks, turbines and the control building will occupy only a small portion of the overall site area and whilst the development will bring forward the cyclical felling of some of the plantations the existing combination of land uses will persist. The proposed development will be undertaken in such a way as to mitigate the extent of any unnecessary damage, potential soil erosion or indirect off-site effects due to changed surface or groundwater conditions.
- 7.13.8. The landscape is of Low sensitivity and the construction and operational phases of the proposed development are considered to have a Moderate magnitude of change and a Moderate/Minor level of effect on the fabric of the application site and will result in effects that are Not Significant.

Effects on Landscape Character

- 7.13.9. The proposed development is located within the Southern Uplands with Forestry LCT and the implementation of the development would require the felling of those forestry coups within which the turbines are proposed, introducing short term change and advancing the periodic felling experienced in this landscape character type. Existing windfarm development to the northeast at Hare Hill and also the consented Hare Hill Extension and to the south at Windy Standard (and Extension) Windfarms and the consented scheme at Afton already have an influence on landscape character. Pencloe Windfarm will introduce additional turbines to the northern edge of the Southern Uplands and will reinforce this as a component of the prevailing landscape character. Although the proposed development will add to the influence of windfarms over the LCT, the presence of existing development will reduce the magnitude of change on the character and qualities of the LCT.
- 7.13.10. In local views from the application site and from the flanks of the adjacent hills, the turbines will be seen as prominent, large-scale man-made features in the landscape, contrasting with the existing colour and texture of the forested hills. The immediate foreground elements, such as access tracks, borrow pits and turbine bases will be often concealed from view by re-planted forestry and local terrain. Within this relatively uniform, upland landscape the turbine structures will be seen as a prominent addition to the landscape, but will be accommodated within the large-scale, expansive character of this landscape. Within the Southern Uplands with Forest LCT, there will a locally Substantial magnitude of change, which in combination with the Low sensitivity of the landscape, and, is considered to result in a locally Major/Moderate and Significant effect across the immediate site area but a generally Moderate and Not Significant effect across the LCT.

- 7.13.11. A level of containment is provided by the loose network of hills that define the extent of the core visual footprint of the proposed development. The influence on wider landscape character is therefore limited by topographic screening, and also by distance and visibility will become gradually more fragmented. The proposed development will be seen, alongside Afton and Windy Standard (and Extension) Windfarms, and in combined or successive views with Hare Hill (and Extension) Windfarms as a new element within a separate component of the landscape.
- 7.13.12. Whilst topography limits the influence of the proposed development there will be indirect impacts on the perceived qualities and characteristics of the Glen Afton unit of the Upland Glens LCT. The turbines will be seen beyond the western ridgeline of the glen with visibility often limited by either landform or forestry where it lines the valley sides. Views from the Upland Glen LCT will frequently be in combination with the consented Afton scheme and the proposed development will be viewed within this context of existing wind development. In the settled bottom of Glen Afton there will be limited areas of visibility with the turbines seen partially with only the upper parts visible. From the Glen Afton unit of the Upland Glens LCT there will be a locally Moderate but generally Slight magnitude of change, which in combination with the Medium sensitivity of the landscape, and, is considered to result in a Moderate and Not Significant effect.
- 7.13.13. There will also be areas of inter-visibility with the elevated portion of the wider mountain environment. From the Rugged Uplands with Lochs and Forest LCT theoretical visibility of 16-21 turbines is shown across elevated areas of: the western ridge including Big Hill of Glenmount, Craiglee and Macaterick and the eastern ridge including Black Craig and Meaul. Actual influence on the perception of landscape character is greatly reduced by distance and there will be a Slight magnitude of change, which in combination with the High sensitivity of the landscape is considered to result in a Moderate and Not Significant effect.
- 7.13.14. Beyond 20 km, due to the effect of distance, the proposed development will be a less visible element in the landscape. The resultant effects on landscape character will only give rise to a Negligible magnitude of change beyond 20 km with effects on landscape character being Not Significant.

Effects on Designated Landscapes

- 7.13.15. Potential effects on the quality and setting of designated landscapes within the Study Area were assessed, in particular relating to RSAs, SLCAs, SLAs and Inventory Gardens and Designed Landscapes. Effects on Wild Land Areas within the Study Area were also considered.
- 7.13.16. Locally moderate and not significant effects were assessed upon the Glenmuir and Afton Special Landscape Character Area which has a modified context, dominant forestry uses and existing windfarm development. Moderate and not significant effects were also assessed on the Galloway Hills Regional Scenic Area where there would be very limited visibility of the turbines, moderated by the distinct separation of the proposed development from the designation and the diverse nature of views.
- 7.13.17. No significant effects as a result of the proposed development will occur in relation to the RSAs, SLCAs, SLAs, Wild Land Areas and Inventory Gardens and Designed Landscapes.

Summary of Effects on Visual Amenity

- 7.13.18. The study included an assessment of the effects of the proposed development upon settlements, transport corridors and viewpoints representative of a range of receptors within the study area.

Effects on Settlements, Transport Corridors and Recreational Routes

- 7.13.19. Effects were assessed on visual amenity from settlements. It was concluded that there would be Moderate and Not Significant effects from Bankglen, Burnside, Cumnock and New Cumnock. These effects are moderated by the existing presence of windfarm development in the landscape, the effects of distance and the context of the development within extensive areas of plantation forestry.
- 7.13.20. Effects were assessed on visual amenity from settlements, roads, railways and long-distance footpaths/ cycle ways within the Study Area, all of which were Not Significant.

Effects on Viewpoints

- 7.13.21. The nature of the visibility of the proposed development was also assessed from 24 viewpoints which were agreed through consultation with SNH and East Ayrshire Council. The viewpoints included settlements, route corridors, landmarks, hill summits and other visitor attractions. Two of the viewpoints were not taken forward to detailed assessment due to lack of visibility of the turbines.
- 7.13.22. The assessment of the viewpoints concluded that there would be significant effects on visual amenity from three of the selected viewpoints as follows:
- Viewpoint 2: From the summit of Blackcraig Hill the proposed development be seen in its full extent beneath the viewpoint and would be seen in combination with Afton and Windy Standard (and Extension) and in successive views with Hare Hill and Extension building upon the existing pattern of development within an appropriate low sensitivity landscape but introducing significant local change.
 - Viewpoint 3: From Afton Cemetery car park the proposed development will be seen as new vertical elements visible on the ridgeline of the Southern Uplands within the forested mantle of the Carsphairn Forest.
 - Viewpoint 4: The viewpoint is located beyond the southern edge of the settlement of New Cumnock from one of the few elevated positions affording an open view to the north edge of the Southern Uplands. The turbines will be seen as noticeable new vertical elements within the forested uplands.
- 7.13.23. Elsewhere in the locality the proposed development would be seen in close association with Afton, Hare Hill and Extension and Windy Standard and Extension Windfarms and would be seen in the context of existing development with limited additional effects which would not give rise to significant effects on visual amenity.
- 7.13.24. From more distant viewpoint locations, the proposed development would appear in a large-scale and diverse landscape setting, which can accommodate the level of change associated with the scale of this windfarm. Pencloe Windfarm would fit within the scale and pattern of development within the northern Southern Uplands and would recede within wider panoramic views, particularly with distance.

Summary of Cumulative Effects on Landscape and Visual Receptors

- 7.13.25. The potential cumulative landscape and visual effects of Pencloe Windfarm have been considered in relation to other operational, consented and application stage projects within a 60 km radius, as detailed in full in Appendix 7.7 Volume IV. The Cumulative Landscape and Visual Assessment considered existing and consented windfarms in addition to those for which a valid planning application had been made up until September 2014.
- 7.13.26. The cumulative assessment appraised the contribution the proposed development would make to the 'cumulative baseline', this being the built and consented sites, on landscape and visual receptors. It then also assesses the effects arising on landscape and visual receptors through the addition of the proposed development when considered in combination with each of the sites at planning application stage.

Cumulative Landscape Effects

- 7.13.27. The Cumulative Landscape and Visual Assessment concluded that with regard to effects on landscape character, significant effects would arise on the Southern Uplands and Forestry LCT where Pencloe would be seen in addition to the existing pattern of built developments and in conjunction with the proposed South Kyle Windfarm. The South Kyle and Pencloe turbines will cover a large proportion of the LCT and will dominate views from many locations within the LCT although the actual visibility throughout will be greatly reduced by the extensive plantations forming the Carsphairn Forest. The addition of Pencloe to the baseline and the proposed South Kyle Windfarm will greatly add to the perception of windfarm development within the LCT and this will contribute to an increase of the uplands with windfarms landscape character. The LCT already has the Windy Standard scheme located adjacent to its southern border and the addition of the proposals will be seen within this context.
- 7.13.28. Other significant cumulative effects on Landscape Character were identified in the East Ayrshire Southern Uplands LCT, arising from the cumulative effects of Pencloe seen in addition to the existing pattern of built and consented development, when experienced in combination with the proposed Ashmark Windfarm and South Kyle Windfarm.
- 7.13.29. No other significant cumulative effects were identified on Landscape Character from the interaction of the proposed development with other operational and consented or planning stage windfarms.
- 7.13.30. Limited significant cumulative effects were identified on the Glenmuir and Afton Special Landscape Charater Area were identified in the East Ayrshire Southern Uplands LCT, arising from the cumulative effects of Pencloe seen in addition to the existing pattern of built and consented development, when experienced in combination with the proposed Ashmark Windfarm and South Kyle Windfarm.
- 7.13.31. No other significant cumulative effects were identified on Landscape Designations or Wild Land Areas from the interaction of the proposed development with other operational and consented or planning stage windfarms.

Cumulative Visual Effects

- 7.13.32. The cumulative assessment was undertaken through a review of computer-generated visibility mapping for each of the windfarms, using wireframe views. The assessment considered the contribution the proposed development would make to the cumulative baseline formed by the built/ consented windfarm sites in the region and the effect resulting from those in the planning application stage.
- 7.13.33. Significant cumulative effects are predicted to arise on the settlements of Bankglen and Burnside from the interaction of the Pencloe Windfarm with the planning stage sites of Ashmark Hill, the Land at Burnfoot and South Kyle Windfarms and also High Cumnock in the case of Burnside. New Cumnock will experience significant effects from the interaction of Pencloe with the planning stage sites at Garleffan and High Cumnock. These effects are limited to those sectors of the settlement which have direct visibility to Pencloe Windfarm.
- 7.13.34. There will be no significant cumulative effects on roads, railways or long distance routes from the interaction of the proposed development with other operational and consented or planning stage windfarms.
- 7.13.35. The assessment identified that there would be locally significant cumulative visual effects on the views experienced by people visiting mountain summits within the northern Southern Uplands, particularly in relation to the planning stage sites of Afton, Ashmark Hill and South Kyle, which would be visible in combined views with the proposed Pencloe Windfarm from the summit of Blackcraig Hill and Cairnsphairn of Cairnsmore. In all cumulative effects arising from the contribution of the Pencloe Windfarm, the greater cumulative effect would arise from the contribution of the planning stage windfarms.
- 7.13.36. As part of the cumulative assessment, five viewpoints were selected as being representative of vantage points within the study area. From the assessment, it was identified there will be significant effects on the experience of receptors from Cumulative Viewpoint 1: Blackcraig Hill when the Pencloe Windfarm is viewed locally in combination with the baseline built and consented sites and then also in combination with each of the Ashmark Hill, South Kyle, High Cumnock, and Garleffan planning stage sites. Significant cumulative effects are also experienced from: Cumulative Viewpoint 2, New Cumnock with Ashmark Hill and South Kyle Windfarms; Cumulative Viewpoint 3, Burnside in combination with Ashmark Hill, High Cumnock and South Kyle Windfarms; Cumulative Viewpoint 4, Mounthope Farm, in combination with Ashmark Hill, Garleffan, High Cumnock and South Kyle Windfarms and from Cumulative Viewpoint 5, Carsphairn of Cairnsmore with Quantans Hill and South Kyle Windfarms.
- 7.13.37. The proposed Pencloe Windfarm will predominantly be seen in combination with other local windfarms in the core study area within 5 km of the outermost turbines. Locally significant cumulative effects are predicted to arise for some receptors from the addition of the Pencloe Windfarm to local windfarm sites currently at the planning stage. The cumulative assessment concludes that the addition of the proposed Pencloe Windfarm to the baseline creates local cumulative effects.

Conclusion

- 7.13.38. In conclusion, the Landscape and Visual Impact Assessment has followed recognised guidance and assessed the potential effects of the proposed development on landscape and visual receptors within a 35 km radius Study Area.
- 7.13.39. The LVIA has established that the proposed development would result in differing degrees of change to the landscape and visual baseline conditions, arising predominantly during the 25 year operational phase.
- 7.13.40. The proposed development will be seen as three adjacent arrays forming a coherent well designed cluster of development on the northern edge of the Southern Uplands and seen within the forested upland landscape of the Carsphairn Forest. The proposed development will be seen within the context of the existing Windy Standard Windfarm (and Extension) and the consented Afton Windfarm and will be perceived within the landscape as part of the same development. The proposed development will be seen to be in scale with the elevation of the Southern Uplands set back from the northern facing flank and foothills, within the upland component of the landscape, avoiding any encroachment into the transitional landscape of the upland fringe.
- 7.13.41. No significant landscape effects are identified from Designated Landscapes or Wild Land Areas.
- 7.13.42. No significant effects are identified on visual amenity from settlements, route corridors, National Cycle Routes or long distance walking routes.
- 7.13.43. The viewpoint assessment identifies very limited significant effects from a limited portion of New Cumnock, beyond the settlement edge. From elevated upland viewpoints the proposed development would be seen in close association with the existing Windy Standard (and Extension) Windfarm and the consented Afton Windfarm and would frequently be seen as part of the same development with limited additional effects which would not give rise to significant effects on visual amenity. Limited significant effects were identified from the summit of Blackcraig, where the proposed development would be seen in combination with Afton and Windy Standard (and Extension) Windfarm and would increase the extent of windfarm development within the view.
- 7.13.44. Cumulative effects arising from the contribution of the proposed development to the baseline of built and consented sites are limited with the windfarm appearing in the context of the existing Windy Standard (and Extension) Windfarm and close to the existing Hare Hill Windfarm and consented Afton and Hare Hill Extension schemes. Limited significant effects are identified on some local receptors from the addition of Pencloe Windfarm to the nearby planning stage windfarm sites including South Kyle, Quantans Hill, Ashmark Hill and the Land at Burnfoot.
- 7.13.45. The design has incorporated general good-practice mitigation measures in relation to the design of the turbines, as well as site-specific mitigation measures. Any new wind turbine development may result in potentially significant effects upon landscape and visual amenity. In the case of the proposed development, significant effects on landscape character have been predicted to be focussed on the Southern Uplands with Forest LCT with further locally significant effects occurring from local hill summits in the Southern Uplands.

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8 Non-Avian Ecology

8.1 Introduction

8.1.1 This chapter describes and evaluates the current nature conservation interest of the application site and the immediate surrounding area, in relation to habitats and non-avian animal species. It subsequently assesses the potential impacts of the proposed development on habitats and species considered to be of local value or above. Potential impacts on birds are considered separately in **Chapter 9: Ornithology**.

8.1.2 A range of ecological surveys have been carried out on the application site in 2010, 2012 and 2013. The 2010 surveys comprised bat and other protected mammals surveys, but the surveys did not meet current, best practice standards and the results are now out of date. These surveys are therefore not reported within the present document.

8.1.3 Surveys for bats and other protected mammals were carried out in 2013 to current survey standards and the results are presented within this chapter. A scoping process, undertaken in 2012, as well as informal scoping undertaken by Lawrence Environmental Consultants, informed the need for, and scope of, the ecological surveys carried out on the application site during 2013. The results of these surveys were then used to inform the windfarm layout and also form the basis of the detailed assessment presented in this chapter. The results of the detailed ecological surveys undertaken are summarised in this chapter, with more details provided in the following appendices in **Volume IV**:

- **Appendix 8.1:** Desk Study;
- **Appendix 8.2:** Habitat Survey;
- **Appendix 8.3:** Bat Survey and
- **Appendix 8.4:** Protected Mammals Survey.

8.1.4 Field survey work was carried out by Quadrat Scotland on commission from Lawrence Environmental Consultants. Where relevant, notes from walkover surveys carried out by Jacobs were added to the survey findings, as described in **Section 0**.

8.1.5 This chapter has been prepared by Jacobs, who also prepared the ecological desk study.

8.2 Policy, Legislation and Guidance

8.2.1 The baseline surveys and ecological assessment have been carried out with reference to the legislation and guidance outlined below.

Relevant Legislation

8.2.2 The non-avian ecological assessment has been undertaken with reference to the following legislation:

- The EC Habitats Directive (Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora);
- The Wildlife & Countryside Act 1981 (as amended);
- The Nature Conservation (Scotland) Act 2004;
- The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended);
- The Protection of Badgers Act 1992 (as amended) and
- The Wildlife and Natural Environment (Scotland) Act 2011.

Other Guidance

- 8.2.3 Other documents and guidance have been reviewed and applied in this assessment, as described below.
- 8.2.4 The Scottish Biodiversity List (SBL) (Scottish Executive, 2006) is a list of animals, plants and habitats that the Scottish Ministers consider to be of principal importance for biodiversity conservation in Scotland. Its purpose is to help public bodies carry out their Biodiversity Duty¹ by identifying the species and habitats which are the highest priority for biodiversity conservation in Scotland. Both scientific and social criteria have been used to define the Scottish Biodiversity List. Scientific criteria include all 'Priority Species and Priority Habitats' included on the UK Biodiversity Action Plan (BAP) (UK Biodiversity Partnership, 1997 *et seq.*)² that occur in Scotland. Social criteria have included the results of an omnibus survey carried out in 2006 to assess which non-domestic species and habitats in Scotland were most important to the Scottish public. These include rare or protected species and habitats as well as some that are common and widespread.
- 8.2.5 The Ayrshire Local BAP (Ayrshire Biodiversity Action Plan Partnership, 2008 *et seq.*) delivers local action for habitats and species in the East, North and South Ayrshire council areas and is a partnership of the three local authorities as well as environmental, forestry, farming, land and education agencies. The Local BAP includes specific action plans within two broad habitats (coastal habitats and lowland raised bog) as well two species / species groups, water vole (*Arvicola amphibius*) and farmland birds, although action for these are also anticipated to benefit a range of additional key species. The various Action Plans describe the status of priority habitats or species, outline the threats they face, set targets and objectives for their management and propose actions necessary to achieve recovery.
- 8.2.6 Key guidance documents relevant to the assessment of effects of windfarms on non-avian ecological receptors include the following (see **Section 0** for further details):
- Guidelines for Ecological Impact Assessment in the United Kingdom (Institute of Ecology and Environmental Management (IEEM)³, 2006) (subsequently referred to as the IEEM guidelines) and
 - Bats and onshore wind turbines: Interim guidance (Natural England (NE), 2012)⁴.

8.3 Methodology

Consultation

- 8.3.1 A formal scoping exercise was undertaken in summer 2012, during which responses were obtained from the following organisations with an interest in non-avian ecology and nature conservation:
- East Ayrshire Council (EAC);
 - Scottish Natural Heritage (SNH);
 - Scottish Environment Protection Agency (SEPA);
 - Forestry Commission Scotland (FCS);

¹ The Nature Conservation (Scotland) Act 2004 gives all public bodies a duty to further the conservation of biodiversity. A significant contribution of this comes from supporting the work of the Scottish Biodiversity Forum and helping to implement the Scottish Biodiversity Strategy.

² The UK BAP has been succeeded by the 'UK Post-2010 Biodiversity Framework', published in July 2012, which is implemented in Scotland through the Scottish Biodiversity List. However, the UK BAP Priority Species and Habitats which occur in Scotland are all included on the SBL.

³ Now the Chartered Institute of Ecology and Environmental Management (CIEEM).

⁴ Note that in the absence of a Scottish equivalent, Natural England guidance is assumed to apply to Scotland too.

- Nith District Salmon Fisheries Board (NDSFB) and
- Royal Society for the Protection of Birds (RSPB) Scotland.

8.3.2 A copy of the formal scoping response received from the Scottish Ministers can be found in **Appendix 5.3 Volume IV**. Individual scoping feedback to the proposed development has been summarised in **Appendix 5.4 Volume IV** and includes details of how the scoping response has been considered within the ES. It should be noted that not all the organisations with an interest in non-avian ecology and nature conservation raised comments regarding the proposals in terms of non-avian ecology. A summary of key points relating to non-avian ecology is provided in **Table 8.1**.

Table 8.1: Scoping Comments Relating to Non-Avian Nature Conservation

Consultee	Comment	Response
EAC	1. No comment was raised relating to non-avian ecology and nature conservation	1. Noted
SNH	1. Advised that the continued loss of blanket bog in East Ayrshire has become a significant concern and that it is not possible to scope out potential impacts on blanket bog. 2. Further advised that the proposed peat mapping will show the indicative extent of areas of the site that were formerly blanket bog and whether this information can be used to guide habitat restoration.	1. The importance of blanket bog is acknowledged in the present chapter. 2. Peat mapping suggests a former extent of blanket bog within current areas of plantation, as described in Section 8.4 . This includes areas proposed for habitat restoration, as described in Appendix 8.5 Volume IV .
SEPA	1. Advised that if there are wetlands or peatland systems present, the ES or planning submission should demonstrate how the layout and design of the proposal, including any associated borrow pits, hardstanding and tracks, avoid impact on such areas. 2. Further advised that a Phase 1 habitat survey should be carried out for the whole site and that the guidance <i>A Functional Wetland Typology for Scotland</i> should be used to help identify all wetland areas. A National Vegetation Classification (NVC) should be completed for any wetlands identified. Results of these findings should be submitted, including a map with all the proposed infrastructure overlain on the vegetation maps to clearly show which areas will be impacted and avoided. 3. It was pointed out that groundwater dependent terrestrial ecosystems, which are types of wetland, are specifically protected under the Water Framework Directive. The results of the National Vegetation Classification survey and Appendix 2 of the SEPA planning guidance on windfarm developments should be used to identify if wetlands are groundwater dependent terrestrial ecosystems. Advised that the route of roads, tracks or trenches within 100 m of groundwater dependent terrestrial ecosystems should be reconsidered. Similarly, the locations of borrow pits or foundations within 250 m of such ecosystems should be reconsidered. If infrastructure cannot be relocated out with the	1. Design mitigation to minimise impacts on wetlands and peatlands, as far as possible, is described in Section 8.6.2 and in Chapter 10: Hydrology, Hydrogeology and Geology . 2. An NVC survey was carried out covering the entire application site. Figure 8.2 Volume III shows the results of the habitat mapping, together with the proposed layout. 3. Chapter 10: Hydrology, Hydrogeology and Geology assesses potential impacts on GWDTEs with respect to SEPA (2014) guidance. 4. Where impacts are unavoidable, mitigation is proposed to reduce the significance of these impacts.

Consultee	Comment	Response
	<p>buffer zones of these ecosystems then the likely impact on them will require further assessment. This assessment should be carried out if these ecosystems occur within or out with the site boundary so that the full impacts on the proposals are assessed. The results of this assessment and necessary mitigation measures should be included in the ES.</p> <p>4. It was further advised that for areas where avoidance is impossible, details of how impacts upon wetlands including peatlands are minimised and mitigated should be provided within the ES or planning submission. In particular impacts that should be considered include those from drainage, pollution and waste management. This should include preventative / mitigation measures to avoid significant drying or oxidation of peat through, for example, the construction of access tracks, dewatering, excavations, drainage channels, cable trenches or the storage and re-use of excavated peat.</p>	
FCS	<p>1. Suggested that an assessment of the implications of the windfarm proposals on biodiversity should be carried out. This should be done in both general terms of effects on the biodiversity strategy aims and specifically the impacts on priority habitats and species; i.e. those with habitat and species action plans.</p> <p>2. Advised that a long-term management plan should be prepared with regards to both ecological and landscape considerations for the site and immediate environs. This should comprise an integrated land-use and management plan fostering the optimisation of the ecological and landscape benefits of both the windfarm site and neighbouring land uses.</p>	<p>1. Baseline surveys have been carried out and the results evaluated with respect to relevant nature conservation priorities, as described in Section 8.4.</p> <p>2. An outline Habitat Management Plan, proposed for the duration of the windfarm, is included as Appendix 8.5 Volume IV.</p>
NDSFB	<p>1. Advised that NDSFB considers it essential to include fisheries surveys in any ecological surveys associated with the proposal.</p>	<p>1. As described in Section 8.4, the watercourses within the application site have limited potential to support fisheries and no dedicated fisheries surveys have been carried out. However, in order to prevent adverse effects on downstream receptors, mitigation will be in place to prevent significant impacts on aquatic habitats.</p>
RSPB Scotland	<p>1. Welcomed the recognition that habitat restoration on the site could help to create conditions favourable for recolonisation by <i>Sphagnum</i>.</p> <p>2. Tree removal may present valuable opportunities for open habitat restoration. Phase 1 and peat depth surveys would be important to inform the design layout and ensure that micro-siting of turbines can be carried out to minimise any loss of blanket mire.</p>	<p>1. Noted.</p> <p>2. Tree removal followed by moorland restoration is proposed as part of the Outline Habitat Management Plan included in Appendix 8.5 Volume IV.</p>

- 8.3.3 As indicated by the scoping responses, the proposed development has the potential to impact a range of sensitive non-avian ecological receptors during the construction, operation and decommissioning phases. These include legally protected species, notably bats and otter (*Lutra lutra*), otherwise notable species such as Biodiversity Action Plan species, habitats of nature conservation importance, notably blanket mire and wet heath, wetlands and designated nature conservation sites. The presence of these key receptors within the zone of influence of the proposed development is therefore investigated within this chapter.

Data Sources

Study Area

- 8.3.4 Any reference in this chapter to the 'application site' refers to the land within the boundary shown in **Figure 4.1 Volume III**, unless otherwise stated or discussed.

Baseline Determination

- 8.3.5 For detailed technical methodologies please refer to **Appendices 8.1-8.4 Volume IV**.

Desk Study

- 8.3.6 To help establish the ecological baseline condition of the application site, a preliminary desk based study using online sources was undertaken in 2013. **Appendix 8.1 Volume IV** details the sources of information. The purpose of the desk study was to review extant ecological data of relevance to the application site and adjacent areas, specifically focusing on statutory designated nature conservation sites, i.e. Ramsar Wetlands, Special Areas of Conservation (SAC), Special Protection Area (SPA), Sites of Special Scientific Interest (SSSI) and National Nature Reserves (NNR), within 10 km of the application boundary. In addition to any Local Nature Reserves (LNR) and non-statutory nature conservation sites, such as any Scottish Wildlife Trust (SWT) reserve or a Wildlife Site (WS) and protected⁵ or notable⁶ species or habitat records within 2 km of the application boundary.
- 8.3.7 In accordance with Bat Conservation Trust (BCT) guidelines (Hundt, 2012) bat data was specifically collected up to 10 km. Non-avian ecology information was obtained from a variety of sources, including Scottish Badgers and Ayrshire Bat Group as well as online databases including the SNH interactive map (SNHa, 2014) and the National Biodiversity Network (NBN) Gateway (NBN, 2014).
- 8.3.8 Data were also sourced from an ES for a planning application within 5 km of the application site, namely the ES for the proposed Ashmark Hill Windfarm (Arcus Renewable Energy Consulting Ltd, 2011), the location for which abuts the northwestern edge of the application site.

Habitat Survey

- 8.3.9 As described in **Appendix 8.2 Volume IV**, in November 2012 and May 2013 Quadrat Scotland carried out a botanical survey to National Vegetation Classification (NVC) standard (Rodwell 1991 *et seq.*) of habitats within the application site. For altered/managed habitats such as conifer plantation and for non-vegetative features such as tracks, rock and watercourses for which the NVC does not apply, Phase 1

⁵ Defined as species (both fauna and flora) that receive full protection under United Kingdom legislation.

⁶ Defined as those species (both fauna and flora) and habitats that are currently of conservation concern, e.g. SBL or Ayrshire BAP priority habitats and species.

habitat survey notation (Joint Nature Conservation Committee (JNCC), 2010) was used instead.

- 8.3.10 During the survey, plant communities and any notable features were described in target notes, which were also used to assess the potential for the application site to support protected or otherwise notable species.
- 8.3.11 Ecologists from Jacobs visited the application site on 19 April 2013 and 13 May 2014 and notes taken during these surveys have, where appropriate, been incorporated into the baseline documented in the present chapter. On the second visit habitat polygons, which had been mapped as including potential Groundwater Dependent Terrestrial Ecosystems (GWDTEs) in mosaic with other communities and which occurred within 250 m of proposed turbines or within 100 m of track infrastructure, were investigated and the locations of the potential GWDTEs were recorded.

Bat Survey

- 8.3.12 Bat surveys were carried out by Quadrat Scotland between May and October 2012 in accordance with survey guidelines defined by the Bat Conservation Trust (BCT) (Hundt, 2012) and Natural England (NE, 2012). The BCT guidelines classify potential windfarm developments as having low, medium or high risk to local bat populations, based on the availability of roost features in the local area as well as the abundance and quality of habitats for commuting and foraging bats and the size of the proposed development. These guidelines identify survey effort commensurate with risk.
- 8.3.13 In the present case it was concluded that a survey effort commensurate with 'low' risk would be appropriate, due to its upland (>300m) situation, the dominance of first-rotation Sitka spruce (*Picea sitchensis*) forestry onsite providing low potential roost habitat and the absence of high-quality bat foraging habitat, such as larger river corridors or deciduous woodland edges. The surveys therefore comprised the following:
- Daytime site inspection to assess the potential for bats to roost onsite or within a 100 m buffer (access permitting), identify potential commuting routes, assess the value of the habitats present to foraging bats and to inform the activity surveys;
 - Dusk transect surveys were carried out once per season, i.e. in spring (May), summer (July) and autumn (September) 2013, inclusive, to record the activity of commuting and foraging bats within the application site boundary. Sampling was done by walking or by driving, with 3-5 min point count recordings being made every 100 m;
 - Static, automated surveys using remote recording detectors (Songmeter SM2 frequency division bat detectors) at five ground level locations within the application site (but extended to six locations in the July and September surveys). Detectors were left in situ for a minimum of seven days per survey season and
 - At height monitoring was carried out using an SM2 detector, with a microphone attached to an anemometry mast, at 35 m height, located in open moorland by Jock's Hags in the south-eastern part of the application site and at an elevation of 520 m. A second microphone was attached at the base of the mast to monitor activity at ground level simultaneously. Both sets of concurrent data were later compared to describe differences between species and their strata of flight activity. Recording was carried out for a minimum of seven days per season (spring, summer and autumn).
- 8.3.14 **Appendix 8.3 Volume IV** provides further details on the bat survey methodology used.

Protected Mammals Survey

- 8.3.15 As described in **Appendix 8.4 Volume IV**, surveys for otter, water vole (*Arvicola amphibius*), badger (*Meles meles*), red squirrel (*Sciurus vulgaris*), wildcat (*Felis silvestris*) and pine marten (*Martes martes*) were carried out by Quadrat Scotland in May 2013. The surveys were based on standard methods and mainly concentrated on searching for field evidence, such as resting places, feeding signs and faeces, although any sightings of individuals were also recorded.

Prediction and Evaluation of Effects

Ecological Impact Assessment Methodology

- 8.3.16 The IEEM guidelines form the basis of the impact assessment presented in this chapter. These guidelines set out a process of identifying the value of each ecological receptor and then characterising the impacts that are predicted, before discussing the effects on the integrity or conservation status of the receptor, proposed mitigation and residual impacts.
- 8.3.17 The initial action for any assessment of impacts is to determine which features should be subject to detailed assessment. The ecological receptors to be the subject of more detailed assessment should be of sufficient value that impacts upon them may be significant in terms of either legislation or policy. The receptors should also be vulnerable to significant impacts arising from the development.
- 8.3.18 All designated nature conservation sites, plant and animal species, habitats and integrated plant and animal communities that occur within the 'zone of impact' of the proposed development are defined as potential 'ecological receptors' (as described below).

Zone of Impact for Ecological Receptors

- 8.3.19 The IEEM guidelines indicate a four stage process: scoping and setting a zone of influence, determining the value of the receptors, predicting / characterising impacts and determining the significance of these impacts.
- 8.3.20 The zone of impact for ecological receptors varies, depending on the nature and behaviour of the receptors and the type of impact that may affect them. As a general rule in this impact assessment, the assessment on individual receptors is considered for the whole of the application site plus the distances listed in **Table 8.2**.

Table 8.2: Zone of Potential Impact from Works Areas for Ecological Receptors

Non-avian Ecological Receptor	Zone of Potential Impact
Internationally designated sites, e.g. Ramsar Wetlands and SACs and nationally designated sites, including SSSIs / NNRs	10 km
High-risk bat species	10 km
Locally designated sites, including LNRs, SWTs and WSs	2 km
Protected species, such as otters, water voles and badgers	500 m
Habitats	250 m

- 8.3.21 The maximum zone of impact for international and national sites was established at 10 km due to the potential designations for bats. For locally designated non-statutory sites, 2 km was chosen as a maximum zone of impact given the nature of their designations and the fact that these sites are not primarily notified for bat interest. Regarding other protected fauna, it is largely the behaviour of these species,

including movement in the landscape, which determines the 500 m maximum zone of impact.

Determining Value

8.3.22 The IEEM guidelines recommend that the value of ecological receptors or features is determined based on a geographic frame of reference. For this project the following geographic frame of reference is used:

- International;
- National (Scotland);
- Regional (southwest Scotland);
- Council area (comprising the three unitary authorities of East, North and South Ayrshire);
- Local (within 2 km) and
- Less than local.

Valuing Habitats

8.3.23 The value of habitats, according to IEEM guidelines, is measured against published selection criteria where available. Reference may, therefore, be made to SBL and Habitat Action Plans (HAPs) contained within the LBAP, although as the guidelines note, the presence of a HAP reflects the fact that the habitat concerned is in a sub-optimal state and hence the action plan is required. A HAP does not necessarily imply any specific level of importance for the habitat. It must be noted in accordance with the guidance, that features may be assigned greater value if there is reasonable chance that they can be restored to a higher value in the future.

Valuing Species

8.3.24 In assigning a level of value to a species, it is necessary to consider its distribution and status, including a consideration of trends based on available historical records. Rarity is an important consideration because of its relationship with threat and vulnerability although since some species are inherently rare, it is necessary to look at rarity in the context of status. A species that is rare and declining should be assigned a higher level of importance than one that is rare with a stable population. Reference may also be made to SBL and local Species Action Plans (SAPs) contained within the LBAP and other indicators of conservation status as appropriate, although as above with HAPs, the existence of a SAP does not necessarily imply any specific level of importance.

Predicting and Characterising Impacts

8.3.25 In accordance with the IEEM guidelines, when describing impacts, reference is made to the following:

- Confidence in predictions – the level of certainty that an impact will occur as predicted, based on professional judgement and where possible evidence from other schemes – this is based on a four point scale; certain / near certain, probable, unlikely and extremely unlikely;
- Magnitude – the size of an impact in quantitative terms where possible;
- Extent – the area over which an impact occurs;
- Duration – the time for which an impact is expected to last;
- Reversibility – a permanent impact is one that is irreversible within a reasonable timescale or for which there is no reasonable chance of action being taken to

reverse it. A temporary impact is one from which a spontaneous recovery is possible and

- Timing and frequency – whether impacts occur during critical life stages or seasons.

8.3.26 Both direct and indirect impacts are considered: direct ecological impacts are changes that are directly attributable to a defined action, e.g. the physical loss of habitat occupied by a species during the construction process. Indirect ecological impacts are attributable to an action, but which affect ecological resources through effects on an intermediary ecosystem, process or receptor, e.g. fencing of a development site may obstruct the access for grazers and cause scrub to invade marshy grassland.

Significance Criteria

8.3.27 In accordance with the IEEM guidelines, a significant impact, in ecological terms, is defined as “an impact (whether negative or positive) on the integrity⁷ of a defined site or ecosystem and/or the conservation status⁸ of habitats or species within a given geographical area, including cumulative and in-combination impacts”.

8.3.28 The approach adopted here aims to determine whether an impact is significant based on a discussion of the factors that characterise it. The ecological significance of an impact is therefore not dependent on the value of the feature in question. The value of any feature that will be significantly affected is subsequently used to determine the geographical scale at which the impact is significant. Thus, an ecologically significant impact on a feature of council area importance would be considered to represent a significant impact at a council area level. This in turn is used to determine the implications in terms of legislation, including the EIA Regulations and policy.

8.3.29 Any significant impacts remaining after mitigation (the residual impacts), together with an assessment of the likelihood of success of the mitigation, are the factors to be considered against legislation, policy and development control in determining the application.

Mitigation, Compensation and Enhancement

8.3.30 It is important to clearly differentiate between mitigation, compensation and enhancement and these terms are defined here as follows:

- Mitigation is used to refer to measures to avoid, reduce or remedy a specific negative impact in situ. Mitigation is only required for negative impacts assessed as being significant or where required to ensure compliance with legislation;
- Compensation is used to refer to measures proposed in relation to specific negative impacts but where it is not possible to fully mitigate for negative impacts in situ. Compensation is only required for negative impacts assessed as being significant or where required to ensure compliance with legislation and

⁷ Integrity is the coherence of ecological structure and function, across a site's whole area, that enables it to sustain a habitat, complex of habitats and/or the levels of populations of species.

⁸ Conservation status for habitats is determined by the sum of the influences acting on the habitat and its typical species that may affect its long-term distribution, structure and functions as well as the long-term survival of its typical species within a given geographical area. Conservation status for species is determined by the sum of influences acting on the species concerned that may affect the long-term distribution and abundance of its populations within a given geographical area.

- Enhancement is used to refer to measures that will result in positive ecological impacts but which do not relate to specific significant negative impacts or where measures are required to ensure legal compliance.

Limitations and Uncertainties

- 8.3.31 The validity of ecological survey data requires that they were obtained using accepted methodologies and that surveys were carried out in suitable conditions. The field survey methodologies outlined above and described in greater detail in **Appendices 8.2-8.4 Volume IV** were all carried out using survey standards endorsed by SNH.
- 8.3.32 Surveys were also carried out during suitable times of year. For habitat surveys this is between April/May and September/October, inclusive. For bat surveys in southwest Scotland the optimal survey time is from April/May through late September/early October. Otter, badger, red squirrel, wildcat and pine marten surveys can be carried out all year round, although periods of heavy rain or snow, strong winds or very low temperatures should be avoided. Water vole surveys should be carried out between March and October, with the optimal time being in spring and early summer before the vegetation gets very dense.
- 8.3.33 The habitat survey was carried out in the months of November and May, respectively. Although November is outside the optimal time, the survey was updated in May 2013 during the optimal time for survey and no significant limitations were noted. The bat surveys ran between 1 May and 24 September 2013, during favourable weather conditions and no significant limitations were noted. The mammal survey was carried out on 15-20 May 2013 and no significant limitations were noted.

8.4 Baseline conditions

Nature Conservation Sites

Statutory Sites

- 8.4.1 Five statutory designations, two of which relate to the same area, are present within 10 km of the application site, as shown on **Figure 8.1 Volume III**. These designations are described in **Appendix 8.1 Volume IV**. Only one designation is cited for non-avian ecological interest features, as shown in **Table 8.3**. Because ornithological or geological interest features are not relevant to this chapter they are detailed in **Chapter 9: Ornithology** and in **Chapter 10: Hydrology, Hydrogeology and Geology**, respectively.

Table 8.3 Statutory Designated Non-avian Ecological Interest Features / Sites within 10 km of the Application Site

Site Name and Designation	Distance and Direction from Application Site	Summary of Designated Interest	
Muirkirk Uplands SSSI	5.9 km north	Habitats:	Blanket bog Mosaic - Upland assemblage

- 8.4.2 No Local Nature Reserves were identified within 2 km of the application site.

Non-statutory Sites

8.4.3 Three ancient woodlands are present within this distance, as detailed in **Table 8.4**.

Table 8.4 Ancient Woodlands within 2 km of the Application Site

Site Name and Designation	Distance / Direction from Application Site	Description
Glen Afton Wood	1.3 km north	Semi-natural woodland of ancient status which is dominated by ash (<i>Fraxinus excelsior</i>), silver birch (<i>Betula pendula</i>), Hawthorn (<i>Crataegus monogyna</i>) and hazel (<i>Corylus avellana</i>).
Carcow	Abuts the western side of the northern tip of the application site	Ancient / semi-ancient woodland. No further details have been obtained
Boltwood	Abuts the application site on the eastern side.	Ancient woodland. No further details have been obtained

8.4.4 No other non-statutory sites designated for non-avian ecology features have been identified within 2 km of the application site.

Existing Species Records

Plants

8.4.5 As described in **Appendix 8.1 Volume IV**, no records have been obtained of plants of nature conservation interest within 2 km of the application site.

Invertebrates

8.4.6 As described in **Appendix 8.1 Volume IV**, no records have been obtained of invertebrates of nature conservation interest within 2 km of the application site.

Fish and Aquatic Macro-invertebrates

8.4.7 As described in **Appendix 8.1 Volume IV**, no records of fish of conservation interest have specifically been obtained for areas within the application site, but Atlantic salmon (*Salmo salar*), brown/sea trout (*Salmo trutta*) and European eel (*Anguilla anguilla*) have been recorded in 10 km x 10 km tetrads located within 2 km of the northern and south-eastern application site boundaries, respectively. Atlantic salmon, brown/sea trout and European eel are all SBL species. No further details have been made available on the locations of these records and it is possible that they relate to areas over 2 km from the application site.

8.4.8 The majority of the watercourses within the application site, namely Lochingerroch Burn, Glenshalloch Burn, Glenhastel Burn and Bolt Burn, drain into Afton Water or its tributary Carcow Burn. Afton Water drains into River Nith at New Cumnock, some 4 km north of the application site. According to SEPA (no date, a), Atlantic salmon, brown/sea trout and European eel are present in the River Nith and its tributaries and the catchment is described as being of high quality. Afton Water is classed as excellent and the River Nith itself is classed as good. Salmon are known to be present on Afton Water⁹.

⁹ <http://www.river-nith.com/the-board/conservation/>

- 8.4.9 Watercourses in the south of the application site, including Sandy Syke and West Strand, drain into the Water of Deugh, which is the main tributary to the River Dee. SEPA (no date, b) classes this catchment as being fair to excellent and significantly improved since the late 1970s when acidification led to the reduction, or in some cases the complete loss of, salmonid populations in the system's upper reaches. Acidification caused by acid rain is exacerbated by conifer forestry, which increases the 'capture' of pollutants from the atmosphere. Trout fishing is reported to have improved in the Water of Deugh in recent years¹⁰.
- 8.4.10 The watercourses within the application site are of limited size and unlikely to support salmon. The limited size of the watercourses (see descriptions within **Chapter 10: Hydrology, Hydrogeology and Geology**) and their modification through adjacent forestry, also makes it very unlikely that brown/sea trout and European eel occur within the application site.
- 8.4.11 There are no records of freshwater pearl mussel (*Margaritifera margaritifera*) from the application site or local area. The species could potentially be present in any watercourse, which supports salmonids. However, it is not listed as being present in the SEPA management plans for the Nith or Dee-Ken catchments (SEPA, no date, a, b). The River Doon, which is located more than 12 km west of the application site, historically supported a thriving pearl mussel fishery, but the population has undergone a sharp decline and the river is now considered to support a remnant but stable population of aging adults with little evidence of spawning and recruitment success in the lower catchment (Vattenfall Wind Power Ltd, 2013). The River Doon is not hydrologically connected to the application site.

Herptiles

- 8.4.12 As described in **Appendix 8.1 Volume IV**, no desk study records have been obtained of herptiles (amphibians and reptiles) within the application site. However, common lizard (*Zootoca vivipara*), slow worm (*Anguis fragilis*) and adder (*Vipera berus*) have been recorded in 10 km x 10 km tetrads located within 2 km of the western, north-northern and south-eastern site application boundaries. The exact locations of records are not known and could be more than 2 km from the application site. Common lizard, slow worm and adder are SBL species. All native herptiles are afforded limited protection under the Wildlife and Countryside Act 1981 (as amended).
- 8.4.13 An incidental sighting of a single male common lizard was made during surveys for the proposed Ashmark Hill Windfarm development (Arcus Renewable Energy Consulting Ltd, 2011), the location of which abuts the very north-western edge of the application site.
- 8.4.14 There are no historical records of great crested newt (*Triturus cristatus*) (GCN) from the local area, which is located on the border of zones classified by the Amphibian and Reptile Groups of the United Kingdom (ARG UK) as marginal or unsuitable to the species (ARG UK, 2010). Although standing water occurs within and outside the application site (see paragraph 8.4.60), these are isolated, poorly developed dystrophic pools or ponds which are unlike the extensively vegetated type of pond, which is preferred by breeding GCN (Langton *et al.*, 2001).

¹⁰ <http://www.fishpal.com/Scotland/Galloway/TroutFishing.asp?dom=Pal>

Mammals

Bats

- 8.4.15 No desk study records were made available of bats within the application site but, as described in **Appendix 8.1 Volume IV**, information provided by Ayrshire Bat Group indicates that a hibernaculum and swarming site is present near Craigdullyart Hill, approximately 7 km northeast of the application site boundary. This is known to regularly support populations of brown long-eared bat (*Plecotus auritus*), Natterer's bat (*Myotis nattereri*) and Daubenton's bat (*Myotis daubentonii*) and has been known to support whiskered bat (*Myotis mystacinus*) in the past. Another roost site record is in New Cumnock, approximately 3 km north of the site, but no details on the species present were provided. The Scottish Leisler's Bat Project 2010-2012 (see **Appendix 8.3 Volume IV**) recorded both Leisler's bat (*Nyctalus leisleri*) and common pipistrelle (*Pipistrellus pipistrellus*) in the New Cumnock area.
- 8.4.16 Very low numbers of foraging and commuting soprano pipistrelle (*Pipistrellus pygmaeus*), common pipistrelle, an unidentified *Nyctalus* species and an unidentified *Myotis* species were recorded in surveys for the proposed Ashmark Hill Windfarm development.
- 8.4.17 Bats are listed on the SBL and fully protected as European Protected Species under the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended). Noctule, common pipistrelle and soprano pipistrelle are also included on the Ayrshire BAP. Although commercial conifer plantation and moorland are unlikely to provide suitable roosting habitat, it is possible that bats forage or commute across the application site.

Red squirrel

- 8.4.18 No desk study records were available with respect to red squirrel within the application site, but as described in **Appendix 8.1 Volume IV** the species has been recorded 700 m north of the application site boundary. The species could potentially occur in plantation forestry within the application site, but is unlikely to have a permanent presence, because the forestry is characterised by dense Sitka spruce (*Picea sitchensis*), which is sub-optimal for red squirrels due to its unpredictable coning cycle and low average seed energy value compared to other tree species (Gurnell *et al.*, 2009; Poulson *et al.*, 2005). Red squirrel is protected under the Wildlife and Countryside Act 1981 (as amended). It is also included on the SBL and the Ayrshire BAP.

Otter

- 8.4.19 As described in **Appendix 8.1 Volume IV**, no desk study records have been obtained of otter within the application site, but the ES for Ashmark Hill Windfarm cited a record of otter on Afton Water in 1991. Otter spraints and prints were recorded in the surveys for the Ashmark Hill planning application, including on Carcow Burn, which runs along part of the western boundary of the application site and on Connel Burn which runs parallel to Carcow Burn, approximately 1 km from the western boundary of the application site at its closest point. Otter is fully protected as a European protected species under the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended) and is also included on the SBL and the Ayrshire BAP.

Mountain hare

- 8.4.20 As described in **Appendix 8.1 Volume IV**, mountain hare (*Lepus timidus*) has been recorded within 10 km hectad NS60, which overlaps with the application site. Although the species is unlikely to occur within plantation forestry, it could potentially

be present in the farmland habitats in the north of the application site and on open moorland in the south of the application site. Mountain hare is partially protected through the ban of various methods of capturing or killing hares that are listed in the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended). It is also included on the SBL.

Other species

- 8.4.21 As described in **Appendix 8.1 Volume IV**, no desk study records have been obtained of other protected or otherwise notable mammal species, such as water vole, badger, pine marten, wildcat, West European hedgehog (*Erinaceus europaeus*) or brown hare (*Lepus lepus*), within the application site or a 2 km buffer.

Habitat Survey Results

- 8.4.22 The results of the habitat survey are detailed in **Appendix 8.2 Volume IV** and mapped on **Figure 8.2 Volume III**.
- 8.4.23 A total of eleven broad habitat types, including vegetation types occurring in mosaic, were recorded within the application site. They are summarised in **Table 8.5** with both Phase 1 habitat codes (JNCC, 2010) and NVC community codes, together with their approximate extent within the application site. These habitats and communities are described in greater detail in the text below.

Table 8.5 Habitats within the Application Site

Phase 1 Habitats	NVC Communities	Extent (ha) within Application site
A1.2.2 Coniferous plantation	n/a	696.31
B1.1 Acid grassland	U4 <i>Festuca ovina</i> - <i>Agrostis capillaris</i> - <i>Galium saxatile</i> grassland	3.22
	U5 <i>Nardus stricta</i> - <i>Galium saxatile</i> grassland	15.84
	U6 <i>Juncus squarrosus</i> - <i>Festuca ovina</i> grassland	5.43
B2.2 Neutral grassland	MG1 <i>Arrhenatherum elatius</i> grassland	5.30
	MG6 <i>Lolium perenne</i> - <i>Cynosurus cristatus</i> grassland	18.94
	MG9 <i>Holcus lanatus</i> - <i>Deschampsia cespitosa</i> grassland	0.47
	MG10 <i>Deschampsia cespitosa</i> - <i>Juncus effusus</i> rush-pasture	21.42
B5 Marshy grassland	M23 <i>Juncus effusus</i> / <i>acutiflorus</i> - <i>Galium palustre</i> rush-pasture	11.02
	M25 <i>Molinia caerulea</i> - <i>Potentilla erecta</i> mire	0.51
C1.1 Dense bracken	U20 <i>Pteridium aquilinum</i> - <i>Galium saxatile</i> community	3.03
D1 Dry dwarf shrub heath	H12 <i>Calluna vulgaris</i> - <i>Vaccinium myrtillus</i> dry heath	(see text)
D2 Wet dwarf shrub heath	M15 <i>Trichophorum cespitosum</i> - <i>Erica tetralix</i> wet heath	7.79
E1.6.1 Blanket bog	M17 <i>Trichophorum cespitosum</i> - <i>Eriophorum vaginatum</i> blanket mire	0.55
	M19 <i>Calluna vulgaris</i> - <i>Eriophorum vaginatum</i> blanket mire	35.97
	M20 <i>Eriophorum vaginatum</i> blanket mire	3.25

Phase 1 Habitats	NVC Communities	Extent (ha) within Application site
	M19/M20 intermediate	5.81
E2.1 Flush	M6 <i>Carex echinata-Sphagnum fallax/denticulatum mire</i>	5.80
G1 Standing water	M2 <i>Sphagnum cuspidatum/Sphagnum fallax bog pool community</i>	<0.01
	M4 <i>Carex rostrata-Sphagnum fallax mire</i>	<0.01
	Standing water not included in NVC survey	0.01
G2 Running water	Not included in NVC survey	6.76
J1.1 Arable land	Not included in NVC survey	0.03

8.4.24 The habitats within the application site are briefly described below, with greater detail provided within **Appendix 8.2 Volume IV**.

Woodland

8.4.25 Coniferous plantation woodland dominates the application site. It is mainly comprised of Sitka spruce, most of which comprises semi-mature coupes. Please refer to **Appendix 4.1 Volume IV** for more detail on the forestry.

8.4.26 Much of the forestry has been planted on drained moorland which includes both deeper (>50 cm) peat and shallow peat or mineral soils, with the former mainly occurring in the southern and eastern parts of the application site. The areas of deeper peat are likely to have supported blanket bog prior to afforestation and blanket bog still remains in open areas. When peat is drained, it undergoes 'oxidative wastage' and it is possible that some of the current areas of shallow peat originally comprised deeper peat also supporting blanket bog, whereas heath or grassland communities are likely to have characterised areas of shallow or no peat. Site treatment prior to planting included standard ploughing to a depth of 40-45 cm, with the deeper peat drained through a network of ditches in addition to the plough furrows. This caused drying of the peat and peatland species are now rare within the forestry, although areas of bog and flush occur within woodland rides.

8.4.27 The forestry typically contains no understory or ground flora due to the heavy shade cast by the trees and the ground is mainly characterised by deep leaf litter. Where a ground flora occurs, this typically comprises mosses, such as *Rhytidiadelphus loreus* and *Hylocomium splendens*.

Acid grassland

8.4.28 Acid grassland is a feature of a few of the open areas where peat is very shallow or absent, e.g. on knolls. It also occurs alongside tracks and in mosaic alongside watercourses.

8.4.29 The following three NVC communities make up the acid grassland habitat within the application site boundary:

- U4 *Festuca ovina-Agrostis capillaris-Galium saxatile* grassland;
- U5 *Nardus stricta-Galium saxatile* grassland and
- U6 *Juncus squarrosus-Festuca ovina* grassland.

8.4.30 U4a *Festuca ovina-Agrostis capillaris-Galium saxatile* grassland, the typical sub-community, mainly occurs along tracks but also occurs alongside Glenhastel Burn and a disused quarry in the west of the application site. It is characterised by grasses, such as wavy hair-grass (*Deschampsia flexuosa*), velvet bent (*Agrostis*

canina), sheep's-fescue (*Festuca ovina*), Yorkshire fog (*Holcus lanatus*) and sweet vernal-grass (*Anthoxanthum odoratum*) and forbs such as common marsh bedstraw (*Galium palustre*). A rather species-poor rank form of U4b *Festuca ovina*-*Agrostis capillaris*-*Galium saxatile* grassland, the *Holcus lanatus*-*Trifolium repens* sub-community, which is characterised by dominant Yorkshire fog and abundant litter, is frequently found in mosaics alongside watercourses but also occurs alongside tracks.

- 8.4.31 The U5 and U6 acid grassland types occur on shallow peat within open moorland areas. They comprise U5b *Nardus stricta*-*Galium saxatile* grassland, the *Agrostis canina*-*Polytrichum commune* sub-community, which is dominated by mat-grass (*Nardus stricta*) and U6a *Juncus squarrosus*-*Festuca ovina* grassland, the *Sphagnum* sub-community, which is dominated by heath rush (*Juncus squarrosus*) over a carpet of *Sphagnum capillifolium* and sometimes *Sphagnum fallax*. Both these communities share a range of associated species, such as common bent (*Agrostis capillaris*), velvet bent, sweet vernal-grass, wavy hair-grass, Yorkshire fog, green-ribbed sedge (*Carex binervis*), tormentil (*Potentilla erecta*) and common marsh bedstraw, as well as the mosses *Rhytidiadelphus squarrosus*, *Hylocomium splendens*, *Polytrichum formosum* and *Polytrichum commune*. Locally the U6 vegetation includes a greater range and abundance of grasses and tends towards U6d *Juncus squarrosus*-*Festuca ovina* grassland, the *Agrostis capillaris*-*Luzula multiflora* sub-community. The U6a grassland tends to occur at the edges of the blanket bog in the transitions to U5b grassland.
- 8.4.32 The U4 and U5 grassland communities are not groundwater dependent, but SEPA (2014) considers U6 grassland potentially moderately groundwater dependent. However, as described in **Appendix 10.2: GWDTE Assessment Volume IV**, the U6 vegetation within the application site is concluded not to be groundwater dependent.

Neutral grassland

- 8.4.33 Semi-improved neutral grassland occurs mainly in the enclosed pastures to the north of the application site and outside of the plantation.
- 8.4.34 The following NVC communities make up the neutral grassland habitat within the application site boundary:
- MG6 *Lolium perenne*-*Cynosurus cristatus* grassland;
 - MG9 *Holcus lanatus*-*Deschampsia cespitosa* grassland and
 - MG10 *Holcus lanatus*-*Juncus effusus* rush-pasture.
- 8.4.35 MG6b *Lolium perenne*-*Cynosurus cristatus* grassland, *Anthoxanthum odoratum* sub-community, is a short turf community mainly comprised of crested dog's-tail (*Cynosurus cristatus*), spear thistle (*Cirsium vulgare*), white clover (*Trifolium repens*), perennial ryegrass (*Lolium perenne*), Yorkshire fog, common bent, velvet bent and the moss *Rhytidiadelphus squarrosus*. Stands of dense bracken (*Pteridium aquilinum*) conforming to U20 *Pteridium aquilinum*-*Galium saxatile* community are associated with MG6 grassland in the north of the application site.
- 8.4.36 MG9 *Holcus lanatus*-*Deschampsia cespitosa*, no clear sub-community, comprises species-poor grassland dominated by Yorkshire fog, tufted hair-grass (*Deschampsia cespitosa*) and occasionally velvet bent (*Agrostis canina*).
- 8.4.37 MG10a *Deschampsia cespitosa*-*Juncus effusus* rush-pasture, typical sub-community, comprises species-poor grassland dominated by soft-rush (*Juncus effusus*) with some Yorkshire fog, marsh thistle (*Cirsium palustre*), creeping buttercup (*Ranunculus repens*) and the moss *Rhytidiadelphus squarrosus*.

- 8.4.38 SEPA (2014) considers MG10 rush-pasture potentially moderately groundwater dependent. However, as described in the GWDTE Assessment in **Appendix 10.2: Volume IV**, the MG10 vegetation within the application site is concluded not to be groundwater dependent.

Marshy grassland

- 8.4.39 Marshy grassland is very common throughout the application site, mainly alongside the open watercourses and also alongside forestry tracks. It also occurs, to a lesser degree, within forest rides which are predominantly comprised of modified blanket bog.

- 8.4.40 The following NVC communities make up the marshy grassland habitats within the application site boundary:

- M23 *Juncus effusus/acutiflorus-Galium palustre* rush-pasture and
- M25 *Molinia caerulea-Potentilla erecta* mire.

- 8.4.41 M23a *Juncus effusus/acutiflorus-Galium palustre* rush-pasture, *Juncus acutiflorus* sub-community, is very frequent along open valleys, such as Glenshallock Burn. It is distinctive in having a dominance of the two rushes soft-rush and sharp-flowered rush (*Juncus acutiflorus*) with frequent common sorrel (*Rumex acetosa*), cuckoo-flower (*Cardamine pratensis*), creeping buttercup, Yorkshire fog, marsh thistle, tufted hair-grass (*Deschampsia cespitosa*), velvet bent and the mosses *Rhytidiadelphus squarrosus*, *Brachythecium rivulare* and *Calliergonella cuspidata*.

- 8.4.42 M25a *Molinia caerulea-Potentilla erecta* mire, *Erica tetralix* sub-community, is generally less frequent than the rush-pasture alongside watercourses and in valleys but is locally quite prominent. It is characterised by having a total dominance of purple moor-grass (*Molinia caerulea*) and very few associated species, except for some sparse common marsh bedstraw and tormentil. Mosses too are generally impoverished due to the build-up of dead purple moor-grass leaf litter.

- 8.4.43 SEPA (2014) considers M23 rush-pasture potentially highly groundwater dependent, whereas M25 is considered potentially moderately groundwater dependent. As described in the GWDTE Assessment (**Appendix 10.2 Volume IV**), at least some of the M23 and M25 vegetation within the application site is concluded to be groundwater dependent.

Dwarf shrub heath

- 8.4.44 Heath habitats are widespread across the application site but occur at relatively low abundance. They are typically associated with shallow (<50 cm) peat soils and mainly occur next to bog habitats or on steeper slopes by watercourses.

- 8.4.45 The following NVC communities make up the heath habitats within the application site boundary:

- H12 *Calluna vulgaris-Vaccinium myrtillus* dry heath and
- M15 *Trichophorum cespitosum-Erica tetralix* wet heath.

- 8.4.46 Dry heath is localised throughout the survey area and is found in small patches on steeper slopes and banks such as occur alongside watercourses, such as Bolt Burn. The main stands occur on the steeper slopes to the north of Struthers Brae. The vegetation is distinctive in the dominance of heather (*Calluna vulgaris*). There is also frequent sparse bilberry (*Vaccinium myrtillus*) and crowberry (*Empetrum nigrum*) and scattered hard fern (*Blechnum spicant*), mat-grass and the mosses *Hypnum jutlandicum*, *Hylocomium splendens*, *Polytrichum commune*, *Racomitrium lanuginosum*, *Rhytidiadelphus loreus* and *Dicranum scoparium*. Broad buckler fern (*Dryopteris dilatata*) and the bog-moss *Sphagnum capillifolium* were also recorded in this habitat.

8.4.47 M15b *Trichophorum cespitosum-Erica tetralix* wet heath, typical sub-community, occurs in areas supporting blanket bog but where the peat depth is less than 50 cm. It is generally low in species. Purple moor-grass is frequent along with heath-rush and the mosses *Polytrichum commune*, *Hylocomium splendens* and *Pleurozium schreberi*. Dwarf shrubs are only sparsely present and include heather and bilberry only where the vegetation is the richest, whereas cross-leaved heath (*Erica tetralix*) is generally absent. Deer-grass (*Trichophorum cespitosum*) may also be sparsely present where the vegetation is in better condition. In the poorest stands the vegetation looks very similar to modified blanket bog (see below) and is mainly classified as wet heath because of the peat depth, although the vegetation usually contains less hare's-tail cottongrass (*Eriophorum vaginatum*) and *Sphagnum capillifolium* than the blanket bog.

8.4.48 H12 dry heath is not groundwater dependent, but SEPA (2014) considers M15 wet heath potentially moderately groundwater dependent. However, as described in **Appendix 10.2 Volume IV**, the M15 wet heath within the application site is concluded not to be groundwater dependent.

Blanket bog

8.4.49 Blanket bog occurs on flat and gently sloping ground throughout the application site and can still be found along even the narrowest forestry rides, where the peat depth is over 50 cm deep.

8.4.50 The following NVC communities make up the blanket bog habitat within the application site boundary:

- M17 *Trichophorum cespitosum-Eriophorum vaginatum* blanket mire;
- M19 *Calluna vulgaris-Eriophorum vaginatum* blanket mire and
- M20 *Eriophorum vaginatum* blanket and raised mire.

8.4.51 M17b *Trichophorum cespitosum-Eriophorum vaginatum* blanket mire, the *Cladonia* species sub-community, occurs within the large open area of blanket bog west and north of Struther's Brae. It is restricted to drier areas having undergone erosion in the past and occurs on hagged peat with un-vegetated faces and areas of bare peat on the surface. Heather is constant together with hare's-tail cottongrass and the mosses *Pleurozium schreberi*, *Hypnum jutlandicum* and *Racomitrium lanuginosum*, along with some *Cladonia portentosa* lichens. This type of blanket mire has no great cover of *Sphagnum*. Although the bare peat surfaces show signs of trampling by deer and the M17b vegetation is dry and unfavourable on top of the hags, some recovery has taken place in the hag bottoms, as indicated by the presence of the M2 *Sphagnum cuspidatum/Sphagnum fallax* bog pool community.

8.4.52 M19a *Calluna vulgaris-Eriophorum vaginatum* blanket mire, the *Erica tetralix* sub-community, represents the blanket bog of the highest quality within the application site. It occurs in some forestry rides, notably around Yarnallow's Knowe, where there is abundant hare's-tail cottongrass with constant and co-dominant heather, frequent crowberry and the mosses *Hylocomium splendens*, *Rhytidiadelphus loreus*, *Pleurozium schreberi* and *Sphagnum capillifolium*. It also differs from the poorer types of blanket bog in having no heath rush, soft-rush or velvet bent and much less *Polytrichum commune* and *Sphagnum fallax*. However, the highest quality blanket bog is found around the large open area just west and north of Struther's Brae. Here, an undulating terrain with large areas of deep peat, over 1.5 m, supports much M19a vegetation, as well as a network of more waterlogged vegetation within pools and hollows that conform to M4 *Carex rostrata-Sphagnum fallax* mire, where bottle sedge (*Carex rostrata*) is dominant and M2 *Sphagnum cuspidatum/Sphagnum fallax* bog pool, where other species such as common cottongrass (*Eriophorum angustifolium*) are prominent whereas bottle sedge is absent. Both of these are quite similar in having a continuous carpet of *Sphagnum fallax*, *Sphagnum*

denticulatum and *Sphagnum cuspidatum* and there can also be plentiful *Sphagnum capillifolium* and *Sphagnum papillosum* where the vegetation grades into M19 bog. The transition to acid grassland around the edges of these areas frequently has U6a *Juncus squarrosus-Festuca ovina* grassland, *Sphagnum* species sub-community, which can have abundant *Sphagnum* but occurs on shallow peat of about 20 cm deep.

- 8.4.53 M20a *Eriophorum vaginatum* blanket and raised mire, the species-poor sub-community, represents the poorest of the blanket bog. It contains just a few species, with hare's-tail cottongrass being the dominant and often sole species present. *Sphagnum capillifolium* and/or *Sphagnum fallax* are locally frequent, but heather and other dwarf shrubs are absent or present at very low cover, whereas the moss *Polytrichum commune* can be very abundant which thrives along forest rides. Other frequent indicators of the modified nature of this blanket bog include heath rush, soft-rush and velvet bent. The condition of the vegetation is poor and heavily affected by deer trampling, as evidenced by poaching and churned up peat.
- 8.4.54 M17, M19 and M20 blanket mire communities are rain fed and not groundwater dependent (SEPA, 2014). Bog pool communities are described separately below.

Flush and spring

- 8.4.55 Acid flush is frequent throughout the application site, where it can be found in association with M23 rush-pasture along watercourses and in association with blanket bog along forestry rides. In the latter cases it may be somewhat artificially derived, as it is often associated with ploughed drains or vehicle tracks and occurs in a linear fashion along the rides. Ploughed drains within plantation blocks also channel water to the rides, thus creating soligenous zones there.
- 8.4.56 Spring habitat was recorded as a rare and isolated community found in only one location, on a steep opening within conifer plantation with dry heath, north-northwest of Yarrgallow Knowe (see **Target Note 30** in **Appendix 8.2 Volume IV**), although it also occurs in modified form along the sides of the forestry trackside drains in this vicinity. However, this area is outside the application site.
- 8.4.57 The following NVC communities make up the flush and spring habitat within the application site:
- M6 *Carex echinata-Sphagnum fallax/denticulatum* mire.
- 8.4.58 The flush vegetation keys out as either M6ci *Carex echinata-Sphagnum fallax/denticulatum* mire, the *Juncus effusus* sub-community, or M6di *Carex echinata-Sphagnum fallax/denticulatum* mire, the *Juncus acutiflorus* sub-community. The former is dominated by soft-rush, whereas the latter is dominated by sharp-flowered rush. Both include abundant *Sphagnum fallax* and *Polytrichum commune*. However, the range of associated species is generally low.
- 8.4.59 M6 mire is considered potentially highly groundwater dependent (SEPA, 2014). As described in the GWDTE Assessment in **Appendix 10.2 Volume IV** at least some of the M6 mire within the application site is concluded to be groundwater dependent.

Aquatic habitats

- 8.4.60 Pools occur within the blanket bog and a pond is also present within plantation in the application site. Locations of these features are listed in **Table 8.6** and shown as Target Notes on **Figure 8.2 Volume III**.

Table 8.6 Standing Waterbodies within the Application Site

Target Note on Figure 8.2 Volume III	Description
TN1	C.10 m x 10 m pond in clearing within plantation.
TN2	Bog pools.
TN3	Bog pool/hollows.
TN4	Small pond with edges supporting <i>Ranunculus flammula</i> , <i>Juncus effusus</i> , <i>Carex rostrata</i> , <i>Potentilla palustris</i> , <i>Eleocharis palustris</i> . M1 bog pool also present.
TN5	Wet hollows/pools.
TN6	M4 pool/mossy flush.

- 8.4.61 The following NVC communities make up the pool habitats within the application site:
- M2 Sphagnum cuspidatum/Sphagnum fallax bog pool community and
 - M4 Carex rostrata-Sphagnum fallax mire.
- 8.4.62 M2 *Sphagnum cuspidatum/Sphagnum fallax* bog pool community occurs in flat hag bottoms within blanket bog west and north of Struther’s Brae. Sub-communities are defined by the presence (and dominance) of either *Sphagnum cuspidatum* or *Sphagnum fallax*, but both species were recorded in the M2 vegetation onsite and it is therefore not possible to identify sub-communities. Associated species include prominent common cotton-grass as well as *Sphagnum denticulatum*, *Sphagnum capillifolium* and *Sphagnum papillosum*, notably where the vegetation blends into M19 blanket bog.
- 8.4.63 M4 *Carex rostrata-Sphagnum fallax* mire also occurs within blanket bog west and north of Struther’s Brae. It is associated with M2 vegetation and shares many of the same species, but bottle sedge is the community dominant. M2 bog pool and M4 mire are not considered groundwater dependent (SEPA, 2014).
- 8.4.64 A network of drains and watercourses crosses the application site (see **Figure 10.1 Volume III**). Primary watercourses within the application site and immediate surroundings include Lochingerroch Burn, Glenshalloch Burn, Glenhastel Burn and Bolt Burn, which drain into Afton Water or its tributary Carcow Burn. Afton Water drains into the River Nith at New Cumnock, some 4 km north of the application boundary. Watercourses in the south of the application site, including Sandy Syke and West Strand, drain into the Water of Deugh. The watercourses within the application site are partly fed by a high number of forest drains.
- 8.4.65 The drains and watercourses within the application site are predominantly narrow, up to 1 m wide and poorly developed with aquatic vegetation being absent, especially within areas of plantation, or mainly comprising creeping bent (*Agrostis stolonifera*). Larger watercourses include Glenshalloch Burn, Glenhastel Burn and Lochingerroch Burn, which reach maximum widths of c.3 m. The former has a bed with cobbles, whereas the latter has a bed with boulders. However, similar to other watercourses onsite, they have a poorly developed ecological structure.
- 8.4.66 **Chapter 10: Hydrology, Hydrogeology and Geology** provides further details of characteristics of each watercourse.

Species Survey Results

Plants

- 8.4.67 No plant species of conservation interest was recorded during the surveys. No evidence of invasive non-native plant species was noted during the course of the ecological survey work.

Bats

- 8.4.68 The roost potential survey revealed no buildings or structures within 200 m of potential turbine locations or within 50 m of potential track routes. The conifer woodland that covers much of the application site has generally low suitability for bats, with forestry blocks being considerably younger than the 80 years at which coniferous trees are considered more likely to contain roosts (Forestry Commission for England and Wales, 2005). No trees within the application site were noted with any features lending bat roost potential, such as significant cracks, crevices or woodpecker holes.
- 8.4.69 Two species of bat were identified during the transect surveys: soprano pipistrelle (*Pipistrellus pygmaeus*) and common pipistrelle (*Pipistrellus pipistrellus*). Very low activity levels were recorded, with no passes being recorded in the May surveys and only seven passes in the July surveys. September saw slightly higher activity but only 15 passes were recorded. Similar proportions of common and soprano pipistrelles were recorded.
- 8.4.70 The static monitoring identified the presence of common and soprano pipistrelle, Leisler's bat (*Nyctalus leisleri*) and Daubenton's bat (*Myotis daubentonii*). A total of 303 passes was recorded across the six AnaBat locations, with the vast majority (279 calls), being recorded during the summer period. As described in **Appendix 8.3 Volume IV**, given the very low levels of activity across the AnaBat locations, it is difficult to make an assessment of activity levels in relation to habitat types. However, most activity was recorded c.500 m east of the application site boundary, along a track within forestry (Location 4). 51.5 % of all bat calls recorded were soprano pipistrelles, whereas 45.2 % of calls were by common pipistrelles. Daubenton's bats accounted for 2.6 % of calls and Leisler's bats accounted for 0.7% (2 passes) of calls. Full details of all calls are provided within **Appendix 8.3 Volume IV**. Leisler's bat is considered a high risk species (as defined by Natural England 2012).
- 8.4.71 The activity surveys at height only recorded bat activity at 35 m in the summer surveys, whereas the microphone at ground level recorded activity in both summer and autumn. Levels of activity were very low: only a single Leisler's bat and two common pipistrelle passes were recorded at 35 m. At ground level, three common pipistrelle and nine soprano pipistrelle passes were recorded in summer and a single common pipistrelle pass was recorded in autumn.
- 8.4.72 Leisler's bat was the only high-risk species recorded in the surveys. However, the very low level of activity indicates that Leisler's bats are not likely to use the application site as roost or foraging area but rather that individual bats pass through the site on their way to more suitable foraging habitat, such as Afton Reservoir.

Otter

- 8.4.73 As described in **Appendix 8.4 Volume IV** (and shown on **Maps 1-2** within the appendix), evidence of otter was recorded along the main watercourses on the application site, including Glenhastel Burn and Glenshalloch Burn, the head of a tributary of the Sandy Syke and at the head of Lochingerroch Burn. Evidence included several holts, including one on Glenshalloch Burn showing signs of recent use, numerous couches, recent tracks and spraints.

Water vole

8.4.74 Active water vole populations were recorded on the upper reaches of Sandy Syke and Glenhastel and Lochingerroch Burns. No activity was recorded within the forestry, where the conifers grew close to watercourses, although signs of past occupation were recorded at such locations. Some of the active populations were in quite small open stretches along the burns between more enclosed conifers. Populations were predominantly found along stretches of slow-moving water, some of which comprised sluggish channels between tussocks of rushes. Even along the main burns, most water vole burrows were located within stands of rush tussocks alongside pools or other pockets of slower moving water. The burrows were largely in groups of 10-20 holes within these pockets of taller vegetation, with further holes in the banks of the burns.

Other mammal species

8.4.75 No signs of other protected or notable mammal species, such as badger, pine marten, wildcat, mountain hare or red squirrel, were recorded in the ecological surveys.

8.4.76 The open moorland has some potential to support mountain hare and the presence of both open moorland and woodland could potentially benefit pine marten and wildcat, but the lack of evidence of these species suggests that they are absent or very occasional in the local area. The conifer plantation is mainly characterised by immature Sitka spruce. This species is regarded as sub-optimal for red squirrels due to its unpredictable coning cycle and low average seed energy value compared to other tree species (Gurnell *et al.*, 2009; Poulson *et al.*, 2005). The potential for red squirrel to utilise habitats within the application site is therefore likely to be low.

Evaluation of Ecological Receptors

8.4.77 An evaluation of the non-avian ecological receptors recorded in the application site or provided as desk study records and considered likely to be present is provided in **Table 8.4**.

Table 8.4 Evaluation of Non-avian Ecological Receptors

Receptor	Legal / Conservation Status	Reason for Evaluation	Evaluation
Nature Conservation Sites			
Muirkirk Uplands SSSI	SSSIs are fully protected under the Nature Conservation (Scotland) Act 2004.	SSSIs are areas which SNH considers to best represent the national natural heritage. One of the designated interests, blanket bog, is also an Ayrshire BAP Priority Habitat.	National value
Glen Afton Wood (locality with ancient woodland)	There is no legislation specifically protecting ancient woodland, but Scottish Planning Policy identifies it as resource that should be protected and enhanced.	Scottish Planning Policy identifies ancient woodland as an important and irreplaceable national resource, albeit not of a sufficient value to warrant designation as an SSSI.	Regional value
Carcow (locality with ancient woodland)	As above	As above	Regional value

Receptor	Legal / Conservation Status	Reason for Evaluation	Evaluation
Boltwood (locality with ancient woodland)	As above	As above	Regional value
Habitats			
Coniferous plantation woodland	Not a national focus for conservation. Planted conifers are an Ayrshire Priority Habitat, but included on the BAP only because of their significant extent in Ayrshire and their potential for enhancement to benefit native biodiversity.	Sitka spruce plantation woodland characterises much of the application site, mostly arranged within coupes of uniform age-class and mostly comprising semi-mature stands with little associated vegetation.	Less than local value
Acid grassland	Two acid grassland communities are priority habitats on the SBL; namely <i>Juncus squarrosus-Festuca ovina</i> grassland and <i>Nardus stricta-Galium saxatile</i> grassland. These include the NVC communities U5 and U6 both of which were recorded within the site boundary. Acid grassland is a priority habitat on the Ayrshire BAP and the broad category is assumed to include all three NVC categories recorded on site, i.e. U4, U5 and U6. U6 grassland is also considered potentially moderately groundwater dependent (UKTAG, 2013).	The extent of acid grassland within the application site is relatively low and fragmented. The structure of the vegetation varies across the application site but is consistently low in species. U6 grassland within the application site is considered not to be groundwater dependent.	Less than local value
Neutral grassland	Upland types of neutral grassland, including MG6, MG9 and MG10 communities, or the associated U20 bracken community, are not national or Ayrshire foci for conservation. MG10 rush-pasture is potentially moderately groundwater dependent (UKTAG, 2013).	The neutral grassland habitats onsite are semi-improved in nature and characterised by common and widespread species. The MG10 rush pasture within the application boundary is concluded not to be groundwater dependent.	Less than local value
Marshy grassland	Purple moor-grass and rush pastures are a priority habitat on the SBL and the Ayrshire BAP. The habitat includes NVC community M23 which was recorded within the site boundary, but not M25 mire which was also recorded in surveys. Both M23 and M25 communities are considered potentially moderately groundwater dependent (UKTAG, 2013).	The UK BAP habitat description for purple moor-grass and rush pastures (UK BAP, 2011) that has been adopted by the SBL and Argyll BAP describes vegetation, which is more diverse than the examples onsite. At least some of the M23 and M25 vegetation within the application site is considered to be groundwater dependent.	Local value

Receptor	Legal / Conservation Status	Reason for Evaluation	Evaluation
Dry dwarf shrub heath	European dry heaths are listed on Annex 1 of the EC Habitats Directive. Dry heath is a priority habitat on the SBL and the Ayrshire BAP.	Heathland habitats are widespread in the region: in 1998 the then Strathclyde ¹¹ Region was estimated to have 3,165 km ² of heather moorland, including habitat mosaics (SNH, 1998). A more recent estimate has not been found. The dry heath on the application site occurs as small patches, which are too small to map and which are therefore likely to represent a very small and fragmented fraction of the dry heath resource within the region.	Less than local value
Wet dwarf shrub heath	Northern Atlantic wet heaths with <i>Erica tetralix</i> are listed on Annex 1 of the EC Habitats Directive. Upland heathland is a priority habitat on both the SBL and the Ayrshire BAP. M15 wet heath is also considered potentially moderately groundwater dependent (UKTAG, 2013).	Wet heath occurs at relatively low abundance within the application site, mainly on the edges of blanket bog. The structure of the vegetation varies but is mainly relatively low in species. Wet heath within the application site is concluded not to be groundwater dependent.	Local value
Blanket bog	Blanket bog is listed on Annex 1 of the EC Habitats Directive. It is a priority habitat on the SBL and the Ayrshire BAP.	The extent of blanket bog within the application site is mainly confined to a zone around Struther's Brae in the southeast. It would have been significantly greater prior to afforestation and some blanket bog remains in rides across the application site.	Council area value
Flush	Upland flushes, fens and swamps are a priority habitat on the SBL and the Ayrshire BAP. M6 mire is considered potentially highly groundwater dependent (UKTAG, 2013).	The UK BAP habitat description for upland flushes, fens and swamps that has been adopted by the SBL and Ayrshire BAP describes species-rich assemblages of this habitat, which are unlike the examples within the application boundary, some of which are of recent origin. The flush habitat within the application site is confirmed to be groundwater dependent.	Local value
Standing water	Eutrophic standing waters, mesotrophic lakes and oligotrophic and dystrophic lakes are priority habitats on the SBL and the Ayrshire BAP.	The application site includes a small number of standing waterbodies. They appear to hold limited ecological interest.	Local value

¹¹ The old Strathclyde Region no longer exists, with Argyll & Bute being formed out of the Strathclyde reorganisation. The former Strathclyde Region covered 13,756 km² and the new Argyll and Bute area covers 6,909 km²; roughly half the size.

Receptor	Legal / Conservation Status	Reason for Evaluation	Evaluation
Running water	Rivers are a priority habitat on the SBL and the Ayrshire BAP.	The watercourses within the application site feed into catchments of generally high ecological status, ranging from fair to excellent and supporting salmonids.	Local value
Fish			
Atlantic salmon	An SBL species	Watercourses within the application site are typically small, have poorly developed ecological structure and are unlikely to support the species. However, the species has been recorded in the local area in the past and may occur within a short distance downstream of the application site.	Local value
Brown/sea trout	An SBL species	Watercourses within the application site are typically small, have poorly developed ecological structure and are unlikely to support the species. However, the species has been recorded in the local area in the past and may occur within a short distance downstream of the application site.	Local value
European eel	Listed with a watching brief on the SBL.	Watercourses within the application site are unlikely to support the species. However, the species has been recorded in the local area in the past and may occur within a short distance downstream of the application site.	Local value
Herptiles			
Adder	Partially protected under the Wildlife and Countryside Act 1981 (as amended in Scotland). Also a priority species on the SBL. Adder appears to be undergoing a rapid decline in Great Britain (Wilkinson and Arnell, 2013), but it is unclear if this trend applies to Ayrshire.	No incidental record of adder was made during any of the ecology surveys, but the species has been recorded in the local area in the past. It can be found within open moorland as well as in woodland rides. The application site is therefore potentially suitable to the species.	Local value
Slow worm	Partially protected under the Wildlife and Countryside Act 1981 (as amended in Scotland). Also a priority species on the SBL.	No incidental record of slow worm was made during any of the ecology surveys, but the species has been recorded in the local area in the past. It can be found within open moorland as well as in woodland rides. The application site is therefore potentially suitable to the species.	Local value

Receptor	Legal / Conservation Status	Reason for Evaluation	Evaluation
Common lizard	Partially protected under the Wildlife and Countryside Act 1981 (as amended in Scotland). Also a priority species on the SBL.	No incidental record of common lizard was made during any of the ecology surveys, but the species has been recorded in the local area in the past. It can be found within open moorland as well as in woodland rides. The application site is therefore potentially suitable to the species.	Local value
Mammals			
Bats	Bats and their roosts are fully protected under the Wildlife & Countryside Act 1981 (as amended) and as European Protected Species under Schedule 2 of the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended).	Very low levels of bat activity were recorded on the application site. No roosts were identified.	
<i>Pipistrellus</i> species (common pipistrelle and soprano pipistrelle)	Common pipistrelle and soprano pipistrelle are both priority species on the SBL and Ayrshire BAP.	The bat fauna within the application site is dominated by common and soprano pipistrelles. These are widely distributed across the majority of Britain and Ireland (Richardson, 2000) and are widespread in Scotland, although the greatest density of soprano pipistrelles is in the central lowlands (Haddow and Herman, 2000).	Local value
<i>Myotis</i> (Daubenton's bat)	Daubenton's bat is a priority species on the SBL.	Very few Daubenton's bats were recorded using the application site in summer, with no apparent habitat preference being evident.	Local value
<i>Nyctalus</i> (Leisler's bat)	Leisler's bat is a priority species on the SBL.	Only three calls of Leisler's bats were recorded in the surveys overall and the results suggest that this species does not roost or forage within the application site but passes through it to more optimal habitat elsewhere.	Local value
Otter	Otter is fully protected under the Wildlife & Countryside Act 1981 (as amended) and as a European Protected Species under the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended). It is also a priority species on the SBL and Ayrshire BAP.	Evidence of otter was recorded along the main watercourses on the application site and included one holt showing signs of recent use.	Council area value
Water vole	Water vole is fully protected under the Wildlife & Countryside Act 1981 (as amended). It is also a priority species on the SBL and Ayrshire BAP.	Considerable evidence of water vole was recorded on watercourses within open areas on the application site.	Council area value

8.5 Receptors Subject to Detailed Assessment

- 8.5.1 The following applies to all the ecological receptors brought forward to the detailed ecological impact assessment stage:
- Their value is assessed as being important at a local level or higher (and/or they are subject to some form of legal protection) and
 - They are potentially vulnerable to significant impacts from the proposed development.
- 8.5.2 Given the nature of its interest features, the distance from the application site (5.9 km) and the lack of any hydrological connection, Muirkirk Uplands SSSI is not likely to be susceptible to significant impacts and detailed assessment is therefore not necessary.
- 8.5.3 Similarly, ancient woodland habitats at Glen Afton Wood, Carcow and Boltwood are not likely to be impacted during any of the development phases, because the potential for significant impacts would relate to direct physical damage of the habitats, which is unlikely as the application site development does not overlap with any of these sites. Detailed assessment is therefore not necessary for these ancient woodland sites.
- 8.5.4 Based on the above and consideration of information obtained during the desk study, consultations and ecological surveys, non-avian ecological receptors subject to detailed assessment includes the following:
- Habitats:
 - Marshy grassland;
 - Dry heath;
 - Wet heath;
 - Blanket bog;
 - Flush;
 - Standing water and
 - Running water.
 - Species:
 - Brown/sea trout;
 - European eel;
 - Adder;
 - Slow worm;
 - Common lizard;
 - Bats;
 - Otter and
 - Water vole.

8.6 Assessment of Construction Impacts

- 8.6.1 Aside from the design mitigation outlined below, the assessment of impacts in this section is undertaken in the absence of specific mitigation measures. Proposed mitigation, compensation and enhancement measures are subsequently presented, following which an assessment of residual impacts is made.

Design Mitigation

- 8.6.2 As described in **Chapter 3: Site Selection, Design and Alternatives**, from the beginning of the EIA process, information obtained about sensitive ecological

features has fed into the windfarm design in order to minimise the potential for negative impacts occurring. This has resulted in the following design decisions:

- Where possible, turbines and borrow pits have been located >250 m from GWDTEs, whereas track infrastructure has been routed >100 m from GWDTEs in line with SEPA (2014) guidance. Where it has not been possible to observe these buffers, a hydro-geological assessment has been carried out to establish if significant impacts are likely and appropriate mitigation measures have been developed where this has been the case (see **Chapter 10: Hydrology, Hydrogeology and Geology**);
- The development has prioritised infrastructure locations on shallow (<50 cm) peat over deeper peat, where possible;
- A minimum buffer of 50 m between turbine blade tip and linear habitat features, including woodland edges and watercourses, has been adopted in accordance with Natural England (2012) interim guidelines on bats and wind turbines and
- Turbines have all been located at least 50 m from watercourses.

Predicted Impacts

8.6.3 During construction it is anticipated that impacts may arise from:

- Vehicular traffic;
- Presence of people;
- Ground and excavation works;
- Construction of hardstanding and structures;
- Drainage;
- Sedimentation from tree felling, track construction and vehicular traffic and
- Environmental incidents and accidents (e.g. spillages).

Potential impacts on habitats

8.6.4 **Chapter 4: Project Description** includes dimensions of all turbines, turbine foundations, crane hardstandings, anemometry masts, access tracks and the control building and substation compound. Land required for these elements is considered to be permanently lost.

8.6.5 Temporary land take refers to land associated with the construction compound, an area which will only be “taken” during the construction phase. Other temporary effects include an anticipated disturbance zone of up to 10 m around all windfarm infrastructure, where damage from construction machinery and people is possible, although in practice a narrower zone is likely where access track work will involve upgrading existing track rather than the construction of new track.

8.6.6 Changes to hydrological conditions on peatland habitats from drainage are conservatively estimated to extend to a distance of 20 m, although impacts are likely to operate on an even smaller scale than this (Dargie, 2007).

8.6.7 **The GWDTE Assessment in Appendix 10.2 Volume IV** includes an assessment of impacts on NVC communities potentially having moderate or high groundwater dependence. The assessment has been carried out for areas of these communities that fall within the 100 m track buffers and 250 m turbine and borrow pits buffers as recommended by SEPA. The assessment concludes that in the absence of mitigation, disruption to the recharge of M6 mire is possible for M6 mire in the vicinity of turbines T5, T10 and T15: Significant hydrological impacts are not predicted for other GWDTEs within the site. .

8.6.8 **Table 8.5** details permanent land take as well as direct construction impacts (including temporary land take), damage to vegetation from machinery and indirect drying impacts on wetland habitats (collectively referred to as disturbance) on all habitats present within the application site.

Table 8.5 Predicted Habitat Loss and Habitat Disturbance

Phase 1 Habitats	NVC Communities	Extent (ha) within Application Site	Predicted Impacts (ha) from the Development	
			Loss	Temporary Loss and Disturbance
A1.2.2 Coniferous plantation	n/a	696.31	10.70	35.78*
B1.1 Acid grassland	U4 <i>Festuca ovina</i> - <i>Agrostis capillaris</i> - <i>Galium saxatile</i> grassland	3.22	0.00	0.00
	U5 <i>Nardus stricta</i> - <i>Galium saxatile</i> grassland	15.84	0.63	2.09
	U6 <i>Juncus squarrosus</i> - <i>Festuca ovina</i> grassland	5.43	0.27	1.35
B2.2 Neutral grassland	MG1 <i>Arrhenatherum elatius</i> grassland	5.30	0.00	0.01
	MG6 <i>Lolium perenne</i> - <i>Cynosurus cristatus</i> grassland	18.94	0.36	1.71
	MG9 <i>Holcus lanatus</i> - <i>Deschampsia cespitosa</i> grassland	0.47	0.00	0.00
	MG10 <i>Deschampsia cespitosa</i> - <i>Juncus effusus</i> rush-pasture	21.42	0.25	1.26
B5 Marshy grassland	M23 <i>Juncus effusus/acutiflorus</i> - <i>Galium palustre</i> rush-pasture	11.02	0.03	0.13
	M25 <i>Molinia caerulea</i> - <i>Potentilla erecta</i> mire	0.51	0.00	0.00
C1.1 Dense bracken	U20 <i>Pteridium aquilinum</i> - <i>Galium saxatile</i> community	3.03	0.07	0.30
D2 Wet dwarf shrub heath	M15 <i>Trichophorum cespitosum</i> - <i>Erica tetralix</i> wet heath	7.79	0.54	1.62
E1.6.1 Blanket bog	M17 <i>Trichophorum cespitosum</i> - <i>Eriophorum vaginatum</i> blanket mire	0.55	<0.01	0.02
	M19 <i>Calluna vulgaris</i> - <i>Eriophorum vaginatum</i> blanket mire	35.97	1.66	6.76
	M20 <i>Eriophorum vaginatum</i> blanket mire	3.25	0.10	0.24
	M19/M20 intermediate	5.81	0.19	0.61
E2.1 Flush	M6 <i>Carex echinata</i> - <i>Sphagnum fallax/denticulatum</i> mire	5.80	0.11	0.44

Phase 1 Habitats	NVC Communities	Extent (ha) within Application Site	Predicted Impacts (ha) from the Development	
			Loss	Temporary Loss and Disturbance
G1 Standing water	M2 <i>Sphagnum cuspidatum/Sphagnum fallax</i> bog pool community	<0.01	0.00	0.00
	M4 <i>Carex rostrata-Sphagnum fallax</i> mire	<0.01	0.00	0.00
	Standing water not included in NVC survey	0.01	0.00	0.00
G2 Running water	Not included in NVC survey	6.76	<0.01	0.00
J1.1 Arable land	Not included in NVC survey	0.03	<0.01	0.03

* This is calculated as a precautionary 10 m buffer around all infrastructure plus 1ha for the construction compound. In reality, disturbance from construction machinery is not likely to affect a 10 m buffer within plantation.

- 8.6.9 Of the c.45.6 ha of blanket bog within the application site, 4.28% will be permanently lost and a further 16.73 % will be temporarily disturbed during construction. Although areas subject to construction disturbance may recover following construction, disturbance could locally cause the peat substrate to be exposed, possibly resulting in erosion. Drying impacts could also cause a decline in the quality of the vegetation. In the absence of mitigation, the permanent loss of bog and disturbance of bog vegetation is considered a significant negative impact on the conservation status of this Annex I habitat in the council area. Confidence in this prediction is considered certain/near-certain.
- 8.6.10 There will be an additional loss of afforested deep peat soils, which would have supported blanket bog prior to afforestation and which can therefore be considered heavily modified bog. Most of the 10.7 ha tree felling required for the proposed development will impact this habitat. However, because the peat has been very disturbed over a considerable period and supports no peatland vegetation, these losses are not considered significant. Confidence in this prediction is considered certain/near-certain.
- 8.6.11 Of the c.7.8 ha of wet heath within the application site, 6.93 % will be permanently lost and a further 20.8 % will be temporarily disturbed during construction. Similar to blanket bog, although areas subject to construction disturbance may recover following construction, disturbance could locally cause the peat substrate to be exposed, possibly resulting in erosion and drying impacts could also cause a decline in the quality of the vegetation. In the absence of mitigation, the permanent loss of wet heath and disturbance of wet heath vegetation is considered a significant negative impact on the conservation status of this Annex I habitat in the local area. Confidence in this prediction is considered certain/near-certain.
- 8.6.12 Of the 5.8 ha of flush, 1.9 % will be permanently lost and a further 7.59 % will be temporarily disturbed during construction (see also the GWDTE assessment within GWDTEW Assessment (**Appendix 10.2 Volume IV**)). In the absence of mitigation, this is considered a significant negative impact on the conservation status of this habitat in the local area. Confidence in this prediction is considered certain/near-certain.
- 8.6.13 Of the c.11.0 ha marshy grassland, 0.27 % will be permanently lost and a further 1.18 % will be subject to temporary disturbance during construction. This is not considered a significant negative impact. Confidence in this prediction is considered certain/near-certain.

- 8.6.14 No permanent or temporary loss or disturbance is predicted for standing water. Confidence in this prediction is considered certain/near-certain.
- 8.6.15 Six watercourse crossings will be required for the proposed development, five of which will be upgrades of existing crossings. The new crossing will result in the permanent removal or shading of 25 m² of habitat (see also the water crossing assessment within **Chapter 10: Hydrology, Hydrogeology and Geology**). The loss of 25 m² relative to the 6.76 ha extent of running water in the application site is not considered a significant negative impact. As described in **Chapter 10: Hydrology, Hydrogeology and Geology**, in the absence of mitigation, there is a potential for significant impacts on drains and watercourses through sediment laden run-off, concrete spillages, as well as spillages and leakages of oil and fuel from construction vehicles working near the watercourse. These impacts could have a negative impact on the biodiversity interest of the watercourses themselves as well as downstream habitats, through generation of turbid or polluted runoff, which could therefore represent a significant negative impact on a feature of local value. Confidence in these predictions is considered certain/near-certain.

Potential impacts on fish

- 8.6.16 As described in **Chapter 10: Hydrology, Hydrogeology and Geology**, in the absence of mitigation, there is a potential for downstream negative impacts on watercourses supporting or potentially supporting trout and European eel, i.e. River Nith and its tributaries, including Afton Water, which are linked by drains and smaller watercourses within the application site boundary but themselves have limited potential to support fish. Potential effects include sedimentation from tree felling and ground clearance activities, concrete spillages, as well as spillages and leakages of oil and fuel from construction vehicles working near the watercourses. Five existing crossings will be upgraded and one new crossing will be constructed. It is concluded that in the absence of mitigation measures, pollutants and sediments may enter these watercourses thereby reducing water quality and significantly impacting salmonids and eels, receptors considered of local value, in downstream catchments. Confidence in this prediction is considered probable only, owing to the precautionary assumptions taken regarding where in the downstream catchments salmonids and eels are present.

Potential impacts on reptiles

- 8.6.17 In the absence of mitigation, tree felling, ground works and site traffic have the potential to impact adders, slow worms and common lizards directly, through loss of habitat or the accidental killing or injuring of individuals. The possible loss of a small number of animals and a small area of suitable habitat is not likely to be significant in terms of the conservation status of these species in the local area, because only a small proportion of suitable habitat and a small number of animals will potentially be impacted by the development. Confidence in this prediction is considered certain/near certain. However, in the absence of mitigation measures, the killing or injuring of individual adders, slow worms or common lizards could represent an offence under the Wildlife and Countryside Act 1981 (as amended) and mitigation is therefore proposed.

Potential impacts on bats

- 8.6.18 No significant impacts are anticipated on bats during construction of the development. The apparent absence of suitable roosting habitat within the application site suggests that individual bats only use the application site for commuting or foraging (and only then in small numbers). As construction during the season when bats are active will only take place during daylight hours, the potential for disturbance impacts to any bats using the application site is considered to be

very low. No significant impacts on bats are therefore predicted. Confidence in this prediction is considered certain/near certain.

Potential impacts on otters

- 8.6.19 Any otter entering the application site during construction could be at risk of coming into contact with harmful substances, falling into excavations or from collisions with construction vehicles. The risk of such impacts taking place is likely to be low, because construction will mainly be restricted to daytime hours and because of the small size of the construction area relative to the large ranges of otters: in freshwater habitats otters are largely nocturnal and occupy home ranges of around 32 km for males and 20 km for females (SNHb, 2014). As such no significant impact on otters is likely as a result of these effects. Confidence in this prediction is considered certain/near certain. Nevertheless, taking a precautionary approach, because the inadvertent killing or injuring of individual otters could represent an offence under the legislation, mitigation is proposed.
- 8.6.20 If a breeding holt occurs within 200 m of works areas or if a shelter occurs within 30 m of works areas, construction disturbance or physical damage from machinery could also represent a legal offence. Both holts and lie-ups were recorded onsite during the surveys, with the nearest resting place (couches) being c.50 m north and c.50 m south of the crossing over Glenshalloch Burn that will be upgraded under the proposals. The nearest holt with signs of recent activity was located further upstream on Glenshalloch Burn, c.350 m from the nearest infrastructure, whereas a potential holt with evidence of recent activity is present c.200 m south of the nearest infrastructure. The potential for impacts to these resting places is therefore not likely to be significant. It is possible that new holt and lie-up locations could be established within the 200 m and 30 m distances prior to construction. In the absence of mitigation, it is considered likely that otters, which are considered to be of council area value, or their shelters could be significantly impacted. Confidence in these predictions is considered probable.
- 8.6.21 There is also a potential for negative impacts on otter from sediment laden run-off and pollution from construction machinery that could temporarily impact numbers of prey species, notably on Glenshalloch Burn where a large part of the otter activity was recorded. However, because otters have large territories, as described above, the likelihood of significant impacts is considered low, because local otters are unlikely to rely only upon prey abundance in Glenshalloch Burn, Glenhastel Burn or any other watercourse onsite. Confidence in this prediction is considered certain/near certain.

Potential impacts on water voles

- 8.6.22 Water vole is widespread within the application site, but no recent evidence was recorded within 75 m of proposed works areas. In the absence of mitigation, sediment laden run-off and pollution from construction machinery could temporarily impact feeding habitats downstream from works areas. No evidence of water vole was recorded in the area of the new crossing (on the West Strand, in the south-eastern part of the application site). However, it is possible that water voles will establish on this watercourse prior to construction commencing and therefore suffer potential negative impacts from direct habitat loss or even inadvertent death or injury to individuals during crossing works. The loss of a very small number of animals could potentially be significant in the council area, as the Ayrshire water vole population is known to have undergone a marked decline in recent years (Ayrshire BAP Partnership, 2008). Confidence in this prediction is considered probable owing to the lack of recent population estimates of water vole in Ayrshire.

Mitigation

- 8.6.23 Prior to construction commencing a Construction Environmental Management Plan (CEMP), an outline of which is included as **Appendix 10.7 Volume IV**, will be produced and agreed with East Ayrshire Council in consultation with SNH and SEPA. This will contain full details of measures to minimise the impact on ecologically sensitive features within the application boundary. A summary of ecology-related aspects to be included in the CEMP is provided below.
- 8.6.24 An Ecological Clerk of Works (ECoW) will be employed during tree felling, unless where this is done as part of the normal forestry operations, and during construction. A detailed specification for the role of ECoW will form part of the CEMP.
- 8.6.25 In addition to the species-specific mitigation outlined below, a watching brief will be in place in the unlikely event that any evidence of protected species within works areas is recorded, e.g. evidence of badgers, pine marten, wildcat or red squirrel. If resting places of such species are identified within a 50 m distance from works areas, mitigation measures will be developed as appropriate. This will be detailed in the CEMP.

Mitigation and enhancement measures to reduce construction impacts on habitats

- 8.6.26 The ECoW will brief site workers on the ecologically sensitive receptors present. Site workers will be instructed not to move beyond 10 m of infrastructure areas and measures to prevent inadvertent damage to habitats of value will be agreed, e.g. use of orange mesh tape fencing, or brightly coloured tape to delineate the extent of the working areas. Site staff will be briefed on the use of this tape and the need to work inside the marked areas.
- 8.6.27 As detailed in the GWDTE Assessment in **Appendix 10.2 Volume IV**, cross track drains will be installed upgradient of M6 at risk from dewatering in order to maintain hydraulic continuity to down gradient areas. Drainage will be passed through settlement tanks, systems to maintain water quality and then discharged down gradient to infiltrate back into the ground, thereby maintaining the overall volume of groundwater. In addition, there will be minimisation of any period of dewatering during the construction of Turbine 5 and the adjacent crane hardstanding.
- 8.6.28 Peat turfs and excess excavated peat will be reinstated along road edges and around the edges of the crane pads and laydown areas. Reinstatement will occur in these areas according to best practice; details of which will be presented within the CEMP.
- 8.6.29 As detailed in **Chapter 10: Hydrology, Hydrogeology and Geology** and the Outline Peat Management Plan (**Appendix 10.5 Volume IV**), if any short-term storage of excavated peat is needed, excavated turfs will be stored adjacent to the construction area from which they have been excavated from to ensure that they remain moist and viable for reinstatement. Temporary stockpiles may be sprayed with water if necessary during particularly dry periods of weather to prevent drying out. They may also be stored adjacent to the forestry cover to provide shade to prevent the peat from drying out and eroding.
- 8.6.30 In order to compensate for the loss of wet heath, bog and flush habitat and disturbance of heath and bog during construction, a Habitat Management Plan (HMP) will be produced to detail the restoration of hydrological conditions suitable for blanket mire and heath habitat within the 80 m turbine buffers. These areas currently comprise plantation woodland with minor areas of moorland as well. The area of cleared forestry which will be available for restoration amounts to a total of 23.6 ha. The plantation will be clearfelled and drains and/or plough furrows will be blocked. The aim of these activities is to raise water levels to improve the condition of peatland vegetation within existing areas of open moorland and facilitate the

establishment of blanket bog or heath in existing areas of plantation. In addition, it is proposed to widen river corridors within 28.8 ha of plantation forestry, and it is further proposed to establish broadleaved woodland communities, modelled on the NVC types W4 *Betula pubescens* – *Molinia caerulea* woodland, W11 *Quercus petraea* – *Betula pubescens* – *Oxalis acetosella* woodland and W17 *Quercus petraea* – *Betula pubescens* – *Dicranum majus* woodland, within 181.5 ha of plantation. The HMP will also detail the subsequent management and monitoring of the habitat management areas. For further detail on the proposals, please refer to the Outline HMP included as **Appendix 8.5 Volume IV**.

Mitigation to reduce construction impacts on fish

8.6.31 As detailed in **Chapter 10: Hydrology, Hydrogeology and Geology**, a range of mitigation measures will be employed to minimise potential adverse impacts on watercourses. They include the following:

- Sediment and drainage control through the separation and treatment of sediment laden water to prevent contaminated runoff from entering down gradient surface watercourses;
- Watercourse crossings will be constructed as pre-cast circular or semi-circular piped culverts, with the size based on calculation of peak flow from the upstream catchment. The actual design of culverts will be done at the detailed design stage, in accordance with SEPA and CIRIA good practice guidance. Prior to construction the designs will be agreed with SEPA;
- Water quality will be tested prior to works commencing in order to ascertain the baseline conditions. Further testing will then be completed during and after the construction of watercourse crossings. Water quality will be tested upstream and downstream of any construction works so that the impact of the works can be determined. Any programme of water testing will be included within the CEMP;
- The storage of oils and other potentially polluting substances will be within the construction compounds or other designated areas away from the main operational areas over 50 m from OS mapped watercourses. Storage will be within impervious storage bunds with 110 % capacity, so that any spillages or leaks are contained and
- If groundwater is encountered when excavating peat for construction of the turbine foundations, dewatering will be used to lower groundwater levels and ensure that wet working and direct contact of cement with the groundwater does not occur. Any water will be pumped to a settling lagoon to allow suspended sediment to settle.

Mitigation to reduce construction impacts on reptiles

8.6.32 All construction work areas within potentially suitable open habitats for reptiles will initially be cut to a height of c.10 cm during the active season for reptiles (April to October) under the guidance of the ECoW (using e.g. a brush cutter or tractor mounted flail), before works in the relevant areas are due to take place, in order to reduce the height of vegetation and make it less attractive for reptile habitation. Immediately following this, working areas will be surveyed by the ECoW and any potential refugia or hibernacula will be moved out of working areas by hand. Working areas will then be kept unsuitable for reptiles through regular cutting until construction commences.

Mitigation to reduce construction impacts on bats

8.6.33 The bat buffers described in **paragraph 8.6.2** will be maintained regardless of any other constraints identified when key-holing turbines.

Mitigation to reduce construction impacts on otters

- 8.6.34 Pre-construction checks for otter will be carried out on all watercourses within 250 m of works areas. If holts or resting places are identified within this distance, mitigation measures will be developed as appropriate. These will be detailed within the CEMP and are likely to include timing works to avoid impacts on holts during the breeding season, potentially using motion sensitive camera to investigate if any holt is a natal holt and appropriate mitigation will be taken to ensure that natal holts are given adequate protection. An ECoW-defined protection zone around resting places will also be enforced to ensure that no inadvertent damage occurs. If considered necessary, a license to undertake such works will be obtained from SNH.
- 8.6.35 In addition, any open excavations will be covered at night to prevent otters from falling in. Alternatively a plank will be inserted into the excavation to allow any animals to climb out.

Mitigation to reduce construction impacts on water voles

- 8.6.36 Pre-construction checks for water vole will be carried out on all watercourses on which new or upgraded crossings are being proposed. The survey will cover a length of at least 50 m upstream and downstream of the location of the proposed crossing and works areas. If active burrows are confirmed within a 5 m distance from works areas, mitigation measures will be developed as appropriate. These will be detailed in the CEMP and are likely to include micro-siting or, if this is not possible, displacement of water voles through habitat manipulation, such as strimming (Strachan *et al.*, 2011). If considered necessary, a license to undertake such works will be obtained from SNH.

Residual Impacts

- 8.6.37 Provided that the mitigation measures described in the previous section are implemented, all residual negative impacts on protected species and other valued ecological features during the construction phase (other than the loss of peatland habitat) will not be significant. Confidence in this prediction is considered certain/near-certain.
- 8.6.38 Provided that the peatland restoration and management measures described in the Outline Habitat Management Plan (**Appendix 8.5 Volume IV**) are implemented, 23.6 ha of peatland habitat, comprising both blanket bog and wet heath, will be created within the application site boundary. These measures greatly outweigh the permanent loss of 2.6 ha wet heath, blanket bog and flush throughout the application site and the additional 9.69 ha subject to disturbance. In addition, diversifying the plantation with 181.5 ha of broadleaved woodland and increasing the cover of open habitats within 28.8 ha of land adjacent to watercourses are also likely to have significant positive impacts for a wide range of plant and animal species.

8.7 Assessment of Operational Impacts

Predicted Impacts

- 8.7.1 During operation of the windfarm, it is anticipated that impacts may arise from:
- Vehicular traffic;
 - Presence of people;
 - Environmental incidents and accidents (e.g. spillages) and
 - Collision with turbine blades (bats).

Potential impacts on habitats

- 8.7.2 During operation of the development there is a small possibility of negative impacts on marshy grassland, heath, blanket bog, flush and aquatic habitats due to accidental spillages by maintenance activities and vehicles. However, given the relatively low levels of maintenance required, the likelihood of potential spillages is low and therefore no significant impacts are likely. Confidence in this prediction is considered certain/near-certain.

Potential impacts on fish

- 8.7.3 The risk of negative impacts on fish in downstream catchments from accidental spillages by maintenance activities and vehicles is not likely to be significant, as individual turbines are placed over 75 m from the nearest watercourses. Confidence in this prediction is considered certain/near-certain.

Potential impacts on reptiles

- 8.7.4 No significant impact is anticipated on adder, slow worm or common lizard during operation of the development because site works will be concentrated around turbines, substation and tracks, which do not provide suitable habitat for reptiles. Confidence in this prediction is considered certain/near certain.

Potential impacts on bats

- 8.7.5 There is a potential for the proposed windfarm to cause injury/death of bats through collision with turbine blades and/or barotrauma¹². Natural England advises that a 50 m buffer (Natural England, 2012) should be maintained between the closest point of the turbine blade and the nearest linear feature, such as a woodland edge, along which bats commute or forage. As described above, this consideration has been incorporated into the design of the turbine layout.
- 8.7.6 No potential for roosts was identified within 200 m of the turbine envelope and the pattern of bat movement identified during the survey period, suggests that the majority of bats enter the application site from roosts further afield. Potential impacts are assessed separately below for each of the three species groups recorded at the application site, i.e. *Pipistrellus*, *Myotis* and *Nyctalus*.
- 8.7.7 *Pipistrellus* – the proposed turbine locations are situated in open areas or current areas of plantation, which will be cleared in a minimum 80 m buffer around turbines. During the operational lifespan of the development (25 years) it is possible that some pipistrelle bats may be impacted by the turbines. The Natural England guidance states common and soprano pipistrelle bats are of ‘medium’ level risk of collision with turbines (Natural England, 2012) on an individual level. However, because these species are widespread and common throughout Britain they are considered to be at ‘low’ risk of impact at a population level. Considering that the turbines will be located away from linear features, in line with the NE guidelines and, considering the low abundance of bats within the application boundary, any mortality associated with impacts with turbines is likely to involve a very low number of animals only and it is therefore considered likely that no significant impact would result upon the local conservation status of common and soprano pipistrelle bats from the operational phase of the proposed development.
- 8.7.8 *Myotis* – very low numbers of Daubenton’s bats were recorded using the application site with no clear habitat association being apparent. As described in **Appendix 8.3 Volume IV**, Daubenton’s bats are predominantly associated with riparian habitats.

¹² The drop in air pressure created around the vortices of moving turbine blades can cause internal haemorrhaging in bats, leading to deaths even where no direct collision with the blades occurs (Baerwald *et al*, 2008).

These are limited within the application site. *Myotis* bats are generally considered to fly at low heights and are therefore considered to be at 'low' level risk of collision with turbines (Natural England, 2012). This, together with the low numbers of Daubenton's bats present, makes it likely that no significant impacts would result upon the conservation status of Daubenton's bats during the operational phase of the proposed development.

- 8.7.9 *Nyctalus* – levels of activity by Leisler's bats were extremely low with only three passes recorded over the course of the surveys. Leisler's bat is a high-flying species and considered to be at 'high' level risk of collision with turbines both as individuals and at a population level (Natural England, 2012). However, because Leisler's bats are very rare within the application site, it is also very unlikely that any individual would suffer collisions with a turbine. As such no significant impact upon the conservation status of noctule is predicted.
- 8.7.10 Confidence in these predictions is considered near-certain.

Potential impacts on otters

- 8.7.11 The risk of negative impacts on otters from accidental spillages by maintenance activities and vehicles is not likely to be significant, because usage of the application site by maintenance vehicles will be relatively infrequent and because the large territories of otters mean that they are unlikely to depend on individual watercourses. Confidence in this prediction is considered certain/near-certain.

Potential impacts on water voles

- 8.7.12 The risk of negative impacts on water voles from accidental spillages by maintenance activities and vehicles is not likely to be significant. The relatively low levels of maintenance required will mean a likely low risk of spillages, terrestrial habitats between the watercourses and the turbines and windfarm infrastructure are likely to contain any such spillages before they can do significant damage and the risk of such an event occurring on a crossing is very low. On this basis no significant impacts on water vole are likely during operation. Confidence in this prediction is considered certain/near certain.

Mitigation

- 8.7.13 During operation of the windfarm, habitat management will proceed in accordance with the HMP. No other mitigation or compensation measures are necessary during windfarm operation.

Residual Impacts

- 8.7.14 Provided that the peatland restoration and management measures described in the Outline Habitat Management Plan (**Appendix 8.5 Volume IV**) are implemented, significant positive impacts are expected from the creation of 23.6 ha of peatland habitats within the application site boundary. These measures greatly outweigh the permanent loss of 2.6 ha wet heath, blanket bog and flush throughout the application site and the additional 9.69 ha subject to disturbance. In addition, diversifying the plantation with 181.5 ha of broadleaved woodland and increasing the cover of open habitats within 28.8 ha of land adjacent to watercourses are also likely to have significant positive impacts for a wide range of plant and animal species.

8.8 Assessment of Decommissioning Impacts

Predicted Impacts

- 8.8.1 The proposed development will have a life span of 25 years, after which it will be decommissioned. It is difficult to predict impacts, which would arise from decommissioning, because of the length of the operational period and the likelihood for changes to have occurred to habitats and species populations during this time, partly in response to ongoing forestry activities onsite. As such, the confidence in all predictions is considered to be probable or uncertain.
- 8.8.2 Decommissioning activities are likely to be similar to construction, albeit less invasive as there will be very much less excavation work. In the absence of mitigation, decommissioning could cause short-term impacts through disturbance similar to those predicted to occur during the construction period.
- 8.8.3 Negative impacts for those habitats and species present at the time of decommissioning are likely to be short term, decommissioning being likely to take approximately six to nine months and restricted to a relatively small proportion of the application site around turbine locations and the substation. All decommissioning traffic will be located along the existing tracks and is therefore unlikely to create additional impacts. Because the impacts are predicted to be of lower magnitude than those predicted during construction and will not involve any habitat loss, they are not anticipated to be significant.
- 8.8.4 Surveys will be undertaken prior to decommissioning to inform an up-to-date assessment of potential impacts on valued non-avian ecological receptors and mitigation measures will be implemented, as required.

Mitigation

- 8.8.5 The need for decommissioning mitigation will be determined nearer the time of decommissioning of the development, following updated surveys and assessment.

Residual Impacts

- 8.8.6 The assessment of residual mitigation impacts will be determined nearer the time of decommissioning of the development, following updated surveys and assessment.

8.9 Cumulative Impacts

- 8.9.1 The Dumfries and Galloway Council planning portal includes a high number of planning applications for the local area. With the exception of windfarm and single turbine applications, the modest scale of these projects combined with their distances from the application site mean that significant cumulative impacts are unlikely. The following only considers the potential for cumulative impacts from other windfarm and wind turbine developments.
- 8.9.2 **Figures 7.4.1 and 7.4.2 Volume III** detail the location of other wind power developments, either operational, under construction, consented but not yet being constructed, or the subject of a planning application within 35 km of the application site. In terms of non-avian ecological receptors, the potential for significant cumulative impacts includes all valued receptors when considering developments immediately adjacent to the application site. In the wider area, the potential for significant cumulative impacts with other developments will be restricted to hydrological impacts on peatland, aquatic habitats and impacts on sea/brown trout and European eel in watercourses within the same watershed, as well as operational turbine impacts on bats. These potential impacts are all considered to operate on a scale of up to c.10 km from the turbine area, although in the case of single turbines, a maximum distance of 5 km has been applied. Of the schemes shown on

Figures 7.4.1 and 7.4.2 Volume III, those relevant to this assessment therefore comprise the following developments, which unless stated otherwise are in separate hydrological catchments:

- Afton Windfarm is a consented 27-turbine development abutting the application site to the south-east. The scheme is in the planning phase;
- Hare Hill is an operational 20-turbine development located c.2.1 km northeast of the application site. Construction was completed in 2000. An application to extend the windfarm with a further 39 turbines southeast of the existing turbines has now been consented;
- Windy Standard is an operational 36-turbine development located c.1.8 km south of the application site. Consent to extend the windfarm with a further 30 turbines (Phase II) was granted in 2007 and construction began earlier in 2014. An application to extend the windfarm (Phase III) with up to 25 additional turbines is currently in the planning phase;
- Ashmark Hill is a proposed seven-turbine development abutting the application site to the northwest. The scheme is in the planning phase;
- Garleffan is a proposed nine-turbine development located c. 0.4 km northwest of the application site. The scheme is in the planning phase;
- South Kyle is a proposed 50-turbine development located c.1.4 km west and southwest of the application site. The scheme is in the planning phase and
- High Cumnock is a proposed eight-turbine development located c. 6.4 km north of the application site. The scheme is in the planning phase.

8.9.3 No single turbines have been identified within 5 km of the application site.

Afton Windfarm

8.9.4 Afton Windfarm was granted permission in October 2014. It has not been possible to obtain the ES for this scheme, which in any case is now relatively old and would have been carried out against different standards to those in place in 2014. For example, bat surveys do not appear to have been carried out for the scheme. The Non-technical Summary of the scheme describes an upland site and states that there will be some loss of wet modified bog habitat, which is evaluated as having 'moderate' value, but the losses were apparently not considered significant. A number of mitigation measures were proposed to prevent significant sedimentation and pollution of watercourses. Significant cumulative impacts on habitats are therefore not likely.

8.9.5 The exposed nature of the Afton site makes it unlikely that the diversity and abundance of bats are significantly different from those at the proposed Pencloe Windfarm site. As such cumulative impacts on bats are not likely to be significant.

Hare Hill

8.9.6 Hare Hill Windfarm has been operational since 2000. It has not been possible to obtain the ES for this scheme, which in any case is now relatively old and would have been carried out against different standards to those in place in 2014. Aerial photography of the site suggests it is characterised by upland moorland and conifer plantation. The site drains into the Afton Water and River Nith catchments, but hydrological impacts on blanket bog or on the aquatic environment are very unlikely as the windfarm is operational. The exposed nature of the Hare Hill site makes it unlikely that the diversity and abundance of bats are significantly different from those at Pencloe. As such cumulative impacts on bats are not likely to be significant.

8.9.7 The Hare Hill extension site abuts the original Hare Hill Windfarm scheme to the southeast. The ES for the scheme describes the site as being characterised by moorland, with no conifer plantation on or near the site being suitable to roosting

bats. The potential for roosting or foraging bats on the extension site was considered so low that bat surveys were not carried out for the scheme. As such the potential for cumulative impacts on bats is not likely to be significant.

- 8.9.8 The Hare Hill extension site is within the catchment of the Kello Water, which flows east into River Nith more than 8 km downstream of the extension site, in a location more than 20 km downstream of the Pencloe Windfarm application site. Cumulative hydrological impacts on peatland are therefore not likely. Due to both design mitigation and the proposed implementation of a Pollution Prevention Plan at the extension scheme, the potential for aquatic habitats and species to be affected by pollution is considered unlikely. Combined with the downstream distance from Pencloe, the potential for cumulative impacts on aquatic habitats and species is not likely to be significant.

Windy Standard Windfarm

- 8.9.9 It has not been possible to obtain the ESs for Phases I and II of Windy Standard Windfarm, both of which are now relatively old and would have been carried out against different standards to those in place in 2014. These sites are characterised by moorland and conifer plantation. The sites drain into the Water of Deugh watershed. Because only three of the proposed turbines for Pencloe Windfarm, namely turbines T8, T16 and T17 and their associated infrastructure are proposed for this watershed and because Pencloe Windfarm is unlikely to be constructed until Windy Standard Phase II has been built, the potential for cumulative impacts on peatland hydrology and aquatic interests is not likely to be significant.
- 8.9.10 The ESs for Windy Standard Phase I and II are over seven years old and it is unlikely that bat surveys were carried out for the planning applications. The habitats identified for Windy Standard Phase I and II appear to be similar to those found at the Pencloe application site and the level of bat use on the site is likely to be similar. As such the potential for cumulative impacts on bats is not likely to be significant.
- 8.9.11 The Windy Standard Phase III site is located west of Phases I and II and located within the same catchment. For the reasons given above, the potential for cumulative impacts on peatland hydrology and aquatic interests is not likely to be significant. The Phase III Scoping Report describes bat surveys carried out on the site in 2012. No roost features were identified and only low numbers of common pipistrelle, soprano pipistrelle, Daubenton's bat and brown long-eared bat were recorded. The low amount of bat activity suggests that the potential for cumulative impacts on bats is not likely to be significant.

Ashmark Hill Windfarm

- 8.9.12 The ES for Ashmark Hill Windfarm describes the site as comprising mainly marshy grassland. Areas of peatland also occur, mainly to the south, but are characterised by modified, mainly dry, bog habitat. As such the potential for cumulative hydrological impacts on peatland is not likely to be significant.
- 8.9.13 Some watercourses within Ashmark Hill were concluded to be suitable for salmonids and the ES identified a range of mitigation measures to reduce the risk of significant impacts on watercourses and aquatic species, including SEPA best practise methods when working in the aquatic environment as well as a commitment to implement site drainage and surface water management plans. As such the potential for cumulative impacts on aquatic habitats and species is not likely to be significant.
- 8.9.14 No bat roost features were identified during surveys. Very low numbers of bats were recorded during surveys, with no passes recorded in eight of 12 manual transects (two monthly transects over six months) and only 305 passes recorded in static surveys. Common pipistrelle and soprano pipistrelle accounted for most of the activity, with a low number of additional passes by *Myotis* and *Nyctalus* bats, with

the latter considered most likely to be noctules. The low number of *Nyctalus* bats was concluded to be consistent with occasional passes by a single or small number of individual foraging or commuting bats. The low number of bats suggests that the potential for cumulative impacts on bats is not likely to be significant.

- 8.9.15 Common lizards, bats, otters and water voles were also recorded at Ashmark Hill. A range of mitigation measures are proposed in the ES to reduce significant effects, including pre-construction surveys for otters and water voles, with a commitment to develop appropriate mitigation plans in consultation with SNH where these species are recorded close to works areas. A range of mitigation measures similar to those proposed in **Section** Error! Reference source not found. of this chapter will then be implemented to reduce the likelihood of impacts on protected species. As such the potential for cumulative impacts is not likely to be significant.

Garleffan Windfarm

- 8.9.16 The Garleffan Windfarm ES describes the site, which is located north of River Nith, as comprising mainly wet heath and acid grassland, surrounded by agricultural habitats at lower elevation. As such the potential for cumulative hydrological impacts on peatland is not likely to be significant.
- 8.9.17 Some watercourses within the Garleffan site are known to be suitable for salmonids and the ES identified a range of mitigation measures to reduce the risk of significant impacts on aquatic features that include a commitment to implement a detailed site drainage plan and a range of sediment and pollutant control measures. As such the potential for cumulative impacts on aquatic habitats and species is not likely to be significant.
- 8.9.18 No bat roost features were identified during surveys. Low numbers of bats were recorded during surveys, with most of the activity being by common pipistrelles, soprano pipistrelles and *Myotis* bats concluded to be Daubenton's bats. A low number (47) of *Nyctalus* passes were also recorded that could be noctule or Leisler's bat or a combination of both. Design mitigation included locating turbines at least 250 m distant from large waterbodies in order to reduce the likelihood of bat collisions/barotrauma for *Nyctalus* bats, which are strongly associated with foraging over large waterbodies. This, combined with the distance between the Garleffan and Pencloe Windfarm sites, means that the potential for cumulative impacts on bats is not likely to be significant.

South Kyle Windfarm

- 8.9.19 The South Kyle site is mainly characterised by conifer plantation, with open moorland (heath and bog) characterising only the higher summits and ridges. The potential for cumulative impacts on peatland hydrology and aquatic interests is therefore not likely to be significant.
- 8.9.20 The site drains into the River Nith and Water of Deugh watersheds and is itself likely to support salmonids. The South Kyle Windfarm ES identifies a wide range of mitigation measure which will be in place during construction of the windfarm, including a range of best practice methodologies identified by SEPA, the Scottish Government, The Highways Agency and the Forestry Commission and a commitment to a comprehensive surface water drainage strategy, measures to avoid significant sedimentation and spillages in watercourses, etc. As such the potential for cumulative impacts on aquatic habitats and species is not likely to be significant.
- 8.9.21 No bat roosts were identified within 500 m of proposed windfarm infrastructure at South Kyle. Bats recorded during surveys mainly comprised soprano pipistrelles, with additional species including common pipistrelle, Daubenton's bat, Natterer's bat, Leisler's bat and possibly a noctule. The majority of activity was associated with watercourses, wetlands and lower-lying forest edges away from the turbine area. As

such the likelihood of significant impacts was concluded to be low. The potential for cumulative impacts on bats is also not likely to be significant.

High Cumnock Windfarm

- 8.9.22 It has not been possible to obtain the ES for High Cumnock Windfarm, but site plans and consultee responses have been obtained from the East Ayrshire Council Planning Portal. From this material it appears that the site is dominated by grazing land and conifer plantation of low ecological value, with minor amounts of ancient woodland, ponds and watercourses forming part of the River Nith watershed.
- 8.9.23 In their consultation response SEPA mention that a few small areas of potential GWDTEs are present on the High Cumnock site but that the proposed areas of development are situated away from these. SNH notes that no fisheries surveys have been carried out but that pre-construction surveys will be carried out on one watercourse on site, with an accompanying assessment of effects and identification of appropriate mitigation, where required and SNH supports this approach. The potential for cumulative impacts on peatland hydrology and aquatic interests is therefore not likely to be significant.
- 8.9.24 In their consultation response SNH raises concerns regarding Leisler's bats on the High Cumnock site and recommend that mitigation outlined in the ES that involved turbine switch off during periods of greatest bat activity is included as a condition of any planning consent. In addition, post-construction monitoring (at height) will be carried out in the first two years of operation to investigate the impacts on bats. Assuming these mitigation measures will be implemented, the potential for cumulative impacts on bats is not likely to be significant.

Conclusion

- 8.9.25 Ten windfarm developments are considered to have the potential for cumulative impacts with the present scheme. However, no likelihood for significant negative cumulative impacts has been identified, although it should be noted that detailed information was not available for some of the schemes considered and therefore certainty in these predictions is only considered to be probable.

8.10 Summary and Conclusions

- 8.10.1 Information relating to non-avian ecological receptors in the application site and the adjacent area has been obtained using both desk-based and field-based methods and collectively this information represents the non-avian ecological baseline conditions reported in this chapter. An evaluation has subsequently been made of those receptors and ecological receptors subject to legal protection and/or valuable at a local or higher level have been considered in the ecological impact assessment.
- 8.10.2 A single nature conservation site, Muirkirk Uplands SSSI, designated for non-avian ecological interests is present within 10 km of the application site. Its designated interests include upland habitats. Because of the distance between the application site and this site (c.6 km), significant impacts are not likely. Similarly, areas of ancient woodland occur within 2 km of the application site, including two areas just outside the application site, but these areas are not likely to be significantly impacted by the development.
- 8.10.3 The development will cause a loss of 2.6 ha wet heath, blanket bog and flush throughout the application site and an additional 9.69 ha of habitat being subject to disturbance. However, some of the application site's conifer plantation will be removed to allow the creation of 23.6 ha of peatland habitat, comprising blanket bog and wet heath, within the site. In addition, the Sitka spruce plantation will be diversified with 181.5 ha of broadleaved woodland, and forestry will be removed within 28.8 ha of land adjacent to watercourses in order to allow the regeneration of

open habitats in the watercourse corridors. Overall, these measures are expected to result in significant positive impacts. Mitigation measures are proposed to avoid or reduce sedimentation of watercourses during construction, following which any residual negative impacts on associated fauna, including salmonids and European eel downstream of the application site, are not likely to be significant.

- 8.10.4 Mitigation measures are proposed to avoid or reduce potential impacts on common lizard, adder, slow worm otter and water vole during construction. This includes pre-construction checks for protected species to determine whether the distribution of these species has changed during the intervening period.
- 8.10.5 A low number of bats were recorded in the application site, the vast majority of which were common or soprano pipistrelles, which are common and widespread species considered at low risk from windfarms at a population level. A very low number of high risk species was also recorded, namely Leisler's bat (three passes). However, the design of the windfarm includes minimum buffers between turbine blade tip and the top of adjacent linear habitat features, including woodland edges and watercourses, of at least 50 m and this, together with the very low numbers of high risk bat species means that impacts on bats are unlikely to be significant.
- 8.10.6 A number of windfarm developments occur within 10 km of the application site and have been included in an assessment of potential cumulative impacts. No potentially significant cumulative impacts have been identified.

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9 Ornithology

9.1 Introduction

9.1.1 This chapter describes the methods used to survey and evaluate the bird interest of the site and adjacent areas, to determine ornithological importance. The potential impacts of the proposed Pencloe Windfarm are assessed and mitigation measures are proposed. **Appendix 9.1 Volume IV** includes the baseline survey and other data used in this assessment. **Appendix 9.2 Volume IV** details the bird collision risk estimates for this project and **Appendix 9.3 Volume IV** outlines the criteria used to assess significance levels. The main aims of the chapter are to identify:

- potential impacts of the proposed development on bird breeding habitat; potential habitat used by migrants or wintering birds;
- potential displacement or attraction of birds during construction, operation and decommissioning;
- risks to local or regional bird populations associated with loss through collision with turbines and other infrastructure;
- the scope for avoiding or mitigating potential impacts and the significance of any residual impacts that cannot be avoided or mitigated; and
- the contribution to cumulative effects from the proposed Pencloe Windfarm acting with other similar projects in this local area (based on a sub set of projects shown in **Tables 2.1 and 2.2, Chapter 2: Environmental Impact Assessment Process**).

9.1.2 Particular attention has been paid to species of conservation concern (**Table 9.1**). These include species with national or international protection under the Wildlife and Countryside Act (1981, and later amendments) and the EU Birds Directive (79/409/EEC).

9.1.3 The key issues identified during the assessment in terms of potential effects were:

- direct loss of ground surface habitat or conifer plantation (estimated at 4.4 ha and 140 ha respectively)¹ on nesting, feeding and passage birds;
- disturbance to nesting birds during construction;
- displacement of nesting, feeding and passage birds into less suitable habitats or attraction into more suitable habitats (e.g. the 140 ha above) and
- collision of birds with rotating turbine blades, the wind turbine towers and meteorological masts during operation.

9.1.4 The site for 16 of the 21 wind turbines is dominated by closed-canopy, single species Sitka spruce conifer plantation on moderate altitude (400 to 500 m AOD) hills (Refer to **Chapter 8: Non- Avian Ecology**). The boundary of the application site covers 872 ha. Some residual areas of wet heath, dry heath, blanket bog and upland unimproved acid grassland are present at Struther's Brae for five of the proposed wind turbine locations. The main access utilises an existing farm track but also passes through improved/semi-improved pasture around the proposed access at Pencloe Farm. The open habitats are grazed at varying levels of intensity, mainly by sheep, roe and red deer. Although deer control and shepherding is carried out, the majority of the site is relatively undisturbed by human activity (timber harvesting had not started over the assessment period 2006-2013).

¹ Estimated tree set back zone required for wind resource utilisation of 100m buffer around Pencloe turbines extended to the wind-firm edges of coups.

9.2 Policy Legislation & Guidance

9.2.1 The application site does not lie within any sites designated for nature conservation value. The site is set back c. 6 km from the nearest Special Protection Area (SPA) (Muirkirk & North Lowther Uplands: primary cited interest hen harrier and other qualifying species) and therefore is beyond the distances that indicate connectivity (Pendlebury et. al. 2011). This SPA is also a Site of Special Scientific Interest. Birds species that form part of the wider conservation interest of the area are covered by policies relating to habitats and species in the wider environment (Refer to **Chapter 6: Planning and Energy Policy**):

- NPPG6: Renewable Energy Developments (Revised 2000)
- Scottish Government Web Based Renewables Guidance provides guidance on issues relating to windfarms, including bird issues.
- PAN51: Planning, environment protection and regulation (Revised 2006).
- NPPG14: Natural Heritage (1998) also provides guidance on policies relating to birds, in particular the EC Council Directive on the Conservation of Wild Birds (79/409/EC), known as the 'Birds Directive'.

9.3 Assessment methodology

Data Sources

9.3.1 The methodology is described in **Appendix 9.1 Volume IV** and was informed by the following data sources and baseline surveys of the application site and adjacent areas (**Table 9.2**):

- desk-based assessment and consultation;
- moorland & point count breeding bird surveys;
- raptor (birds of prey) survey;
- black grouse survey and
- vantage point watches.

9.3.2 The survey approach was based on the use of standard survey methodologies and drew on survey guidelines identified by SNH for the assessment of windfarms where considered relevant to this type of homogeneous conifer habitat in Ayrshire and Natural Heritage Zone 19: Western Southern Uplands and Inner Solway (SNH 2005, 2006). While the data set collected for the proposed development does not use two years of surveys undertaken within the last five years as recommended in the very recent SNH 2014 guidelines, it is considered there is sufficient information and consistency between the 2006 and 2010 surveys (**Table 9.2**) to enable this assessment.

9.3.3 Target species for these site surveys included:

- Hen harrier (*Circus cyaneus*);
- Peregrine falcon (*Falco peregrinus*);
- Merlin (*Falco columbarius*);
- Goshawk (*Accipiter gentilis*);
- Black grouse (*Tetrao tetrix*);
- Golden plover (*Pluvialis apronaria*);
- Migratory and wintering geese and swans of conservation concern and
- Other breeding, wintering and migratory waders of conservation concern.

Significance Criteria

- 9.3.4 For this assessment bird species that are of value at the East Ayrshire local level or more, for example in Natural Heritage Zone 19, are considered in detail. Similarly species that are listed by SNH (loc. cit.) of conservation concern that occur at Pencloe in sufficient numbers or frequency and potentially sensitive to wind energy developments are included. Nesting bird species present at the application site that potentially could be exposed to disturbance or damage from this proposal are included to ensure legal compliance under the Wildlife & Countryside Act 1981 and Nature Conservation (Scotland) Act 2004. Summary tables used to derive the levels of significance are included in **Appendix 9.3 Volume IV**.

Consultation

- 9.3.5 A summary of the original survey findings (2006 to 2011) and assessment methods were provided to SNH as part of the scoping in February 2012. The site development started a number of years prior to comments from the consultees and clarification was sought from the SNH senior ornithologist Dr. A. Douse on 14/12/2012 on their guidance for scoping out certain issues. His advice was that there was no in-principle objection to scoping out some/all ornithology issues in an EIA, that this was a decision of risk for the developer and to obtain advice on the specifics of this application from the SNH area case work advisor (who did not respond). The SNH area officer advised that, since there was some evidence of specially protected birds in the area around the application site, an impact assessment would be required and that no distinction/scoping out would be made for other species (of lesser or no conservation priority). Relevant responses to the 2012 Scoping Report regarding ornithological issues are summarised below.
- 9.3.6 Scottish Natural Heritage (SNH area officer telephone conversation 17/09/12) pointed out that the key concern was the *“presence of specially protected species in close proximity to the proposed windfarm site”*.
- 9.3.7 There was no comment in the SNH scoping response on potential impacts via connectivity distances to the nearest designated site or sites (the potential for impacts on those bird populations cited in the nearest SSSIs or SPAs). This correlated with SNH guidance (Pendlebury *et. al.* 2011) and therefore this EIA focused on conservation-sensitive species that reside in the wider countryside with the potential to interact with the proposed Pencloe Windfarm.
- 9.3.8 The RSPB responded to the scoping request (June 2014) to advise that the local black grouse population should be one focus of the assessment and that the commercial conifer plantation in and around the application site at Pencloe was likely to be of low ecological value (including the likely low ornithological interest with low flight activity levels by raptors). The RSPB also advised that remnant sectors of blanket mire should be retained where possible and that removal of conifers would present potential conservation gains and should be explored within a habitat management plan. They advised that cumulative effects should be assessed and that partnership with other organisations involved with habitat restoration in this area should be explored and incorporated into any subsequent habitat management plan.

Desk based assessment

- 9.3.9 A desk-based study was undertaken to collate bird records for a 2 km zone beyond the site boundary (as recommended by SNH guidance) to check for the presence of breeding raptors. Distribution and abundance data was collected from published sources and nature conservation organisations on species with a moderate or high nature conservation value by virtue of their abundance, rarity, behaviour and perceived vulnerability to windfarm developments (SNH 2005). Initial consultations

with RSPB & SNH suggested that there were few if any known birds of conservation concern currently present in the study area, but that this may also be a function of an historical paucity of bird surveys in the general area. This information gap was addressed by reference to the contemporary and adjacent bird data sets accumulated for the Afton and Ashmark Hill windfarms (Eon 2004; RWEpower 2012). The coordinator of the Dumfries & Galloway and South Strathclyde raptor study groups supplied data on nesting Schedule 1 listed birds of prey in 2013 (**Confidential Figure 9.11**). The site proposed for the Pencloe Windfarm is not designated for its nature conservation value nor is it adjacent to ornithological SSSIs or SPAs (**Figure 8.1 Volume III**). The proposed development is 8 km from the nearest SPA (Muirkirk & North Lowther Uplands) which has a boundary similar to that of the Muirkirk Uplands SSSI. This SPA is designated for breeding hen harrier, short-eared owl, merlin, peregrine falcon and golden plover. The site is 5.4 km south of a non-designated Scottish Wildlife Trust (SWT) reserve (Knockshinnoch Lagoons) that supports wildfowl, waders and water rail.

Field survey methodology

- 9.3.10 **Appendix 9.1 Volume IV** provides details of (i) the baseline surveys that covered the open habitats on Struther's Brae summit and the improved agricultural fields at Pencloe Farm around the access, (ii) point count samples of songbirds within the conifer plantation, (iii) surveys of black grouse and Schedule 1 listed raptors, (iv) surveys for owls and nightjar and (v) flight activity surveys (**Figure 9.6 Volume III**). A summary of the surveys is shown in **Table 9.2**. Surveys for adjacent windfarm developments took place in 2003/04 and 2010/11 and parts of these covered the Pencloe survey area (**Appendix 9.1 Volume IV**).

Table 9.1 Summary of bird surveys at Pencloe

Survey type	2006	2007	2010	2011	2013
Vantage points	June 2006 to July 2007 At 2 VPs for 156h		June 2010 to September 2011 At 3 VPs for 270h		
Winter walk over		Nov. Dec.	Sept. & Dec.		
Black grouse leks		March April x3		April x2	
Raptors		April x 4	Sept. x 2		
Owls & nightjar		x 4	x 2		x 1 July
Point counts	May at 4 locations	April at 4 locations	June at 6 locations		
Moorland bird survey	Struther's Brae	Struther's Brae		Access track Pencloe Farm	Access track Pencloe Farm

9.4 Baseline conditions

Winter walkover and vantage point surveys

- 9.4.1 A combination of walkover and vantage point surveys indicated that during the autumn and winter months the application site was utilised mainly by a local population of resident buzzard, sparrowhawk, kestrel and raven with red grouse on the moorland summit of Struther's Brae. There was a very low frequency of flight activity of the target species on only seven occasions during the accumulated 228 hours of observations (**Table 9.3**). These occurred predominantly in the autumn periods and involved hen harrier, peregrine falcon and merlin (**Appendix 9.1**

Volume IV and Figure 9.9 Volume III). On average one target species flight² was recorded per 32 hours of survey and this compared with one flight for every 18 hours survey for the Ashmark Hill proposal (RWEpower 2012).

Table 9.2 Summary of target species recorded during 228h of autumn and winter vantage point surveys at Pencloe

Species	2006/07 number of flight lines	2010/11 number of flight lines
Hen harrier	5	0
Peregrine falcon	0	1
Merlin	0	1

9.4.2 As with the contemporary and adjacent data sets accumulated for the Afton and Ashmark Hill windfarms, there was no evidence of wildfowl commuting routes in the local area (Eon 2010; RWEpower 2012). There was a north-south commuting corridor for gulls along Glen Afton to and from the Afton reservoir. There were three flights by snipe over the autumn/winter periods. Small flocks of one, three, four and six golden plover were present on Ewe Hill (1 km west and north west of the application site) on three occasions during walk out to the vantage point location in that area during October/November 2010. There were no flights of golden plover detected during the vantage point watches. Common crossbill were present in the Pencloe forest (singing and with family parties) during December to February 2010/2011 along with the remains of a woodcock. A peregrine falcon was flushed near dawn from a tree roost at Afton Caravan Park on 20/01/11 and a peregrine falcon was recorded leaving the crags at Boltcraig (0.8 km north east of the Pencloe development) on two occasions.

Breeding bird surveys (including moorland birds, forest birds, raptors and black grouse)

9.4.3 Results of all the breeding bird survey work undertaken between 2006 and 2013 are summarised in **Appendix 9.1 Volume IV** and **Figures 9.1 and 9.2-9.5 Volume III**. Many of the breeding birds recorded within the study area lie outside the application site but are included for completeness, to provide local context and to inform potential mitigation/enhancement (if required). Apart from skylark, song thrush and lesser redpoll, there were no species of high conservation importance recorded breeding, or probably breeding on or close to the application site during the survey period. Common crossbill are listed under Schedule 1 of the Wildlife & Countryside Act 1981, are in favourable conservation status in Scotland and the UK and breed within the Pencloe Forest (**Confidential Figure 9.11**). A regularly occupied peregrine falcon eyrie is on the periphery of the application site (**Confidential Figure 9.11**).

9.4.4 Buzzard and sparrowhawk were frequently observed soaring and commuting over the conifer plantations of Pencloe and Lochingerroch with between 3-5 pairs of each nesting here. Based on the dusk and nocturnal surveys, a minimum of two tawny owl territories are expected to be supported in this maturing conifer block.

9.4.5 Single black cock (male black grouse) were observed lekking during dawn surveys at three different locations, but these locations were not used by different birds simultaneously (**Appendix 9.1 Volume IV** and **Figure 9.5 Volume III**). The closest two lek sites are 1.2 and 1.4 km from the nearest parts of the proposed development. There was no evidence of greyhens (female black grouse) active within or close to the nominal 1.5 km radius of these leks during the breeding

² Flights recorded at all height bands

season. There was a December record of a grey hen c. 1 km northeast of wind turbine No. 1 (**Figure 9.5 Volume III**). Analysis of the conifer and moorland habitat suitability at Pencloe and Lochingerroch forests indicates that it represents a moderate to poor resource for this species. For example the majority of the conifer crop is at the closed canopy stage and dwarf shrub heath is relatively sparse and poorly developed along the rides. One or two red grouse territories were present on the summit area of moorland around Struther's Brae. They occur at a similar density to that found in the South Kyle study area 6 km to the west (Vattenfall 2013).

- 9.4.6 Three pairs of curlew bred in the fields around the access route on the northern sector of the application site from a total of seven pairs in the wider survey zone (**Figure 9.10 Volume III**). The approximate centres of their territories were situated 150 m to 500 m from the new route and proposed upgrade sections of the existing farm track. Snipe were found breeding at three locations around the periphery of the area and none were within 800 m of the proposed development. Similarly the nearest breeding pairs of oystercatcher are peripheral to the project and its infrastructure.
- 9.4.7 Skylarks and meadow pipits bred at low densities in the fields south of Pencloe Farm and on Struther's Brae and approximately five territories of the former species overlap these sectors of the development. Approximately two to three pairs of wheatears bred within 250m of the proposed access along the northern part of the site. Willow warblers were present along some of the open areas and margins of the conifer compartments.
- 9.4.8 Species such as chaffinch, coal tit, song thrush, dunnock and woodpigeon were widespread at the sample points within the conifers along with lower numbers of blackbird, goldcrest, siskin, common crossbill and lesser redpoll. Due to the homogeneous conifer crop it is a safe assumption to expect a similar range and density of forest songbirds to have been present across the rest of the forest over the survey period.

Summer vantage point watches & flight activity

- 9.4.9 The general activity rates by common species such as buzzard, sparrowhawk, kestrel and raven increased during the peak spring and summer periods. The 226 hours of vantage point watches showed very low activity levels of target species flights (three flights³) during the summer breeding period (**Table 9.4, Appendix 9.1 Volume IV and Figure 9.9 Volume III**). On average one target species flight was recorded per 75 hours of survey at Pencloe and this compared with no flights of this subset of species during the summer survey for the Ashmark Hill proposal (RWEpower 2012).

Table 9.3 Summary of target species recorded during the 226 hours of summer vantage point surveys at Pencloe

Species	2006/07 number of flight lines	2010/11 number of flight lines
Hen harrier	0	1
Peregrine falcon	0	0
Merlin	1	0
Greylag goose	0	1

³ Flights recorded at all height bands

9.5 Ornithological importance

- 9.5.1 Wintering bird data gathered in 2006/07 and 2010/11 suggests that the site is of low conservation importance to most species of birds at this time of year. Schedule 1 listed species, such as common crossbill, are likely to have nested over the latter part of the winter within the Pencloe & Lochingerroch forests. There was no evidence that the proposed development coincides with a commuting route used by overwintering wildfowl. Use by raptor species of higher conservation concern (hen harrier, peregrine falcon, merlin) was recorded predominantly during the autumn period, it occurred at a very low frequency and/or not at risk height⁴.
- 9.5.2 There was limited evidence for some spatial aggregation of hen harrier flights over the moorland around Struther's Brae⁵. This sector plus the low-lying farmland at Pencloe Farm supports prey species such as short-tailed field vole, skylark and meadow pipit and the conifer plantation supports breeding songbirds also predated by hen harrier. There was no strong evidence that these species occurred at particularly high densities at Pencloe compared with elsewhere in East Ayrshire or within NHZ 19 (RWE npower 2012; Vattenfall 2013) and the lack of nesting hen harrier suggest the area to be sub-optimal. Overall the application site at Pencloe is assessed of low value for the Natural Heritage Zone (NHZ) population of hen harrier.
- 9.5.3 The observations indicate (i) that the application site did not support key roost sites or day rest perches for the local pair of peregrine falcon and (ii) the application site did not occupy regularly used foraging or commuting flight routes for this pair. The application site at Pencloe supports prey species such as wood pigeon, jay, carrion crow, woodcock and curlew. There was no evidence that these species occurred at particularly high densities at this location compared with elsewhere in East Ayrshire or within NHZ 19 (Loc. cit.). The application site therefore represents a low value resource for the local breeding pair of peregrine falcon. The peregrine breeding pair within the wider study area represents c. 4% of the population within the local South Strathclyde region covered by the raptor study group, or c. 3% of the NHZ 19 population⁶ (Ethridge *et. al.* 2012). Based on the 1% criteria for importance, this nest site is of high value for peregrine falcon in regional terms, but below the 1% level nationally of c. 1530 pairs in 2002 (Holling & RBBP 2011).
- 9.5.4 The breeding bird data gathered at Pencloe indicate that the hill ground and low-lying grazings contain a small number of breeding red grouse and curlew respectively with low densities of other common upland birds such as meadow pipit and skylark. The three curlew territories in the vicinity of the access track at Pencloe Farm are likely to represent less than 1% of the estimated regional Strathclyde population, but are likely to be of importance at the level of the East Ayrshire population of c.<300 pairs⁷. Skylark is one species of conservation concern and the five territories that are closest to the project and its infrastructure represent less than 1% of the regional NHZ 19 population. These territories are of local importance at the scale of the surrounding three pastoral farm units around the application site.
- 9.5.5 There is a small residual population of black grouse around the periphery of the Pencloe & Auchingerroch forests, with no more than a single bird recorded at two different locations: 1100 to 1500 m from the application site. This correlates with the 2007 survey findings of Zisman *et. al.* (2009) who located seven leks in their Glen

⁴ Risk height 2006/07 = 20m to 120m a.g.l.; Risk height 2010/11 = 30m to 120m a.g.l.;

⁵ Note any spatial analysis based on just six flights is indicative.

⁶ Based on 34 occupied, inland territories 2012

⁷ The current Ayrshire or Strathclyde breeding curlew population is unknown and a precautionary estimate of 300 is adopted for East Ayrshire.

Afton survey area predominantly with single males present. There are no accurate regional population estimates (Zisman et. al. loc. cit. recorded 38 males in their sub set of three study areas), but the black grouse recorded in the survey area for the proposed Pencloe Windfarm are likely to be of importance at the East Ayrshire level.

- 9.5.6 The plantation and area where turbines are proposed supports common species of songbirds and raptors (e.g. chaffinch, coal tit, robin, buzzard, kestrel and sparrowhawk). The application site is therefore of low conservation importance both for these breeding and non-breeding birds in the context of East Ayrshire (and regionally at NHZ 19: Western Southern Uplands and Inner Solway).
- 9.5.7 There was no evidence from the autumn or spring vantage point watches undertaken for the proposed Pencloe Windfarm that this sector of East Ayrshire represents an important diurnal migration corridor or flyway (see also Eon 2010; RWEpower 2012).

9.6 Evaluation Criteria

Significance criteria

- 9.6.1 Significance was assessed on the basis of the following:
- the ecological value of the ornithological interest; and
 - the likely magnitude of impact in terms of loss or disturbance to species populations.
- 9.6.2 The ornithological importance of the site and significance of impacts have been assessed according to the criteria summarised in **Tables** in **Appendix 9.3 Volume IV**. These have been devised from the widely accepted CIEEM guidelines for assessing the ecological importance of non-designated land areas. Unless otherwise highlighted all the predicted impacts and outcomes for populations are rated as certain or near certain.

9.7 Assessment of construction impacts

- 9.7.1 Impact predictions have been derived using a combination of professional ornithological judgement based on known bird behaviour patterns, habitat quality and a semi-quantitative assessment of the bird abundances recorded by the surveys. Subsequent discussion of results and potential impacts focuses mainly on bird species with moderate or high ornithological value. Magnitude and significance of potential impacts are assessed for the regional populations of birds in the Western Southern Uplands and Inner Solway NHZ 19 in accordance with SNH guidance (SNH 2006).
- 9.7.2 The future baseline disturbance against which the impacts are assessed (i.e. the do-nothing scenario) relates to routine, clearfell timber harvesting over the next five-twenty years. This assumes that the local land use does not change, for example that the normal timber harvesting and restocking occurs and livestock farming continues along Glen Afton.
- 9.7.3 The direct loss of ground surface habitat for nesting, feeding and passage birds (c. 4.4 ha) is considered under operational impacts below along with attraction into the 140 ha modified habitats in the tree clearance zone.

Predicted disturbance impacts arising from construction

- 9.7.4 Previous work aimed at promoting safe working distances between forestry operations and rare breeding birds has been published by the RSPB and Forest Authority (Currie and Elliott, 1997; FCS 2006). More recently disturbance distances

have been extensively reviewed (Whitfield *et. al.* 2008) and the author has also applied their own and other consultancy's experience from recent ecological clerk of works experience for those species not covered above (*loc. cit.*).

- 9.7.5 With the exception of deer stalking and shepherding around Pencloe Farm, and occasional walkers, the application site is currently relatively undisturbed by human activity. Construction work, that includes enabling forest clearance, will cause localised disturbance impacts that will be most significant for birds nesting or foraging close to borrow pits, site compounds, operating machinery and other windfarm infrastructure. In the context of this assessment at Pencloe, there are no species of high ornithological importance at the regional NHZ 19 level that may be adversely affected by construction disturbance.
- 9.7.6 For hen harriers the autumn foraging activity was concentrated in the vicinity of the proposed five wind turbines on Struther's Brae (turbines 4,5,6,7&9). Similar moorland is ubiquitous throughout NHZ 19 and the c. 58 ha area at Struther's Brae accounts for fractions of one per cent of this resource regionally⁸. Based on their sporadic and transient use of this sector of moorland (and post construction observations elsewhere that show minimal displacement e.g. Haworth & Fielding 2012) the disturbance impacts (without mitigation) are therefore likely to be of very low magnitude and not significant at the regional scale.
- 9.7.7 The set-back distance to a peregrine falcon roost site is c. 1800 m and with an aspect away from the nearest parts of the project (turbines 1 & 4), the probability of displacement is considered low. The local pair is likely to utilise a number of different roost sites in its core area, they are likely to acclimatise to the works and would not lose this resource over the two year construction phase. Specific mitigation is not required and there would be no measureable significant impacts at the regional scale. The nearest parts of the project are >1.5 km from the eyrie and no disturbance impacts are predicted on the nesting pair (Whitfield *et. al.* 2008). Mitigation is not required and there would be no measureable significant impacts on the population dynamics of peregrine falcon at the regional scale.
- 9.7.8 The two pairs of curlew in the vicinity of the access track through the fields at Pencloe Farm are outside the zone of influence of wind turbines, but will be exposed to (i) one-off ground breaking/turf removal and (ii) traffic disturbance during a maximum of two breeding seasons (March-July)⁹. In response, these individuals are likely to utilise suitable alternative nest and brood rearing habitat in the fields at Pencloe. Unmitigated, the level of impact will be low and would not affect the conservation status of this local population. The other species of wader, snipe and oystercatcher occupy territories that are set back at least 800m and therefore sufficiently far from the works disturbance to be unaffected by this project.
- 9.7.9 One or two black grouse may be temporarily displaced from the peripheral parts of the forest by construction disturbance. Based on the marginal value of such habitat and infrequent signs of use, the level of impact will be low and would not affect the conservation status of the local population. In the absence of mitigation, no impacts are predicted (i) on the lek sites, as set back distances are large or (ii) on the foraging activity of this local population. Mitigation is therefore not required and the effects of construction disturbance will be non significant.
- 9.7.10 For species of low or moderate conservation value such as buzzard, sparrowhawk, kestrel, red grouse and tawny owl some territories will be compromised during this stage of the project (refer to paragraph **9.8.2**). Unmitigated, the effects will be non

⁸ Moorlands account for c.> 800 km² in NHZ 19 (SNH 2002. Natural heritage zones: a national assessment of Scotland's landscapes).

⁹ The review of Whitfield *et. al.* (2010) suggest that curlew exhibit some tolerance of wind turbines (and possibly track infrastructure included).

significant in terms of their conservation status at both local and regional scales. One or two red grouse territories may be temporarily affected by works during the breeding season, but based on their responses at other monitored sites in Scotland no significant impacts are predicted (for example Lawrence 2009, 2011). Similarly for skylark in the open habitats the disturbance impacts will be of moderate magnitude and not significant at the scale of the Western Southern Uplands and Inner Solway NHZ 19. Other than supervision to ensure compliance with the Wildlife & Countryside Act 1981 (as amended) for turf breaking in summer, no mitigation is required.

- 9.7.11 Based on standard best forestry practice, there will be transient impacts on the range of common songbirds that occupy the conifers. Even for biodiversity action plan species such as song thrush, or lesser redpoll these impacts (unmitigated) will be of minor magnitude and insignificant at the scale of the Western Southern Uplands and Inner Solway NHZ 19. Mitigation is therefore not required and the effects of construction disturbance will be non significant. Compliance with the legal obligations for potential disturbance or destruction of birds nests in general is required (refer to paragraphs **9.8.13 to 9.8.15**).
- 9.7.12 In summary, construction disturbance will not result in disturbance impacts for breeding birds with high nature conservation value. There may be minor impacts on species such as curlew with moderate conservation value that can be mitigated.

Mitigation for construction impacts

- 9.7.13 In mitigation for impacts on curlew, the route of the majority of the new access track diversion lies around 40 m from the Pencloe Farm buildings and mature broadleaved trees. This represents less optimal nest site or brood rearing locations for curlew. It is advised to schedule track construction and upgrade around Pencloe Farm outside of the summer nesting period to mitigate the impacts on breeding curlew. On a precautionary basis (i) optimal nest habitat can be created by grazing control offset from the immediate zone around the access track, (ii) dissuasion techniques employed prior to nest selection along the track route and (iii) predator control enhanced to reduce nest failure. The residual level of impact will be low to negligible on a locally important resource and not significant.
- 9.7.14 On a precautionary basis to cover inter-year variability for other waders nests, pre-construction surveys are advised to confirm the locations of their core nest areas and then advice taken from the site EcoW.
- 9.7.15 To ensure compliance with the Wildlife & Countryside Act 1981 for forest clearance, the preference is scheduling outside of the nesting season. Where these enabling works coincide with the bird nesting season pre-felling checks will be used to comply with the legal safeguards for birds. Pre-felling checks for common crossbill nests are also a legal requirement and would be needed in mid winter to match its nesting season. Temporary 'no-go' areas to protect ground or tree nesting birds within the construction site will be demarcated. Buffer distances will be applied as appropriate to individual species and locality (Whitfield et. al. 2008).

Residual construction impacts

- 9.7.16 There are predicted to be no significant lasting adverse effects arising from construction disturbance for the species of high nature conservation value (**Table 9.1**). For those of lower conservation value, no significant negative residual effects are predicted as a result of the proposed development (**Table 9.5**).

Cumulative construction impacts

- 9.7.17 A similar category and suite of nine wind energy projects surrounding the Pencloe proposal as employed in the Ashmark Hill EIA (RWEnpower 2011) forms the basis

for this assessment. This includes: Ashmark Hill at 2 km centre distance, Hare Hill Extension 5 km, Whiteside Hill 11 km, Afton 3 km, Ulzieside 13 km, Sanquhar Community 10 km, Windy Standard Extension 6 km, Quantans Hill 10 km and South Kyle 6 km (**Table 9.4**). Two operational projects Hare Hill at 5 km and Windy Standard at 4 km are not included in this assessment as the baseline compiled to inform the assessment encompasses the potential effects arising from the existing environment, which includes these operational developments. Additive effects have been restricted to those projects that have the potential to interact with the key receptor populations at a similar scale to which non-negligible residual impacts have been predicted for the proposed Pencloe Windfarm. In this case the focal species are peregrine, black grouse and curlew and since the assessment of residual effects concludes that none would be significant at the regional scale, the cumulative assessment focuses on the same populations at the local scale¹⁰. There are data availability limitations that preclude a full cumulative impact assessment on all categories of projects in the whole of the Western Southern Uplands and Inner Solway NHZ.

Table 9.4 Windfarm projects included in the cumulative assessment for the proposed Pencloe Windfarm

Windfarm	Distance km	Number turbines	ES available?	Shared species
Hare Hill Extension	5	39	N	Curlew
Windy Standard Extension	6	30	Y	Black grouse, peregrine?
Ashmark	2	12	Y	Curlew, black grouse
Whiteside Hill	11	11	Y	Curlew, black grouse, peregrine
Ulzieside	12	20	Y	Curlew, black grouse, peregrine
Sanquhar Community	10	15	Y	Curlew, black grouse,
South Kyle	6	50	Y	Black grouse, peregrine
Quantans Hill	10	19	Y	Curlew, black grouse, peregrine, merlin
Afton	3	27	Y	Curlew, black grouse

9.7.18 There is the potential for non-negligible additive impacts in the short-term especially if the construction phase of six of the above eight projects overlap with the proposed Pencloe Windfarm construction phase. The residual effects on peregrine and black grouse for Windy Standard Extension and South Kyle are assessed as negligible. However, providing that good practice is followed for the remaining projects to mediate the adverse, short term effects of construction disturbance on key receptors such as curlew and black grouse, then significant residual effects should be avoided.

9.8 Assessment of predicted operational effects

Predicted direct habitat loss or modification

9.8.1 There are no species of high ornithological importance that are predicted to be adversely affected by the land take of the proposal. The unmitigated impacts of

¹⁰ It is possible that sufficient low-level impact for a large number of accumulated projects could alter regional bird populations.

- direct habitat loss and/or loss of moorland prey on ranging hen harriers and merlins will be insignificant at both the local scale and at the scale of NHZ 19. The increased open habitats and forest edges caused by the operational requirement of the windfarm is likely to favour a variety of songbird species and increase their availability to predators such as hen harrier and merlin. At the regional level these positive effects are considered to be negligible to small in magnitude and not significant. The unmitigated impacts of direct habitat loss that supports the peregrine falcon prey species such as corvids and woodpigeon is considered to be non significant at both the local and regional scales. These impacts will not preclude or compromise continued breeding by peregrine falcon in the wider locality.
- 9.8.2 For other species of lower conservation value such as red grouse and curlew, the unmitigated impact of direct habitat loss on breeding is assessed of minor magnitude at the local scale (between 7% and 1% respectively¹¹) and not significant regionally. The regeneration of habitats within the forest clearance areas is unlikely to favour red grouse over the short to medium term (5-20 years). Mitigation is not required for either red grouse or curlew and the effects of landtake or modification will be non significant.
- 9.8.3 The smaller upland passerine birds including meadow pipit, skylark and wheatear may experience some territory incursion as a result of track and hardstanding construction. Unmitigated impacts at the regional population level will be of negligible magnitude and not significant. Mitigation is therefore not required for the effects of landtake or modification. Similarly the common species of woodland specialist songbirds (such as chaffinch, coal tit, etc.) will be reduced at the local scale by the enabling tree clearance (c. 140 ha from a total of 888 ha of conifers). Unmitigated, this effect is considered to be of low magnitude (c. 15% by area or by bird territories) at the local level and negligible at the regional scale. Mitigation is therefore not required and the effects of landtake or modification will be non significant.
- 9.8.4 The regeneration of habitats in among the harvested residues will alter the use made of the site by birds over the following 25 years and will follow the pattern normally associated with harvesting cycles, but without the effects of restocking with conifers. Those songbirds (e.g. willow warbler, song thrush, wren, dunnock, robin, meadow pipit, bullfinch, lesser redpoll) that occupy scrub or open habitats will increase within the forest clearance areas. Unmitigated, this positive effect is considered to be of low magnitude (c. 15%) at the local scale and negligible at the regional scale. Mitigation is therefore not required and the effects of landtake or modification will be non significant.
- 9.8.5 Some of the breeding territories of buzzards, sparrowhawk, tawny owls and kestrels will be located in areas where habitat loss will result in adverse impacts (premature felling of c. 15% of the conifer crop¹²). Within the context of standard forest harvesting cycles and forest re-design Pencloe forest will subsequently support a similar local population of these raptors long term (with minor, positive effects from the prey resource within the open and edge habitats). Unmitigated impacts at the regional level for these lower priority species will be of low to negligible magnitude and not significant. Mitigation is therefore not required and the effects of landtake or modification on their populations will be non significant.

¹¹ For red grouse, five wind turbine platforms & tracks = 4.0ha from c. 58ha of moorland on Struther's Brae. For curlew, track = 0.46ha from c. 60ha of field area at Pencloe Farm.

¹² Note that the 140 ha enabling tree clearance affects the younger or smaller conifers that represent suboptimal nest locations for these species.

Predicted disturbance impacts of wind turbines

- 9.8.6 Preliminary observations from post construction monitoring at similar windfarm sites in the UK suggests that a wide variety of bird species appear to habituate to or tolerate the regular patterns of medium to low-level disturbance (Fielding & Haworth 2013; Haworth & Fielding 2014; Lawrence 2009, 2011; Stolte 2009; Whitfield et. al. 2010). These include the regular and predictable pattern of wind turbine noise, movement and shadow flicker along with operational maintenance checks on individual turbines. These will involve access by engineers in motor vehicles along the access tracks on average at a weekly interval. The latter disturbance pattern will be small-scale and predictable and will result in minor (short-term) impacts on birds nesting close by (e.g. c. 10-20 m for red grouse, sparrowhawk, tawny owl or 20-100 m for curlew, buzzard, kestrel) to the access tracks and turbine bases (per. obs. & loc. cit.). Note the two curlew territories overlap the Pencloe Farm access track only and not the footprint of the wind turbines. Unmitigated impacts at the regional level for these lower priority species will be of very low magnitude and rated of negligible significance. Mitigation is not required.
- 9.8.7 The setback distance to one of the peregrine falcon roost sites and an eyrie is sufficient to preclude downgrading of this resource locally or regionally over the medium to long term. Unmitigated, the potential adverse effects are considered to be negligible and therefore of negligible significance at the regional scale. Mitigation is therefore not required and the effects of disturbance from operating wind turbines or access traffic on this local pair or the regional population will be non significant.
- 9.8.8 There is little evidence (short to medium term) from the UK windfarms that species such as black grouse are precluded from windfarm/forest/moorland edge habitats (Lawrence 2009-12; Stolte 2009/10). The small population of this species around the application site is therefore unlikely to be dissuaded from utilising the re-structured habitats on and around the footprint of the proposed development in the future (minor, positive effects from foraging resource within the open habitats). Unmitigated impacts at the regional level for black grouse will be of very low magnitude, probably neutral and rated non significant. Mitigation is not required. Species such as hen harrier or short-eared owl may be attracted into the tree-free habitat (**Section 9.9.1**) and if this involves nesting and display activity there may be an increased collision risk (SNH information Note 2012) (**Section 9.9.9**).

Predicted collision risk

- 9.8.9 The very low level of flight activity recorded at Pencloe does not enable a full spatial analysis of this activity by the target species, but there is no indication of distinct flight routes or corridors across the survey area. Collision risk analysis has been undertaken even though the conservation priority (target) species flight data were below the threshold considered at risk (refer to **Appendix 9.2 Volume IV**). This is also corroborated by the flight line activity recorded on adjacent parts of this terrain around Pencloe Forest (Eon 2004 loc. cit. & RWEnpower 2011 loc. cit.). The accumulated time at risk height factored by the accumulated observation time and observation area generates negligible theoretical collision rates¹³: These are <1 bird over the project lifespan of 25 years for peregrine falcon (**Appendix 9.2 Volume IV**), merlin or greylag geese. Therefore based on data gathered for this EIA, the direct loss of individuals for hen harrier, merlin, peregrine falcon or greylag geese is considered of negligible to low magnitude and not significant. Thus no mitigation is advised in terms of project location, design of the array or wind turbine size. As a

¹³ The contact rates/unit weighted observation time are all < $6.05 \times 10^{-7} \text{ s ha}^{-1} \text{ h}^{-1}$ and based on comparison with SNH generic models that use 10% turbine down time, 98% avoidance rates (Band et.al. 2007) the collision risk for peregrine falcon = 1 bird every 50 years of operation. (similar to the calculations of Section 8.5.4.2 of RWEnpower 2011).

precaution it is advised to incorporate appropriate habitat management measures for the tree clearance zone in order to mitigate for the attraction of hen harrier or short-eared owl (SNH information Note 2012) (**Section 9.9.8**).

- 9.8.10 Based on collision monitoring at upland sites in Scotland (Duffy & Steward 2008; Lawrence 2005, Lawrence 2011-13) flight activity by common species such as buzzard, sparrowhawk and kestrel are likely to result in occasional collisions over the 25 year life span of the proposed windfarm along with sporadic collisions by red grouse with the tubular turbine towers and meteorological masts. These impacts will be of moderate magnitude and of minor significance at the scale of their respective populations in NHZ 19. Direct loss of individuals could also affect nocturnal songbird migrants (e.g. redwing, fieldfare) and species such as a woodcock¹⁴.

Mitigation for operation impacts

- 9.8.11 There are no aspects of operation in terms of land take, disturbance/displacement or the estimated collision risk that require mitigation to offset predicted impacts on birds with high nature conservation value. In terms of the tree clearance zone it is advised to explore habitat management measures to manage any future potential for increased collision risk for hen harrier and short-eared owl (**Sections 9.9.8, 9.9.9**).

Residual operation impacts

- 9.8.12 The residual impacts from all aspects of the operation phase are of negligible magnitude and not significant.

Cumulative operation impacts

- 9.8.13 There is the potential for cumulative impacts from collision mortality from at least five of the nine windfarm projects identified in **Table 9.4** to be potentially significant at a local to district level for peregrine (c. 4-5 ranges). The contribution of the predicted collision mortality from the Pencloe project is however categorised as minor/negligible (**Section 9.10.9; Appendix 9.2 Volume IV**). This magnitude of impact on the local population would not act in combination to a significant level with the other local windfarms. Following current guidance on cumulative impact assessment (SNH 2012) this is not considered a significant impact in the context of the EIA regulations.
- 9.8.14 There is the potential for minor additive impacts in the medium/long-term for the landtake, collision risk and other operational impacts for the proposed Pencloe Windfarm along with the other nine projects (**Table 9.4**). This could theoretically apply to the low density, scattered black grouse population shared between these nine projects. On a precautionary level, it is advised to explore habitat management measures in combination with similar initiatives from neighbouring projects. The combined effects on the other shared receptors with higher conservation sensitivity are assessed as not significant (**Table 9.5**).

¹⁴ These categories of birds are not covered by any previous wind turbine EIA data gathering in the UK or are part of current or updated national guidelines. Without baseline data the predicted impacts are categorized as uncertain and by definition the target, source populations will be mainly non local/regional.

9.9 Assessment of predicted decommissioning phase impacts

- 9.9.1 Reference is made to the level of disturbance impacts for the construction phase in **Section 9.8** and these will be of similar magnitude on those species expected to be present in c. 25 years' time on this site. It is advised that the birds are surveyed prior to decommissioning in order to inform appropriate mitigation in the future. At the time of this assessment any predictions will be probable or uncertain.

Mitigation for decommissioning impacts

- 9.9.2 A similar set of measures may be required as outlined in **Section 9.8.14** prior to decommissioning in order to inform appropriate mitigation in the future. At the time of this assessment any predictions will be probable or uncertain.

Residual decommissioning impacts

- 9.9.3 The residual impacts from all aspects of the decommissioning phase are likely to be of minor magnitude (in some case positive) and not significant (**Table 9.5**). These predictions are probable or uncertain.

Cumulative decommissioning impacts

- 9.9.4 The cumulative impacts from the decommissioning phase of the Pencloe Windfarm along with the other neighbouring projects are likely to be of minor magnitude (in some case positive) and not significant (**Table 9.5**). These predictions are probable or uncertain.

9.10 Summary and Conclusions

- 9.10.1 Breeding bird and flight activity surveys were undertaken in and around the application site for the proposed Pencloe Windfarm between 2006 and 2013.
- 9.10.2 Apart from five of the proposed wind turbines and associated infrastructure the proposed development occurs in low diversity conifer plantation habitat. A section of the proposed access track passes through improved and semi-improved pasture south of Pencloe Farm that hosts two to three curlew breeding territories.
- 9.10.3 The moorland where five of the 21 wind turbines are proposed supports a low sensitivity breeding bird community and is occasionally used for hunting by raptors such as a hen harrier. Other peripheral areas of moorland beyond the application site boundary support three to four black grouse leks with surveys showing just single males present in spring, indicating intermittent use.
- 9.10.4 Analysis of these data sets indicates that the tract of upland forest proposed for Pencloe Windfarm is of low importance for birdlife in the context of East Ayrshire or the Southern Uplands. It also does not coincide with frequently used or regular migratory or winter flight routes.
- 9.10.5 The proposal is set back from local or nationally designated sites for bird conservation by significant distances.
- 9.10.6 Specially protected or conservation-sensitive birds such as merlin, peregrine falcon, hen harrier and black grouse are present occasionally, but do not breed within the confines of the application site. The nearest peregrine falcon eyrie is regularly occupied and is set back by a sufficient distance to preclude disturbance or displacement effects.
- 9.10.7 The estimated collision risk for species such as peregrine falcon is very low and unlikely to result in a measurable change to the regional population. The proposed Pencloe Windfarm is also assessed as contributing a minor and non significant

impact cumulatively with other proposals in the local area on the regional population of this and the other key bird species.

- 9.10.8 Consideration of the scale of the impacts for each of phases of the proposed development concludes that in addition to the embedded mitigation, some specific mitigation is advised (e.g. for curlew and black grouse). There are likely to be minor, residual impacts on the key bird species in and around the application site, and these are rated as non significant **Tables 9.1 & 9.6**. The proposed development will not result in medium or long term changes to the local bird populations, and in terms of the lack of potential ornithological impacts is considered a suitable site for a renewable energy project of this scale.

Table 9.5 Summary of Residual Effects

Potential Impacts	Receptor(s) <i>Sensitive</i>	Nature Conservation Value	Potential Effect Magnitude	Potential Impact Level (significance)	Summary of Proposed Mitigation Measures	Residual Effect Magnitude	Residual Effect Level (significance)
Construction: Disturbance and Displacement	<i>Hen harrier</i>	Medium	Low	Minor (short-term)	(i) Undertake pre-construction surveys to identify any Schedule 1 bird species nest sites (e.g. goshawk, common crossbill ¹) in the breeding season before works (including felling operations for the windfarm) commence. ¹ = year round (ii) Programme construction works to avoid areas of known sensitivity (e.g. demarcated within 500m of active Schedule 1 species nest sites or 300m of lek sites) during key sensitive periods. (iii) Construction works will be monitored by an experienced site ecologist: to ensure protection zone adherence & implementation of mitigation measures. (iv) Felling or vegetation clearance/turf stripping that occurs in the breeding season (¹ incl. winter tree felling) will be supervised to comply with the legal obligations.	Low	Negligible-Minor (short-term)
	<i>Merlin</i>	Medium	Low	Minor (short-term)		Low	Negligible
	<i>Peregrine falcon</i>	Medium (high regional)	Low	Minor (short-term)		Low	Minor (short-term)
	Other Raptors & Owls	Low (Medium-Local)	Medium	Moderate (short-term)		Low	Minor (short-term)
	<i>Black grouse</i>	Medium	Low	Minor (short-term)		Low	Minor (short-term)
	<i>Curlew</i>	Low (Medium-Local)	Medium	Moderate (short-term)		Low	Minor (short-term)
	Wintering/Passage Geese, gulls	Negligible	Negligible	Negligible		Negligible	Negligible
	<i>Common Crossbill</i>	Medium	Medium	Moderate-minor (short-term)		Low	Minor (short-term)
	Woodland Songbirds	Low	Medium	Minor (short-term)		Low	Negligible
	Moorland Songbirds	Low (Medium-Local)	Medium	Minor (short-term)		Negligible-Low	Negligible-minor (short-term)

Potential Impacts	Receptor(s) <i>Sensitive</i>	Nature Conservation Value	Potential Effect Magnitude	Potential Impact Level (significance)	Summary of Proposed Mitigation Measures	Residual Effect Magnitude	Residual Effect Level (significance)
Operation: Landtake & modification	Other Raptors & Owls	Low (Medium-Local)	Medium	Minor (short-term)	(i) Habitat enhancement and restoration: implement a Habitat Management Plan (HMP). Increase nesting success for black grouse, curlew & other birds of conservation concern.	Low	Negligible-Minor (positive)
	<i>Black grouse</i>	Medium	Low	Minor		Low	Minor (positive)
	Red grouse	Low (Medium-Local)	Medium/low	Moderate-minor		Low	Minor
	<i>Curlew</i>	Low (Medium-Local)	Low	Minor		Low	Minor (positive)
	<i>Common Crossbill</i>	Medium	Medium	Moderate-minor		Low	Minor
	Woodland Songbirds	Low (Medium-Local)	Medium	Minor (short-term)		Low	Negligible-minor (positive)
	Moorland Songbirds	Low (Medium-Local)	Low	Minor (short-term)		Negligible-Low	Negligible-minor (positive)
Operation: Disturbance and Displacement	<i>Hen harrier</i>	Medium	Low	Minor	(i) Regular, scheduled maintenance activities will be undertaken to an agreed method statement (in consultation with SNH). (ii) For emergency operations, utilize the guidance of an experienced Ecow ornithologist, based on maintenance of up-to-date status of species of conservation concern in the area.	Negligible-Low	Negligible-minor
	<i>Merlin</i>	Medium	Low	Minor		Negligible-Low	Negligible-Minor
	<i>Peregrine falcon</i>	Medium	Low	Minor		Low	Negligible-Minor
	Other Raptors & Owls	Low (Medium-Local)	Low	Minor		Low	Negligible-Minor
	<i>Black grouse</i>	Medium	Low	Minor		Low	Minor
	<i>Curlew</i>	Low (Medium-Local)	Low	Minor		Low	Minor
	<i>Common Crossbill</i>	Medium	Low	Minor		Low	Minor
	Woodland Songbirds	Low (Medium-Local)	Low	Minor		Negligible-Low	Negligible
	Moorland Songbirds	Low (Medium-Local)	Low	Minor (short-term)		Negligible-Low	Negligible

Potential Impacts	Receptor(s) <i>Sensitive</i>	Nature Conservation Value	Potential Effect Magnitude	Potential Impact Level (significance)	Summary of Proposed Mitigation Measures	Residual Effect Magnitude	Residual Effect Level (significance)
Operation: Collision risk	<i>Hen harrier</i>	Medium	Low/ negligible	Negligible	(i) An agreed monitoring programme (with SNH) will be implemented to monitor activity by species such as Peregrine falcon, hen harrier, goshawk and merlin within the wind turbine area. (ii) Enact measures to reduce the attractiveness of clearfell habitats should monitoring identify a significant increase in activity within the wind turbine area above a previously agreed threshold. (iii) Adopt bird collision surveys contingent upon findings from standard O&M staff reporting procedures.	Negligible	Negligible
	<i>Merlin</i>	Medium	Low/ negligible	Negligible		Negligible	Negligible
	<i>Peregrine falcon</i>	Medium	Low	Minor		Low	Negligible-Minor
	Other Raptors & Owls	Low (Medium-Local)	Medium	Minor		Low	Minor (long term)
	<i>Black grouse</i>	Medium	Low/ negligible	Minor		Low	Negligible
	Wintering/Passage Geese, gulls	Negligible	Negligible	Negligible		Negligible	Negligible
	<i>Common Crossbill</i>	Medium	Low/ negligible	Negligible		Negligible	Negligible
	Woodland Songbirds	Low (Medium-Local)	Medium/low	Minor		Negligible-Low	Negligible
	Moorland Songbirds	Low (Medium-Local)	Medium/low	Minor		Negligible-Low	Negligible
Decommissioning: Disturbance	<i>Hen harrier</i>	Medium	Low	Minor (short-term)	(i) Undertake pre-decommissioning surveys to identify any Schedule 1 bird species nest sites (e.g. merlin, goshawk) in the breeding season before decommissioning works commence. (ii) Programme decommissioning works to avoid areas of known sensitivity (e.g. within 500m of active Schedule 1 species nest sites) during key sensitive periods.	Low	Negligible-Minor
	<i>Merlin</i>	Medium	Low	Minor (short-term)		Low	Negligible-Minor
	<i>Peregrine falcon</i>	Medium	Low	Minor (short-term)		Low	Minor (short-term)
	Other Raptors & Owls	Low (Medium-Local)	Medium	Minor (short-term)		Low	Negligible-Minor (short-term)
	<i>Black grouse</i>	Medium	Low	Minor (short-term)		Low	Minor (short-term)
	<i>Curlew</i>	Low (High-Local)	Low	Minor (short-term)		Low	Minor (short-term)
	<i>Common Crossbill</i>	Medium	Low	Minor (short-term)		Low	Minor (short-term)
	Woodland Songbirds	Low (Medium-Local)	Low	Minor (short-term)		Low	Negligible-minor (short-term)

Potential Impacts	Receptor(s) <i>Sensitive</i>	Nature Conservation Value	Potential Effect Magnitude	Potential Impact Level (significance)	Summary of Proposed Mitigation Measures	Residual Effect Magnitude	Residual Effect Level (significance)
	Moorland Songbirds	Low (Medium- Local)	Low	Minor (short- term)		Low	Negligible-minor (short-term)
Decommissioning: Land use reversion	<i>Hen harrier</i>	Medium	Medium	Moderate	(i) Identify target species of conservation concern in 25 years time, design/amend forest plan to maintain/maximize diversity. (ii) Removal of collision risk	Low	Minor positive (long term)
	<i>Merlin</i>	Medium	Medium	Moderate		Low	Minor positive (long-term)
	<i>Peregrine falcon</i>	Medium	Low	Minor		Low	Minor (long term)
	Other Raptors & Owls	Low (Medium- Local)	Medium	Minor /moderate		Low	Minor positive (long-term)
	<i>Black grouse</i>	Medium	Medium	Moderate		Low	Minor positive (long-term)
	<i>Curlew</i>	Low (High- Local)	Negligible	Negligible		Negligible	Negligible
	<i>Common Crossbill</i>	Medium	Moderate	Moderate- minor		Moderate- Low	Minor
	Woodland Songbirds	Low (Medium- Local)	Medium	Moderate		Low	Minor positive (long-term)
	Moorland Songbirds	Low (Medium- Local)	Medium/Low	Minor		Low	Minor positive (long-term)
Cumulative: Construction Disturbance	<i>Hen harrier</i>	Medium	Low	Minor (short- term)	(i) Non in addition to project-specific measures above (includes HMP). (ii) coordinate with other local developers in shared survey data sets and combined actions on key species, such as black grouse, curlew.	Low	Minor (short- term)
	<i>Merlin</i>	Medium	Low	Minor (short- term)		Low	Minor (short- term)
	<i>Peregrine falcon</i>	Medium	Low	Minor (short- term)		Low	Minor (short- term)
	Other Raptors & Owls	Low (Medium- Local)	Medium	Minor (short- term)		Low	Negligible-Minor (short-term)
	<i>Black grouse</i>	Medium	Medium	Minor (short- term)		Low	Minor (short- term)
	<i>Curlew</i>	Low (High- Local)	Low	Minor (short- term)		Low	Minor (short- term)
	<i>Common Crossbill</i>	Medium	Low	Minor (short- term)		Low	Minor (short- term)

Potential Impacts	Receptor(s) <i>Sensitive</i>	Nature Conservation Value	Potential Effect Magnitude	Potential Impact Level (significance)	Summary of Proposed Mitigation Measures	Residual Effect Magnitude	Residual Effect Level (significance)
	Woodland Songbirds	Low (Medium- Local)	Medium	Minor (short- term)		Low	Negligible-minor (short-term)
	Moorland Songbirds	Low (Medium- Local)	Low	Minor (short- term)		Low	Negligible-minor (short-term)
Cumulative: Land take/modification	<i>Hen harrier</i>	Medium	Low	Minor	(i) As above	Low	Minor (positive)
	<i>Merlin</i>	Medium	Low	Minor		Low	Minor (positive)
	<i>Peregrine falcon</i>	Medium	Low	Minor		Low	Minor
	Other Raptors & Owls	Low (Medium- Local)	Medium	Minor		Low	Minor
	<i>Black grouse</i>	Medium	Low	Minor		Low	Minor (positive)
	<i>Curlew</i>	Low (High- Local)	Low/medium	Minor		Low	Minor (positive)
	<i>Common Crossbill</i>	Medium	Low	Minor		Low	Minor
	Woodland Songbirds	Low (Medium- Local)	Medium	Minor		Low	Minor
	Moorland Songbirds	Low (Medium- Local)	Low	Minor		Low	Minor
Cumulative: Collision risk	<i>Hen harrier</i>	Medium	Low	Minor	(i) Non in addition to project- specific measures above (includes HMP).	Low	Minor (long-term)
	<i>Merlin</i>	Medium	Low	Minor		Low	Minor (long-term)
	<i>Peregrine falcon</i>	Medium	Low	Minor		Low	Minor (long-term)
	Other Raptors & Owls	Low (Medium- Local)	Medium	Minor		Low	Minor (long-term)
	<i>Black grouse</i>	Medium	Low	Minor		Low	Minor (long-term)
	Wintering/Passage Geese, gulls	Low	Negligible	Negligible		Negligible	Negligible
	<i>Common Crossbill</i>	Medium	Low	Minor		Negligible- Low	Minor (long-term)
	Woodland Songbirds	Low (Medium- Local)	Low	Minor		Low	Minor (long-term)
	Moorland Songbirds	Low (Medium- Local)	Low	Minor		Low	Minor (long-term)

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10 Hydrology, Hydrogeology & Geology

10.1 Introduction

- 10.1.1 This chapter considers the assessment of the potential impacts of the proposed development on the surface water and groundwater environment in terms of both quality and quantity, and includes a review of flood risk and potential changes to existing flood risk patterns. In addition, it also addresses the potential impact of the proposed development on soil and geology across the application site (including peat).
- 10.1.2 This chapter should be read in conjunction with **Chapter 8: Non-Avian Ecology** as it makes reference to some of the detail within this chapter.
- 10.1.3 There are several appendices to this chapter (refer to **Volume IV**):
- **Appendix 10.1a Peatslide Hazard and Risk Assessment Factual Report**
 - **Appendix 10.1b Peatslide Hazard and Risk Assessment Interpretive Report**
 - **Appendix 10.2 GWDTE Assessment**
 - **Appendix 10.3 Watercourse Crossings**
 - **Appendix 10.4 Standard Practice Measures**
 - **Appendix 10.5 Peat Management Plan**
 - **Appendix 10.6 Borrow Pit Assessment**
 - **Appendix 10.7 Outline CEMP**
 - **Appendix 10.8 Sediment and Drainage Control Measures**

10.2 Legislative, Policy and Guidance

- 10.2.1 In addition to the planning framework relevant to this application, this assessment has been undertaken with regard to statutory and general guidance, and a range of environmental legislation including the following.

Legislation

- The Water Environment (Controlled Activities) (Scotland) Regulations, 2011 (CAR);
- EU Water Framework Directive (2000/60/EC);
- The Environment Act 1995;
- Control of Pollution Act 1974;
- Environmental Protection Act 1990;
- The Water Supply (Water Quality) (Scotland) Regulations, 2001;
- The Freshwater Fish Directive (2006/44/EC);
- Surface Waters (Fishlife) (Classification) (Amendment) Regulations, 2003
- The Flood Risk Management (Scotland) Act 2009;
- Water Environment and Water Services (Scotland) Act 2003 (WEWS Act);
- Private Water Supplies (Scotland) Regulations 2006;
- Pollution Prevention and Control (Scotland) Regulations 2000;
- Environmental Liability (Scotland) Regulations 2009
- Pollution Prevention and Control (Scotland) Regulations 2000; and
- The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2011;

Planning Policy and related guidance:

- Scottish Planning Policy (SPP), Scottish Government, 2010;
- Planning Advice Notes (PANs), Scottish Executive;
 - PAN 69: Planning and Building Standards Advice on Flooding;
 - PAN 61: Planning and Sustainable Urban Drainage Systems; and
 - PAN 58: Environmental Impact Assessments
- East Ayrshire Council – East Ayrshire Local Development Plan, Main Issue Report, 2012
- SEPA Pollution Prevention Guidance Notes (PPG):
 - PPG01 General Guide to the prevention of water pollution;
 - PPG02 Above ground oil storage tanks;
 - PPG03 Use and Design of Oil Separators in Surface Water Drainage Systems;
 - PPG05 Works in, near or liable to effect watercourses;
 - PPG06 Working at construction and demolition sites;
 - PPG07 Refuelling facilities;
 - PPG08 Safe Storage and Disposal of Used Oils;
 - PPG13 Vehicle Washing and Cleaning;
 - PPG21 Pollution incident response planning;
 - PPG22 Incident Response – Dealing with Spills; and
 - PPG23 Maintenance of Structures over Water.
- CIRIA publications:
 - C532 Control of water pollution from construction sites (2001); and
 - C650 Environmental good practice on site (2005).
- SEPA publications:
 - Groundwater protection policy for Scotland Version 3 (2009);
 - Regulatory position statement – Developments on Peat (2010);
 - Position Statement – Culverting of Watercourses (2006);
 - Land Use Planning System Guidance Note 4, Version 6 (2014);
 - Engineering in the Water Environment: Good Practice Guidance – River crossings (2010); and
 - Scottish Renewables and SEPA – Developments on peatland: and Guidance on the assessment of peat volumes, reuse of excavated peat and the minimisation of waste (2012).

Other Guidance:

- Scottish Renewables, Scottish Natural Heritage, SEPA, Forestry Commission Scotland – Good practice during windfarm construction (2010);
- Forest and Water. UK Forestry Standard Guidelines (Forestry Commission, 2011);
- DEFRA Good practice guide for handling soils (MAFF 2000);
- DEFRA Construction Code of Practice for the Sustainable Use of Soils on Construction Sites (2011);
- Institute of Environmental Management and Assessment (IEMA) Guidelines for Environmental Impact Assessment (2004); and
- Scottish Natural Heritage, 2nd Edition June 2013 – Constructed Tracks in Scottish Uplands.

10.3 Methodology

10.3.1 This section outlines the methodology adopted to assess the environmental impacts of the proposed windfarm upon the local water environment and underlying geology.

10.3.2 The methodology is based upon the collection of information from a wide variety of data sources including published material and consultation with statutory bodies. **Table 10.1** details the data sources referred to throughout this assessment.

Table 10.1 Data sources

Topic	Source of data and information
Topography Elevation, relief, climate	Ordnance Survey mapping Flood Estimation Handbook (FEH)
Surface Water Flooding Water Quality Recreational Water PWS	Scottish Environmental Protection Agency (SEPA) – Interactive Maps Water Framework Directive Water Quality SEPA Indicative Flood Map River Dee (Kirkcudbright) District Salmon Fishery Board (RD(K)SFB) Dumfries and Galloway Council East Ayrshire Council
Groundwater Aquifer properties	BGS Bedrock and superficial aquifer mapping Groundwater vulnerability mapping of Scotland (scale 1:625,000) Hydrogeological Map of Scotland (scale 1:625,000)
Geology Solid and drift	British Geological Survey online mapping Solid (scale 1:50000) Drift (scale 1:50000)
Water Resources Abstractions and discharges	SEPA Dumfries and Galloway Council East Ayrshire Council

Scope

10.3.3 The scope of the assessment is to identify:

- Constraints on the proposed development associated with the hydrology, hydrogeology and geology of the application site, including peat, so that the most sensitive areas can be avoided or protected throughout the windfarm design process;
- Potential impacts and risks associated with construction, operation and decommissioning activities that can be controlled through best management practices;
- Mitigation measures to control and reduce other potential significant impacts of the proposed development on the water and soil environment; and
- The significance of residual impacts.

Study area

10.3.4 The application site is located within an area of commercial forestry in the north eastern part of the Carsphairn Forest, approximately 4 km south of New Cumnock and 16 km east of Sanquhar. The application site has undulating topography, with four main hills separated by valleys with watercourses flowing generally northwards or southwards. The highest elevation on the application site is Milray Hill, which is situated in the south west of the application site. To the north of Milray Hill, the

application site generally slopes northwards towards the catchments of Afton Water and to the south of Milray Hill, the application site slopes southwards towards the Water of Deugh.

- 10.3.5 This chapter is primarily concerned with the application site and its surroundings up to 2 km from the application site boundary. However, where a hydrological connection deems it necessary, the assessment has considered locations beyond this extent as described.

Consultation

- 10.3.6 A copy of the formal scoping response received from the Scottish Ministers can be found in **Appendix 5.3 Volume IV**. Individual scoping feedback to the proposed development has been summarised in **Appendix 5.4 Volume IV** and includes details of how the scoping response has been considered within the ES. A summary of key points relating to this chapter is provided in **Table 10.1**.

Table 10.2 Summary of Consultee Responses

Comment	Consultee	How Addressed	Relevant Section in ES
Peat deposits should be identified and a detailed map of peat depths submitted. Peat should be avoided where possible. Details of the management of peat excavation must be provided.	SNH SEPA ASFB TSG	Peat depth and stability surveys have been undertaken, with the results incorporated into the Peat and Landslide Hazard Assessment. The outputs of this assessment have been taken into account during the design of the scheme. A Peat Management Plan has been developed to assist in minimising the impact on peat and to maximise the re-use of excavated peat onsite.	The peat deposits onsite are described in Section 4. The Peatslide and Hazard Risk Assessment Factual and Interpretive Reports are presented in Appendix 10.1a and 10.1b Volume IV . An Outline Peat Management Plan is presented in Appendix 10.5 Volume IV
Private water supplies should be identified and the risk posed by the development should be assessed. Mitigations should be proposed where necessary.	SEPA TSG	A data request was sent to Dumfries and Galloway Council and East Ayrshire Council which identified the location of any private water supplies and this information was incorporated in to the baseline assessment of this chapter.	Section 10.4
Groundwater abstractions within the site boundary must be addressed, and avoided where possible. Impacts upon abstractions and groundwater must be outlined and mitigated against where necessary.	SEPA	No groundwater flow and abstractions within areas which are hydraulically connected to the proposed development have been identified.	Groundwater and abstractions are described in Section 10.4.

Comment	Consultee	How Addressed	Relevant Section in ES
Wetland habitats including GWDTEs should be identified and assessed. Areas of wetland habitat should be avoided. Where avoidance is not possible details of mitigation and management should be provided.	SEPA SNH	A walkover of the application site and an NVC survey has identified several wetland habitats. The layout has been optimised to avoid sensitive habitats where possible. For all identified habitats within 250m of proposed foundations and 100m of proposed tracks, a detailed impact assessment has been undertaken and mitigation measures proposed where any impacts have been identified.	Wetland habitats have been described in Section 10.4, with further information regarding the botanical assessment of these habitats contained within Chapter 8: Non-Avian Ecology . The GWDTE assessment is contained in Appendix 10.2 Volume IV and impacts are discussed in Sections 10.5 and 10.5.
Engineering works in watercourses should be avoided. Watercourse crossings required as part of the scheme should be identified and the impacts of these assessed.	SEPA TSG	Watercourse crossings have been avoided where possible. A total of six new crossings are required as part of the proposed development. The design of these minor watercourse crossings will be undertaken at the detailed design stage in accordance with CIRIA and SEPA guidance.	The location of proposed watercourse crossings is shown in Figure 10.1 Volume III , with detail on each of the new watercourse crossings included in Appendix 10.3 Volume IV . The potential impacts of the crossings and the proposed mitigation are assessed in Sections 10.5 and 10.6
Opportunities for improvement such as the creation of buffer zones around watercourses and the removal of weirs should be considered.	SEPA	A 50m buffer was applied around all mapped watercourses during the design of the scheme. Buffer strips will be provided as part of sediment control measures. All existing culverts onsite were observed to be in good condition and in use.	Sediment and drainage control measures are detailed in Appendix 10.8 Volume IV .
Flood risk should not be increased.	SEPA TSG	Existing flood risk is considered in the baseline assessment. Mitigation measures will be implemented during construction and operation to avoid any increase in flood risk.	Existing flood risk is described in Section 10.4, potential impacts and mitigation are assessed in Sections 10.5 and 10.6

Comment	Consultee	How Addressed	Relevant Section in ES
Pollution prevention measures should be detailed.	SEPA TSG	Pollution prevention measures will be included as part of the mitigation for construction, operation and decommissioning. A detailed Construction Management Statement (CMS) will be prepared upon receiving planning application and a detailed Construction Environmental Management Plan (CEMP) will be produced at the detailed design stage in consultation with SEPA, SNH, the Dumfries and Galloway Council, East Ayrshire Council and other stakeholders.	Mitigation measures are outlined in Sections 10.5, 10.6 and 10.7. An outline CEMP has been included in Appendix 10.7 Volume IV .
Planned abstractions should be detailed at the planning stage	SEPA TSG	No water abstractions are currently proposed.	Scoped out of chapter.

Baseline determination

- 10.3.7 The baseline assessment is derived from a desk-based data collection exercise and thorough consultation with SEPA, Scottish Water, Dumfries and Galloway Council and East Ayrshire Council. Several site visits have been undertaken to determine the sensitivity of the hydrological, hydrogeological and geological receptors and to identify potential watercourse crossings.
- 10.3.8 All hydrologically, hydrogeologically or geologically sensitive receptors within and downstream of the application site (if hydraulically connected) have been mapped. These include groundwater dependent terrestrial ecosystems (GWDTE), private water supplies (PWS), Ordnance Survey (OS) mapped watercourses, fisheries and any downstream environmentally protected areas. This mapping facilitated an iterative approach to windfarm layout which has mitigated potential risk through avoidance of sensitive receptors, where possible.
- 10.3.9 Management of any GWDTEs or PWS identified on or within proximity to the application site is in line with relevant SEPA guidance (SEPA 2014) and management of surface water runoff will be undertaken in accordance with Scottish Planning Policy.
- 10.3.10 An integrated approach to hydrology, hydrogeology and ecology has been adopted to fully understand peat extents and potential GWDTEs and to determine the most appropriate strategy for development of the windfarm by minimising impact on these sensitive resources.

Prediction and evaluation of impacts

- 10.3.11 There are no relevant published guidelines or criteria for assessing and evaluating impacts on hydrology, hydrogeology or geomorphology within the context of an EIA. This assessment is based on a methodology derived from the Institute of Environmental Management and Assessment (IEMA) guidance (2004). The following steps are used to assess potential impacts of identified receptors and to determine whether identified impacts are significant or not. Tables referred to in the text are listed below in seven steps.
- 1) Determine the **value** of receptors – this takes consideration of policy importance, use, protection status, social and environmental factors on a scale of sensitivity (i.e. high, medium or low) as defined within **Table 10.3**;
 - 2) Determine the **magnitude** of impacts to receptors using the scale high, medium, low or negligible defined within **Table 10.4**;
 - 3) Evaluate the **potential impacts** - this utilises the value of identified receptors (using the criteria in **Table 10.3**) and the magnitude of potential impacts (using the criteria in **Table 10.4**). Potential impacts are considered to be major, moderate, minor or negligible (refer to **Table 10.5**). Major or moderate impacts are considered to be significant (shaded), whereas minor or negligible impacts are considered to be not significant.
 - 4) Determine the **likelihood** of impacts to identified receptors occurring using a scale of likely to unlikely as defined in **Table 10.6**. The probability of occurrence for a potential impact is related to how regularly a given event or outcome will come to pass. This can be assessed in a number of ways, including assessments based on qualitative or quantitative data, or experience from other similar sites. It should be noted that in contrast to many EIA disciplines the probability of occurrence is highly critical when analysing impacts to the water environment. This is because many potential impacts will only be realised during extreme events or incidents (i.e. storms or major spills). Therefore, likelihood is considered in isolation and it is necessary to assess the **possible or likely impacts** (see next step).
 - 5) Assess the **possible or likely impacts** by combining the **evaluation of potential impacts** with the **likelihood** of those impacts occurring using the matrix in **Table 10.7**. Likely impacts are considered to be major, moderate, minor or negligible. Impacts evaluated as being moderate or major (shaded) are defined as significant for the purpose of the EIA in line with the EIA Regulations. Those impacts assessed as minor or negligible are not considered to be significant in terms of EIA.
 - 6) If the assessment results in significant impacts (i.e. either moderate or major impacts), then additional mitigation measures are considered to try and reduce these impacts.
 - 7) Once mitigation measures are applied, the **likelihood of residual impacts** occurring is re-assessed using **Table 10.6**. The **possible or likely residual impacts** to identified receptors are then assessed using the matrix in **Table 10.7**.

Table 10.3 Receptor Value

Sensitivity	Hydrological / hydrogeological / geological description
High	<ul style="list-style-type: none"> • High environmental importance; international or national value including: <ul style="list-style-type: none"> • Ramsar Sites • Special Areas of Conservation (SAC); • Special Protection Areas (SPAs); • Sites of Special Scientific Interest (SSSIs); • Watercourses or waterbodies with 'high' or 'good' WFD overall status • Public water supplies; • Principal or highly productive aquifers with high aquifer vulnerability; • Nationally important fisheries; or • Areas with a high risk of flooding.
Medium	<ul style="list-style-type: none"> • Important in the context of the region or district e.g. watercourses or waterbodies with 'moderate' WFD overall status; • Main river within a catchment, locally important watercourses; • Private water supplies; • Locally important aquifers; • Groundwater that supports highly dependent groundwater dependent terrestrial ecosystems (GWDTEs); • Areas with a moderate risk of flooding, with existing flooding being confined to areas immediately adjacent to watercourses; • Highly productive aquifer with low to medium vulnerability or moderately productive aquifers with high vulnerability and drinking water protected areas; • Regionally important fisheries; or • Pristine or active peat bog habitat; evidence that peat body has an intact hydrological system or possibility that peat could recover to pristine status.
Low	<ul style="list-style-type: none"> • Watercourses or waterbodies with WFD 'poor' or 'bad' overall status; • Minor watercourses / waterbodies; • Low productivity / non aquifer/ low groundwater vulnerability; • Receptor not used for water supplies (public or PWS); • Private water supplies located within the vicinity of a mains water supply or private water supplies used for agricultural purposes and not for drinking water purposes; • Degraded fisheries or receptor not important for fisheries; • Low risk of flooding; • Groundwater that supports moderately dependent GWDTE; or • Degraded or inactive peat; small isolated areas of peat; soil not sensitive to change, e.g. degraded / grazed; shallow, evidence of widespread erosion. Significant active land drainage has occurred resulting in ongoing dewatering of peat.

Table 10.4 Magnitude of Impact Criteria

Receptor	Magnitude			
	High	Medium	Low	Negligible
Runoff regime	Long term irreversible change in overall volume of runoff from the whole site and changes to flow paths and rates resulting in change to flood risk and erosion potential.	Temporary change in overall volume of runoff from the whole site and changes to flow paths and rates resulting in change to flood risk and erosion potential.	Short term change in volume of runoff and changes to flow paths and rates in localised areas of the site resulting in change to flood risk and erosion potential to localised areas only.	No measureable change in site runoff regime.
Surface water quality	Measureable change in water quality status with respect to EQS (The Scottish Government, 2014) for more than one month; long term irreversible impact on aquatic ecosystems.	Measureable change in water quality status with respect to EQS for less than one month; temporary impact on aquatic ecosystems in the medium term.	Measureable change in water quality but no change with respect to EQS. No significant impact on aquatic ecosystems.	No measureable change in surface water quality.
Water Supply	Measurable change in the quality or volume of the available supply for abstraction with respect to The Water Supply Regulations (The Scottish Government, 2011); leading to change in water pressure and/or in supply volumes.	Measurable change in the quality or volume of the supply for more than 1% of samples with respect to The Water Supply Regulations; temporary visual colouration change and alteration to sediment content.	Measurable change in the quality or volume of the supply for less than 1%, but no change with respect to The Water Supply Regulations. No change in pressure or flow.	No measureable change in water supply.
Riverine flow regime	Measurable change in riverine flows resulting in a change in dilution capacity or change in flood risk for watercourses or water bodies directly monitored under the WFD.	Measurable change in riverine flows resulting in a change in dilution capacity or change in flood risk for smaller watercourses or water bodies, not directly monitored under the WFD.	Detectable change in riverine flows but no measurable change in dilution capacity or flood risk.	No measureable change in riverine flow regime.

Receptor	Magnitude			
	High	Medium	Low	Negligible
Geomorphology	Permanent change to geomorphology over the application site and the area within 2 km of the site including large changes in erosion and deposition regimes.	Permanent change in geomorphology over the application area and its surroundings up to 2 km from the site boundary including some changes in erosion and deposition regimes.	Temporary change in geomorphology over a limited area including slight changes in bed morphology, sedimentation patterns and erosion rates.	No change in geomorphology.
Groundwater flow regime	Irreversible or permanent change to the recharge, flow or discharge of groundwater. May impact upon licenced groundwater abstraction, water supply to ecosystem or groundwater base flow to a watercourse such that it impacts on WFD criteria or standards.	Measurable change to the recharge, flow or discharge of groundwater. May impact upon licenced groundwater abstraction, water supply to ecosystem or groundwater base flow to a watercourse but with no impact on WFD standards. Impacts affect large or multiple area(s).	Short term reversible changes to the recharge, flow or discharge of groundwater. Impacts are limited to small discrete areas.	No measurable change in the recharge, flow or discharge of groundwater.
Groundwater Quality	Permanent or long term (>one month) change in groundwater quality with respect to EQS (Scotland) for more than one month.	Temporary change in groundwater quality, changing site quality with respect to EQS for less than one month.	Measurable but temporary change in groundwater quality, but not changing status with respect to EQS.	No measureable change in groundwater quality.
Peat hydrology / quality / volume and extent of peat	Significant permanent alteration to peat hydrology resulting in the change of status of the peat body.	Moderate alteration to peat hydrology resulting in localised changes in the status of peat bodies. Any changes are largely temporary.	Minor alterations to peat hydrology.	No measureable change in peat hydrology.

Table 10.5 Evaluation of Potential Impact

Receptor Sensitivity	Magnitude of Impact			
	Negligible	Low	Medium	High
High	Negligible	Moderate	Major	Major
Medium	Negligible	Minor	Moderate	Major
Low	Negligible	Negligible	Minor	Moderate

Table 10.6 Definitions of Likelihood of Occurrence

Likelihood of occurrence	Definition
Likely	There is a high probability that the consequence will be realized within the lifetime of the development or duration of the activity.
Possible	A consequence may or may not arise during the lifetime of the development.
Unlikely	There is a very low probability that any consequence will ever arise within the lifetime of the development or duration of the activity.

Table 10.7 Significant Impact Matrix

Evaluation of Potential Impact (from Table 10.5)	Likelihood of Occurrence		
	Unlikely	Possible	Likely
Major	Minor	Moderate	Major
Moderate	Negligible	Minor	Moderate
Minor	Negligible	Negligible	Minor
Negligible	Negligible	Negligible	Negligible

The impacts recorded in highlighted cells are 'significant' in terms of the EIA Regulations (The Scottish Government, *Town and Country Planning Regulations, 2011*)

Impact Limitations and uncertainties

- 10.3.12 Our assessment is based on current data available at the time of reporting. This includes data sourced from several third parties.
- 10.3.13 Assessment of flood risk and drainage is based on current conditions and does not account for potential changes in climate over the life of the development. Detail design of certain aspects of the development, such as watercourse crossings and drainage design will need to take into consideration the potential for changes in conditions due to climate change.

10.4 Baseline conditions

- 10.4.1 A site visit was undertaken on 30th and 31st August 2012 in order to assess baseline conditions of the application site. Key issues/features were identified including surface water features, dominant soil types, geology and other land use characteristics likely to influence hydrological processes. Weather during the site visit was dry, sunny and warm on the first

day, and showery with intermittent light rainfall throughout the second day. Preceding weather was also wet with higher than average rainfall conditions in the month prior to the visit.

- 10.4.2 Following a change in site layout an additional survey of new watercourse crossings was undertaken in May 2014 as part of a habitat walkover survey. The weather during this walkover was dry and sunny with some cloud cover.

Climate and Topography

- 10.4.3 The average annual catchment rainfall for the area is approximately 1,868 mm based on data obtained from the Flood Estimation Handbook (FEH) CD-ROM (Wallingford HydroSolutions Ltd, 2009), indicating a wet climate having the potential to exhibit a high runoff regime.
- 10.4.4 The application site has varied, undulating topography. The highest elevation within the application site boundary is approximately 530 metres Above Ordnance Datum (m AOD) to the south west of the application site; this is the western slope of Struther's Brae which has peak of 540 m AOD located immediately east of the application site boundary. The second highest elevation for the application site is Milray Hill, which is situated to the south west of the application site, rising to approximately 526 m AOD. To the north of Milray Hill and Struther's Brae the application site generally slopes toward Afton Water. To the north west of Struther's Brae is Auchincally Hill (506 m AOD) and to the north is Meikle Hill (441 m AOD). These hills form a series of undulations separated by valleys containing watercourses that are tributaries of Afton River. To the north of Meikle Hill the application site slopes down to a minimum elevation of 230 m AOD.
- 10.4.5 To the south of Struther's Brae and Milray Hill the application site slopes toward the south to a minimum elevation of approximately 390 m AOD; the valleys to the south contain watercourses that are tributaries of the Water of Deugh.

Water Dependant Statutory Designated Sites

- 10.4.6 According to Scottish Natural Heritage mapping (SNH, 2014), there are no statutorily designated sites within the application boundary, immediately downstream of the application site or within a 2 km radius of the application site. Therefore, these receptors are not considered further within this assessment.

Hydrology

Surface water

- 10.4.7 The application site is located within the Solway Advisory Group area for river basin management. The majority of the site, north of Milray Hill, is located within the River Nith Catchment while the southern portion is located within the River Dee (Solway) Catchment.
- 10.4.8 The River Nith catchment has a total area of around 1,230 km² and extends from New Cumnock in the north through to Dumfries and Galloway in the south. It discharges on the northern shore of the Solway Firth. Landuse within the catchment varies from industrialised in the north to agricultural and urban in the mid and southern areas.
- 10.4.9 The majority of the application site, to the north of Struther's Brae and Milray Hill, drains to the Afton Water catchment. The Afton Water flows in a northerly direction to the east of the application site boundary, located approximately 20 m from the northern tip of the application site at the closest point. Afton Water serves the River Nith catchment, and the two rivers meet approximately 4 km to the north of the application site, just north of New Cumnock.
- 10.4.10 The southern part of the application site serves the Water of Deugh within the River Dee (Solway) Catchment, via a series of named and unnamed tributaries. The Water of Deugh flows westwards along the southern application site boundary before flowing to the south east. It flows into the Water of Ken and a series of lochs including Loch Ken. Loch Ken is a reservoir stretching from New Galway in the north to Castle Douglas in the south, where it flows into the River Dee.

- 10.4.11 Watercourses within the application site boundary have been divided into five main surface water catchments draining either to Afton Water or the Water of Deugh, which are described below and shown in **Figure 10.1 Volume III**.
- 10.4.12 Several burns from both within and outwith the application site flow into Afton Water. Upstream of the application site, Afton Water (upper) flows from the hills of Meikledodd, Alwhat, Alhang and Millaneoch via a series of Burns including Afton Water and Montraw Burn to the Afton Reservoir. The reservoir is a still water lake of approximately 40 hectares in area and is located approximately 1.5 km to the south east of the application site. Downstream of the reservoir, Afton Water is served by many burns from both the east and west, including the Gray, Langlee, Pollach and March Burns (from the east) and Bolt Burn and Sandy Syke (from the west, adjacent to the application site boundary of the proposed development). There are three other main catchments which flow into Afton Water. These burns are fed by many tributaries, some of which are marked on the OS mapping and others which were identified during site visits. Numerous forest drains have formed channels over time, and these drains discharge water into the tributaries which feed these burns:
- Carcow Burn - collects water from both the Glenhastel Burn and Auchincally Burn in the west of the application site and the Glenshalloch Burn in the central part of the application site. The Carcow Burn flows along the northern application site boundary and enters Afton Water 50 m north of the application site;
 - Glenshalloch Burn – collects water from the central area of the application site extending from Struther's Brae and discharging into the Carcow Burn;
 - Lochingerroch Burn – collects water from the eastern area of the application site and flows into Afton Water approximately 160 m east of the northern tip of the application site.
- 10.4.13 The Water of Deugh collects water from the southern portion of the application site from the area of the application site to the south of Struther's Brae and Milray Hill, primarily via West Strand and other tributaries to the east.

Water Quality

- 10.4.14 SEPA (*RBMP*, 2014) has classified Afton Water and the Water of Deugh which lie to the north and south of the application site respectively. Below are discussed the 2010 WFD classifications for the watercourses. The classified reach of Afton Water adjacent to the application site is a little over 15 km in length, and has been classified as having an overall status of 'poor ecological potential', an overall ecological status as 'poor' and an overall chemical status of 'pass' with 'high' for Water Quality. Afton Water has also been classified by SEPA as a drinking water protected area, with a condition of 'Pass'.
- 10.4.15 Current pressures on Afton Water include flow regulation and morphological alterations as a result of water collection, purification and distribution. Hydromorphology is classified as 'moderate' and morphological pressure is 'poor'. This has resulted in 'poor' fish passage leading to the watercourse being classified as 'poor' for fish.
- 10.4.16 The Water of Deugh runs along the southern boundary of the application site and in the upper catchment (upstream of Carsphairn Lane) is 24.4 km in length. This reach has been classified as having an overall status of 'bad ecological potential', overall ecological status of 'bad' and overall chemical status of 'pass'.
- 10.4.17 Current pressures on the Water of Deugh include abstractions, flow regulation and morphological alterations due to production of renewable electricity, impounding (weir/dams) and forestry. For this watercourse hydromorphology is classified as 'bad, with 'poor' fish passage and 'poor' for fish.
- 10.4.18 SEPA carry out river basin planning for all Scottish basin districts every six years, these plans include targets for improving water quality for each cycle in the future. The overall WFD environmental objectives for the first (2015), second (2021) and third (2027) river basin management cycles for Afton Water and the Water of Deugh are as set out in **Table 10.8**.

Table 10.8 WFD Target Objectives

Year	Status		
	2015	2021	2027
Afton Water	Good	Good	Good
Water of Deugh	Bad	Bad	Good

10.4.19 The surface water environment with respect to water quality is considered to have **High** sensitivity to impact from the Project, based on the WFD status of Afton Water. Sensitivity of the Water of Deugh to the south is lower, however an overall sensitivity of high is adopted for the purpose of this assessment.

Flood Risk

Fluvial Flood Risk

10.4.20 Indicative flood mapping provided by SEPA (*Flood map, 2014*) shows the approximate extent and location of a 1 in 200 flood (or 0.5% probability of occurrence in any one year). Mapping indicates that there are areas at risk from fluvial flooding adjacent to the Carcow Burn, Afton Water and Water of Deugh watercourses. The mapping indicates that the floodplains are confined within narrow valleys and therefore do not impact upon the application site:

- The floodplain of Carcow Burn is located along the northern application site boundary. There are no wind turbines or infrastructure located within or adjacent to the floodplain. There are no wind turbines proposed in this area of the application site, with the nearest wind turbine located 1 km south of the floodplain. The access track will not cross Carcow Burn, and the nearest road is approximately 300 m south east and elevated 60 m above the floodplain.
- The floodplains associated with Afton Water and the Water of Deugh are outside of the application site boundary.
- As such flood waters are not indicated to pose a risk to the proposed windfarm development within the application site.

Tidal Flood Risk

10.4.21 The application site is 230 m above sea level at its lowest point; therefore, this risk does not apply to the site.

Groundwater Flood Risk

10.4.22 Groundwater flooding is not considered to be a risk to the existing application site, due to the relatively impermeable nature of the confining superficial deposits layer. Shallow groundwater is likely to contribute to saturated soil conditions during extreme or prolonged rainfall conditions which would lead to overland flows.

Surface Water

10.4.23 The low permeability of some of the soils and superficial cover over the application site area will give rise to surface runoff in the event of extreme rainfall and/or saturated ground conditions from preceding rainfall events, as was evidenced during the site walkover survey. Surface runoff will also be generated from the existing semi-permeable access tracks within the application site.

10.4.24 During wet conditions, flows pass overland following topographic grades to forest drains, watercourse channels or tributaries down-slope and eventually into the receiving sub-catchment watercourses as defined in **Section 10.4.7 to 10.4.13**. Potential exists for localised surface ponding of water during these conditions, particularly in forested areas; however, flooding is likely to be shallow and only inundate some isolated areas.

Artificial Drainage Systems

- 10.4.25 There are a number of existing watercourse crossings which convey water under the existing access tracks onsite. There are also several road crossings downstream of the application site, where burns pass under the road to the east of the application site. During the site walkover these crossings were observed to be in good condition and free from debris. Should they become blocked they could cause localised flooding of watercourses.
- 10.4.26 There is a low flood risk across the application site, mainly limited to a risk during high rainfall conditions causing overland flow and minor isolated ponding in some areas.
- 10.4.27 Flood risk sensitivity of the application site is currently assessed as **Low** and further assessment of flood risk associated with the proposed development is limited to potential impact of watercourse crossings and management of surface water runoff.

Fisheries

- 10.4.28 No fisheries have been identified within the watercourses on the application site. However, some of the downstream waterbodies do have fisheries.
- 10.4.29 The northern portion of the application site falls within the River Nith catchment, which has been designated under the Freshwater Fish Directive. The Directive also includes Afton Water to the east of the application site. The River Nith Freshwater Fish catchment has an overall mandatory status of 'Pass' but an overall guideline status of 'Fail'. The River Nith District Salmon Fishery Board (NDSFB) currently undertakes fisheries management within the River Nith catchment area, where there are economically important fisheries for both salmon and sea trout. Other fish species include the Grayling, Pike, Tench, Stoneloach, Stickleback, Perch, Eel, Lamprey and Rainbow Trout.
- 10.4.30 Within the River Nith Catchment, the Afton Reservoir is located approximately 1.5 km to the southeast and upstream of the application site. It is a still water lake of approximately 40 hectares area, managed by the New Cumnock Angling Association. It is open for wild and stocked brown trout fishing all year round. Angling clubs also exist along Afton Water.
- 10.4.31 The southern portion of the application boundary falls within the River Dee (Galloway) protected area under the Freshwater Fish Directive. The Directive includes the Water of Deugh and has an overall mandatory status of 'Fail', and overall guideline status of 'Fail'. River Dee (Kirkcudbright) District Salmon Fishery Board (RD(K)SFB) undertake fisheries management within the River Dee Catchment area. The Water of Deugh, is known for wild brown trout fishing.
- 10.4.32 Fisheries are considered to have a **Medium** sensitivity to impact from the Project.

Peat and Geology

Peat

- 10.4.33 Site visits and peat probing confirmed the presence of peat on the application site. A Peatslide Hazard and Risk Assessment (PHRA) consisting of a Factual Report and an Interpretive Report is presented as **Appendix 10.1a** and **1b Volume IV** respectively. These reports provide greater detail on the surveys undertaken.
- 10.4.34 The peat profile at Pencloe comprises light brown to dark red brown amorphous, plastic to slightly fibrous peat beneath the present-day root mat. Much of the peat body at the application site has been extensively disturbed, either by afforestation or agricultural improvement and this has resulted in significant disturbance to the natural water table within the peat, the structure and integrity of the peat and the acrotelmic horizon. A network of man-made drainage channels are present across the application site, which in turn discharge to natural watercourses. These man-made ditches are thought to have dewatered the peat over time. There was no evidence onsite of active, natural subsurface drainage pipes in the peat profile during site surveys.

- 10.4.35 Prior to afforestation, areas of deeper peat (>0.5m) are likely to have supported active blanket bog. However, due to drainage of the application site over time and the subsequent dewatering of peat, only small areas of blanket bog and flush habitat still remain in open areas and woodland rides. It is also possible that some areas of shallow peat originally comprised deeper peat which supported blanket bog species. However, much of the peat habitats within the application site are now degraded and there are only isolated areas of active peatland species. The largest area of active peatland species are in an area of open moorland comprising predominantly blanket bog vegetation in the south east of the application site to the west and north of Struther's Brae. This area of habitat is in relatively good condition compared to the rest of the application site. Areas of flush habitat were noted in this area and the ground was generally saturated during field visits. This suggests an active intact hydrological regime in this area. Peat depths in this area are generally shallow (<1.0m) with some localised areas of peat greater than 1m deep.
- 10.4.36 Peat depths across the application site were estimated from the depth of penetration from some 876 peat probe locations. Peat depths are mapped in **Appendix 10.1a**. Across the main turbine envelope, peat depths range between 0 and 3.3m, with the average peat depth across the application site calculated as 0.62m. Across the majority of the northern and central areas of the application site much of the deposits are less than 0.5m in depth and comprise well decomposed peat and peaty organic soils. In the northern area of the application site which comprises grazing land, peat is virtually absent with only localised areas up to 1.2m in depth. Much of the peat across the rest of the application site is less than 1m in depth with some localised deposits greater than this. The most significant accumulations of peat were recorded in the southern and eastern areas of the FCS land where thicknesses up to 2 m were frequently recorded and were occasionally in excess of 3m. Several minor peat slide features were observed within the application site, mostly confined to the area of open moorland to the north and west of Struther's Brae in the south eastern part of the application site. Peat morphology in this area has been considerably affected by erosion, as evidenced by peat haggling and other minor peat slide features in the area.
- 10.4.37 The PHRA (**Appendix 10.1a** and **Appendix 10.1b Volume IV**) found that much of the application site has a low risk of peat slide; however, there are several localised areas with higher peat slide risk. Some 45 locations within the turbine envelope and a further three locations on the access track are considered to have moderate peat slide activity (a score 200 – 299 on the Peat Slide Hazard Rating System (PHRS)). A further one location within the turbine envelope is considered to have high (>300 on the PHRS) peat slide activity.
- 10.4.38 Due to the drainage of peat that has occurred over time across the application site and as there are only small isolated areas of active peatland habitats, peat is considered to have a **Low** sensitivity from the proposed development.

Superficial Geology

- 10.4.39 British Geological Society (BGS) mapping (BGS, 2014) shows (see **Appendix 10.1 Volume IV, Figure 2**) that areas of quaternary peat and Devensian glacial till are found across the application site. Glacial till predominantly comprises low permeability clays and silts. The till occurs infrequently and is generally located in the valleys of the numerous watercourses which drain the application site, whilst the peat is generally located on the hill slopes in the southern portion of the application site. Small localised alluvium deposits are located adjacent to the Glenshalloch Burn.

Bedrock Geology

- 10.4.40 BGS mapping shows bedrock geology to comprise several formations associated with the Ordovician Greywackes beneath the application site. The solid geology for the application site is shown in **Appendix 10.1 Volume IV, Figure 3**.

- 10.4.41 To the western edge, around Milray Hill is the Leadhills Supergroup. This formation is described by the BGS as comprising greywackes, shales, siltstones and mudstones with conglomerates. Turbidite sandstones from the predominant geology within this succession are typically well bedded on a scale of centimetres to several meters. Grading within the formation is widespread, with localised ripple cross-lamination.
- 10.4.42 The remaining area of the application site is underlain by the Kirkcolm, Blackcraig and Marchburn Formations of the Barrhill Group. The Kirkcolm formation is predominately located in the northern half of the application site; the Marchburn Formation is located in a small area to the far northern tip of the application site, whilst the Blackcraig formation is located to the south of the application site. The Kirkcolm formation is described as comprising quartzo-feldspathic greywacke and siltstone, with quartz grains forming up to 45% and with abundant detrital feldspar. The bedding thickness is reported generally between a few centimetres to 1.5m and the formation is interbedded with variable thicknesses of fine-grained wacke and laminated siltstone. The Marchburn Formation in the north of the application site is also a greywacke comprising siltstones and the occasional conglomerate formation. The southern portion of the application site is underlain by the Blackcraig Formation, which is a massive wacke and conglomerate and interfingers with the Kirkcolm Formation at the upper and lower boundary. This is described as coarse boulder conglomerate and massive, coarse grained sandstone with high concentrations of epidote, clino-pyroxene and hornblende, with quartz no greater than 33%. The boulders are generally well rounded and up to 1.5m and frequent clasts are present, predominantly comprising granite, granodiorite and felsites.
- 10.4.43 The underlying superficial and bedrock geology is considered to have Low sensitivity impact from the Project.

Groundwater

- 10.4.44 The BGS Hydrogeology map (2014) indicates that there are no significant aquifers underlying the application site. The Kirkcolm Formation beneath the north of the application site and the Blackcraig formation and Galdenoch Formation (undifferentiated) beneath the south of the application site are described by the BGS as highly indurated greywackes with limited groundwater in near surface weathered zone and secondary fractures. It is unlikely that the bedrock allows regional scale groundwater flows.
- 10.4.45 BGS mapping shows that areas of quaternary peat and Devensian glacial till are found across the application site. Glacial till predominantly comprises low permeability clays and silts. The till occurs infrequently and is generally located in the valleys of the numerous watercourses which drain the application site, whilst the peat is generally located on the hill slopes in the southern portion of the application site. Small localised alluvium deposits are located adjacent to the Glenshalloch Burn. Of these, only alluvium in part has aquiferous potential.
- 10.4.46 The application site is situated within a groundwater Drinking Water Protected Area (New Cumnock bedrock and localised sand and gravel aquifers). The Scottish Government have designated groundwater bodies used for the abstraction of water intended for human consumption providing more than 10m³/d as an average or serving more than 50 persons or those bodies intended for such future use as Drinking Water Protected Areas. However, as detailed in Section 10.4.52 there are no private water supplies within catchments on or downstream of the application site.

Groundwater Quality

- 10.4.47 Such groundwater as may exist beneath the application site is reported (SEPA RBMP, 2014) to have a 'Good' quantitative status, however, groundwater quality within the catchment has been classified as having 'Poor' qualitative status. A classification of 'Poor' means that concentrations of pollutants (priority substances and priority hazardous substances) in the water body exceed the environmental limit values specified in the Water Framework Directive Article 16 daughter Directive. However, it is unknown what dataset this relies upon.

10.4.48 SEPA's Aquifer Vulnerability Map and associated reports (SEPA, 2004 & 2006) indicates that the uppermost aquifers in the area are in Class 4a, 4b and 4c. This means that such aquifers that may exist have varying thickness of superficial deposits, which will be able to provide some attenuation capacity. However, the aquifer itself has no ability to attenuate pollution.

Groundwater dependent terrestrial ecosystems (GWDTE)

10.4.49 Several potential GWDTE have been identified within the application site. **Appendix 10.2 Volume IV** assesses whether potential GWDTE are likely to be dependent on groundwater. The methodology used to determine this uses a combination of ecological and hydrogeological assessments to determine whether potential GWDTE are groundwater dependent or not:

- 1) An ecological assessment of potentially groundwater dependent plant communities; and
- 2) A qualitative hydrogeological assessment to identify groundwater and surface water interactions.

10.4.50 The assessment considered five habitats that are potential GWDTE, of these only two are were found to be possible GWDTE, whilst the remaining three are not considered to be GWDTE. These areas are shown in Figure 1 of **Appendix 10.2 Volume IV**. Based on the outcomes of this assessment, M6 (mire) and M23a (rush-pasture) are considered to have a **Low** sensitivity to any changes in the groundwater regime from the proposed development. M15b (wet heath), MG10a (rush-pasture) and U6 (grassland) are not considered to be sensitive to any changes in the groundwater regime from the proposed development (**Table 10.9**).

Table 10.9 Sensitivity of GWDTE within the Application Site

NVC Habitat	GWDTE?	Sensitivity
M6 (mire)	Possible GWDTE	Low
M15b (wet heath)	Not GWDTE	-
M23a (rush-pasture)	Possible GWDTE	Low
MG10a (rush-pasture)	Not GWDTE	-
U6 (grassland)	Not GWDTE	-

10.4.51 Further information on the frequency and coverage of these habitats within the application site, is given in **Chapter 7: Non-Avian Ecology**.

Private Water Supplies (PWS)

10.4.52 There are no records of PWS within the application site boundary. However, there are several private water supplies registered adjacent to the application site (within 2 km of the application site boundary). Three private water supplies have been identified adjacent to tributaries draining to Afton Water from the east. Another PWS has been identified in a catchment to the north of the application site, on a tributary which drains to Connel Burn. None of these supplies fall within catchments on or downstream of the application site and, therefore, there is no hydraulic connection between these supplies and the proposed development. As such there is no likely impact to these supplies from the proposed development. PWS are therefore not considered further in this assessment. For reference, the locations of these supplies are shown in **Figure 10.1 Volume III**.

Licensed Abstractions and Discharge Consents

- 10.4.53 There are no known licensed abstractions or discharge consents from within the application site. Consultation with SEPA has confirmed there are several discharge consents within a 2 km radius of the application site boundary; however, there is no hydraulic connection between these discharge consents and the proposed development. Therefore, there is no likely impact from the proposed development and licenced abstractions and discharge consents are not considered further in this assessment.

Baseline Sensitivity Summary

- 10.4.54 The importance assigned to the various receptors discussed in the sections above is summarised below.
- 10.4.55 The overall sensitivity of **Surface Water** has been assessed to be **Medium**. This is based on the presence of local fisheries in downstream waterbodies of the River Nith and River Dee and the WFD classification of water quality in the Afton Water and Water of Deugh catchments, which are classified as having poor ecological potential and bad ecological potential respectively.
- 10.4.56 The overall sensitivity of **Groundwater** and associated receptors is considered to be **Low**. This is because there is very little groundwater flow in bedrock or localised superficial aquifers underlying the application site and only small areas of possible GWDTE have been identified within the application site boundary. In addition, no PWS reliant on groundwater have been identified in catchments within or downstream of the application site.
- 10.4.57 The overall sensitivity of the **Geology** and associated receptors is considered to be **Low**. This is primarily due to presence of generally shallow peat across the application site, with relatively few isolated, deeper areas. The peat resource has been significantly disturbed through drainage practices and afforestation and the remaining peat is predominately degraded with little evidence of intact peat hydrological systems.

10.5 Assessment of Construction Impacts

Predicted Impacts

Introduction

- 10.5.1 The design of the proposed development has taken into account sensitive hydrological, hydrogeological and geological receptors. Where possible, sensitive receptors have been avoided, thereby reducing potential impacts arising from the project. These are detailed in **Chapter 2: Site Selection, Design and Alternatives** and includes where possible, the avoidance of constructing infrastructure:
- In or near watercourses and waterbodies;
 - On or near GWDTE;
 - Within areas of deep peat; and
 - Within or downslope of areas of moderate or high peat slide risk.
- 10.5.2 During construction of the proposed development standard practice measures will be implemented. These are detailed in **Appendix 10.4 Volume IV**.
- 10.5.3 This section assesses the potential impacts of the proposed development during construction, operation and decommissioning taking into account both design features and standard practice measures. Whilst the incorporation of these measures / design features has helped to reduce the magnitude or likelihood of some potential impacts occurring, it was not possible to avoid all potential impacts. Potential impacts are also assessed prior to specific mitigation measures being applied. A summary of the potential impacts is given in **Table 10.11**.

Forestry Clearance

- 10.5.4 Much of the application site is forested and this will be clear felled prior to construction commencing. It has been determined that 299.29ha will be felled during Felling Phase 1 (2014 – 2018) which includes areas which would have been felled as part of normal forestry operations as well as additional felling as part of the windfarm construction. This is an increase of approximately 20% compared with the baseline felling proposed with no windfarm being constructed.
- 10.5.5 Felling is proposed to be done in each of the four sub-catchments within the application site boundary. Several areas of felling are in close proximity to watercourses, particularly in the Water of Deugh and Glenshalloch Burn catchments. In the Water of Deugh catchment, felling will occur directly to the north of the Water of Deugh and surrounding the tributaries of West Strand and the un-named tributaries to the south of the proposed turbines T15 and T19.
- 10.5.6 Once turbines have been constructed, all of the felled area will be re-planted with woodland fringe broadleaf species, leaving an 80 m keyhole around each turbine, as shown in **Figure 8.5.1 Volume III** and further detail is given in the Habitat Management Plan (**Appendix 8.5 Volume IV**). The re-planted species will be less densely planted than the planting evidenced prior to felling.
- 10.5.7 Felling has the potential to have the following impacts on hydrological, hydrogeological and geological receptors:
- Changes to surface water runoff patterns and rates causing an increase in flooding (this is further explained below);
 - Disturbance and degradation of soils including peat;
 - A local decline in downstream water quality in the medium term caused by:
 - The generation of turbid and nutrient rich runoff from areas of exposed soil during or after felling due to increases in soil erosion;
 - Spillages and leakages of oil, fuel and other potentially polluting substances; and
 - The removal of riparian vegetation and shading of streams.
- 10.5.8 Clear felling of areas of forestry will result in short term changes to the surface water runoff regime in the catchments within and downstream of the application site boundary. The removal of trees will reduce rainfall interception and evapotranspiration rates, potentially leading to an increase in the volume and rate of runoff and consequently higher peak flows within surface watercourses within catchments on the application site and downstream of the application site boundary. Clear felling operations could also compact soils, reducing infiltration rates, thereby also increasing runoff rates. This has the potential to slightly increase flood risk. However, these changes are likely to be relatively short term, as once construction of each turbine has been completed, planting of the surrounding area will be carried out. As the catchment becomes replanted, the increased number of trees will increase interception and evapotranspiration rates, reducing the volume and rate of runoff from the catchment. As felling will occur in all sub-catchments within the application site boundary, there is potential for these impacts in all the areas of the sub-catchments downstream of felling operations.
- 10.5.9 Research into changes of runoff due to tree felling within forestry plantations does not currently provide sufficient information to accurately predict increases in downstream flows. There is general consensus within hydrological literature that the presence of forestry plantations has little effect on flooding resulting from extreme events such as the 10% AEP (annual exceedence probability) or (1 in 10 year event). During such an event, the interception capacity of the forest canopy will have become exhausted (Maitland PS et al, 1990) (McColloch & Robinson, 1993), therefore, the presence of forestry would not have a large influence on surface water runoff or flood risk. However, in smaller events, where the interception capacity is not exhausted, the presence of forestry is more likely to reduce the magnitude of flood events. Therefore, the removal of forestry is more likely to influence runoff

rates and volumes and consequently downstream flooding during small magnitude flood events.

- 10.5.10 There will be no anticipated change to runoff from the application site for a 0.5% AEP event and therefore there will be no change to indicative flood mapping as a result of felling activities.

Access Tracks

- 10.5.11 The proposed scheme includes an estimated 17.3 km of permanent access tracks, 4.4 km of which will be upgrade to the existing forestry tracks, which have been utilised where possible. With the exception of watercourse crossings, new sections of access tracks have been located a minimum distance of 50 m from the main watercourses on the application site. The construction of watercourse crossings will be within this buffer and the potential impacts associated with the construction of watercourse crossings are outlined within Paragraphs 10.5.16 to 10.5.18.
- 10.5.12 Tracks will be constructed in the following catchments that are hydraulically connected to the proposed development:
- Glenshalloch Burn catchment;
 - Carcow Burn catchment;
 - Afton River catchment;
 - Lochingerroch Burn catchment; and
 - Water of Deugh catchment.
- 10.5.13 Upgraded tracks will predominantly be constructed using cut tracks, where soil (including turves), peat and other sub-soils will be excavated down to the underlying sub-strata. The excavated track is then backfilled with approximately 0.75 m depth of compacted stone and stripped turves and excavated peat or top-soil/sub-soil is used appropriately to dress and landscape the side slopes and verges. Small sections of track (a total of 1.3 km) will be constructed as rock fill tracks in areas where peat is deeper (generally >1.0m depth) and where there are steep slopes perpendicular to the track. This track construction type is generally similar to that of the 'cut' road design but includes greater depths of track construction and excavation. Drainage will be provided in the form of swales. Surplus peat will be placed and dressed along the low-side of the track to blend in with surrounding landscape, and obscure the sight-line of the road where possible.
- 10.5.14 The majority of the track (75 out of 78 survey positions) is located in areas of low peat slide risk (see **Appendix 10.1b Volume IV**). A further three survey positions in the north of the application site at the northern end of the track route close to Pencloe Farm are considered to have moderate peat slide activity due to moderately severe slope angles, peat thickness, degree of saturation and proximity to existing erosional features.
- 10.5.15 The construction of access tracks and their continued use during construction could have the following potential impacts on hydrological, hydrogeological and geological receptors:
- A decline in downstream surface water quality and associated receptors such as fisheries due to turbid runoff from construction earthworks and vehicular activity. The Water of Deugh catchment, including the sub-catchment of West Strand, the Lochingerroch Burn catchment, the Glenshalloch Burn catchment and the Carcow Burn catchment are likely to be impacted most by the construction of the access tracks. Any potential effects to surface watercourses are expected to be localised and short term only.

- In the event of a peat slide, there may also be potential for a decline in local surface water quality in watercourses / waterbodies downstream of the occurrence due to peat material being transported downstream. The risk of peat slide is low across much of the proposed track route; however, there are several sections which cross areas of moderate peat slide risk. There is therefore an increased risk of impacts to watercourses / waterbodies down gradient from these areas.
- Changes to surface water runoff patterns and rates. The potential reduction in the rates of infiltration due to compaction of the new track surface, therefore increasing the rates of runoff; additionally the access tracks may create preferential pathways for surface water to follow. Both of these impacts have potential to cause an increase in flooding down gradient of the tracks.
- Direct loss of up to 0.18 ha of M6 habitat due to the construction of tracks which cross mosaics which include M6 in three locations near T10 and T15 and within the polygon marked at the hill top near Saddle Hags.
- Changes to groundwater flow patterns and reduction in groundwater recharge which may have indirect impacts on an area of M23 habitat located in the valley of the Glenshalloch Burn. This area of habitat is 0.83 ha and is thought to be a possible GWDTE. The track north east of turbine T14 bisects the area of alluvium that may contribute groundwater to this area of M23 and could impact the volume of interflow or shallow groundwater feeding this habitat by interruption of the existing flow regime, and pose a risk of indirect habitat loss.
- There is a low potential for peat slide risk from the construction of tracks - which could cause degradation to peat habitats, changes to peat hydrology and a decline in downstream surface water quality due to the generation of peat fines in surface water runoff.
- Disruption and degradation of soils including peat. The Outline PMP (**Appendix 10.5 Volume IV**) estimates that 28,667 m³ of peat will be excavated during the construction of new cut tracks and 6054m³ for the construction of rock fill tracks. In addition there will also be some peaty or mineral soil that will be disturbed during construction. All of the peat excavated during the construction of new cut and rockfill tracks will be able to be re-used on track verges to a width of approximately 5 m and an average depth of 0.4 m. Peat excavated from other infrastructure will also be re-used around the tracks.

Watercourse Crossings

- 10.5.16 There are six watercourse crossings proposed as part of the proposed development, two of which are new and four of which are upgrades as shown in **Figure 10.1 Volume III**. Further details including photographs of crossing locations and stream dimensions are given in **Appendix 10.3 Volume IV**. Watercourse crossings are located in the following catchments:
- Water of Deugh;
 - Glenshalloch Burn; and
 - Carcow Burn.
- 10.5.17 All of the watercourse crossings on application site are minor crossings (i.e. narrow watercourse, relatively flat gradients, low velocity flows), which will be crossed via culverts. Crossings will be constructed as pre-cast circular or semi-circular piped culverts, with the size based on calculation of peak flow from the upstream catchment. The actual design of culverts will be done at the detailed design stage, in accordance with SEPA and CIRIA good practice guidance. Prior to construction the designs will be agreed with SEPA. Culverts will be sized to pass the 0.5% AEP flow, including an allowance for climate change on future rainfall intensities. Overland flow routing in the event of a blockage will also be considered in the design, with flow to be directed back into the watercourse downstream of any obstruction. Culverts will be embedded so that the base is at grade with the streambed or lower to maintain bed form processes and minimise disruption to wildlife migration. The need for

ledges to enable the movement of mammals through the pipe will be assessed at the design stage and incorporated as necessary.

- 10.5.18 During the construction of watercourse crossings, the potential impacts are limited to a temporary decline in local water quality due to:
- The generation of turbid runoff from plant movement near the works;
 - Spillages or leaks of other contaminants such as fuels or oils which could enter watercourses; and
 - Disturbance of stream banks and / or substrate which could lead to increased erosion rates and local changes to fluvial geomorphology.
- 10.5.19 The temporary decline in surface water quality is expected to occur in the immediate vicinity of watercourses only, with no impacts on downstream fisheries expected due to the distance between construction activities and downstream fisheries.
- 10.5.20 There is also potential for watercourse crossings to become blocked or constricted which may cause water to back up upstream of crossings, causing an increase in flood risk.

Wind Turbine Foundations and Crane Hardstandings

- 10.5.21 The proposed development includes the construction of 21 turbines and associated hardstanding areas. The concrete turbine foundations will measure approximately 20 m by 20 m (area of 400 m²). These will be approximately 3.5 m in depth; however, this will be dictated by the depth of peat or soils overlying bedrock at each proposed turbine site. Excavations will be formed with sides 'battered' back to ensure that they remain stable during construction.
- 10.5.22 The crane hardstanding areas are 800 m² apiece and will be excavated and backfilled with stone to a suitable depth. Two additional 'tail crane' hardstandings of 36 m² area may also be required.
- 10.5.23 Potential impacts to hydrological, hydrogeological and geological receptors during the construction of turbines and crane hardstanding include (further details are given below where necessary):
- Possible reduction in short term local groundwater recharge and / or changes to groundwater flow patterns if dewatering is required.
 - Indirect loss of several small areas of M6 habitat due to possible changes in local groundwater recharge in the areas of turbines T5 and T10. This could impact a total of 0.038 ha of M6 habitat.
 - Adverse water quality effects on groundwater and/or down gradient surface watercourses due to potential spillages of concrete during turbine foundation construction which could migrate into these receptors.
 - A temporary decline in water quality in down gradient surface watercourses due to the generation of turbid runoff from construction earthworks, excavations and vehicular activity.
 - Changes to surface water runoff patterns and rates from the introduction of hardstanding foundations and earthwork excavations.
 - Degradation of soil and peat during excavation of the turbine bases and crane hardstandings. The Outline PMP (**Appendix 10.5 Volume IV**) estimates that approximately 3,314 m³ and 14,624 m³ of peat will be excavated at the turbine foundations and crane hardstanding areas respectively. In addition there will also be some peaty or mineral soil that will be disturbed during construction of this infrastructure. All of the peat excavated from the turbine foundations will be able to be re-used at each location. The majority of the foundation will be reinstated, apart from the central pedestal which the turbine will sit on. Surplus peat from the excavation of other nearby infrastructure will also be re-used to reinstate the turbine foundations. Some of the

material excavated from the crane hardstanding areas will be re-used around these areas to an average length of 200 m with a width of 5 m and an average height of 1 m. The majority of the remaining peat will be re-used to reinstate other infrastructure.

- In the event of a peat slide, there may also be potential for a decline in local surface water quality in watercourses / waterbodies downstream of the occurrence due to peat material being transported downstream and an increase in dissolved organic carbon. The risk of peat slide is low across much of the application site, apart from turbine T6 which is in an area of moderate peat slide risk. There is therefore an increased risk of impacts downstream of turbine T6 in the Glenshalloch Burn and its upper tributaries.

- 10.5.24 If groundwater is encountered during excavations for turbine foundations, then the excavations will be dewatered to ensure that wet working and direct contact of cement material with the groundwater does not occur. This will mean that there is potential for loss of recharge and interruption of existing groundwater regimes in the immediate locality. Any water will be pumped out from the excavation areas and passed to a settling lagoon to allow suspended sediment to settle. Treated water will be discharged to an area of vegetated ground designated for drainage, allowing seepage into ground. There will be no discernible overall loss of recharge to groundwater. There will be no direct discharge of pumped groundwater to adjacent watercourses or drainage channels.
- 10.5.25 There is potential for spillages of concrete to migrate to groundwater and/or surface water receptors. Concrete is highly alkaline and corrosive, but is only mobile for a short period of time before it sets. Therefore the potential for migration into water receptors would only occur for a short duration until it begins to set. The migration of concrete is more likely to occur in highly fractured and fast flowing groundwater environments. Within this application site, there is limited potential for groundwater storage or transport in any of the local low productivity aquifers below the application site, and it is therefore not considered that significant migration of concrete in groundwater would occur in the event of a spillage. However, this will be confirmed by an intrusive ground investigation prior to works commencing. Any water will be pumped out and passed to a settling lagoon to allow suspended sediment to settle. Treated water will be passed either to a nearby drainage channel, or will be discharged through an area of vegetated ground designated for drainage and landscaped accordingly, allowing seepage into the ground. There will be no direct discharge of pumped groundwater to adjacent watercourses. The chosen method will be included within the CEMP and will be agreed with SEPA prior to construction activities.
- 10.5.26 It is recognised that not all turbines are situated on topographical high points and some turbine locations will be subject to ephemeral surface runoff pathways which will convey rainfall runoff during extreme events. As part of the standard practice measures (detailed in **Appendix 10.4 Volume IV**), a Sediment and Drainage Management Plan (SDMP) will be developed to manage flows across the application site, including at each turbine location, during construction. This plan will take into account the potential for inflow from up gradient areas as well as managing runoff from the turbine location.

Electric Cables

- 10.5.27 Electric cables for the proposed development will be installed within small trenches (approximately 0.6 m wide and 1.2 m deep) that will run alongside the access tracks. The majority of the cable route will be located on shallow mineral soils or shallow peat.
- 10.5.28 There is potential for trenches to transport turbid water from works areas to drainage channels and surface watercourses down gradient. The cables will be laid directly into the trench and a sand surround applied over the cables. Excavated material will then be replaced as quickly as possible to reduce the period of time that trenches are open. While the trenches are open, impermeable barriers (made of clay or other impermeable material) will be placed at intervals along the open length of the trench.

Control Building and Substation Compound

- 10.5.29 The proposed location of the substation compound is in the south of the application site, in the Water of Deugh Catchment and will include the single storey Control Building measuring 23 m x 10 m and an external switchgear area (9 m x 9 m). The compound will measure approximately 100 m x 50 m and will contain car parking facilities and a storage yard. The compound is proposed to be located on shallow peat soils between 0.6 and 2.5 m deep on an area that slopes down to tributaries of the Water of Deugh about 200 m to the south. The compound is to be located completely within an area with a low risk of fluvial inundation (as indicated by SEPA's flood maps (SEPA *Flood Map*, 2014)).
- 10.5.30 There is potential for adverse water quality impacts to the Water of Deugh from the generation of turbid runoff, the mobilisation of peat fines and any spillages of concrete or other contaminants such as fuel or oils.
- 10.5.31 Approximately 7,356 m³ of peat will be required to be excavated to form the foundations of the compound. A portion of this will be re-used around the Control Building, it will be placed in a strip around the compound, approximately 200 m in length, to an average width of 10 m and height of 0.8 m. Surplus peat from this area may be able to be re-used in reinstatement of other nearby infrastructure.

Temporary Construction Compounds

- 10.5.32 Two construction compounds are proposed as shown in **Figure 10.1 Volume III**. The Northern Temporary Construction Compound, located close to the site entrance, is located within the Lochgerroch Burn catchment approximately 300 m to the west and up gradient of the watercourse. There are shallow peat soils (less than 0.5 m depth) in this area. The Southern Temporary Construction Compound, in the vicinity of Struthers Brae, is located in the Water of Deugh catchment approximately 80 m north east of an un-named tributary to the Water of Deugh. The ground is gently sloping and there are shallow peat soils less than 0.5 m deep.
- 10.5.33 Construction of the temporary compounds will require the stripping of peat/topsoil, laying down a geotextile material and then placement of a working surface of stone. The stripped material will be stored adjacent to the compound for subsequent use in reinstatement and screening. Due to the shallow nature of soils / peat in these locations and minimal need for excavation there will not be a large volume of material generated in these locations.
- 10.5.34 The compounds will store oil, fuel and other chemical substances and will also house welfare facilities for construction workers including portacabin toilets. Any foul wastewater from the compounds would be sealed within the portacabin toilets and be removed to be disposed off-site.
- 10.5.35 Potential impacts associated with hydrological, hydrogeological and geological receptors include:
- A temporary decline in water quality in down gradient surface watercourses due to the generation of turbid runoff, possible spillages or leakages of oils, fuels and other potentially polluting substances and leakages of wastewater from the welfare facilities within the compounds; and
 - Changes to surface water runoff patterns and rates.

Borrow Pits

- 10.5.36 Four borrow pits are proposed to be created to extract aggregate for use during the construction phase of the windfarm. Detailed information on the proposed borrow pits is found in the Borrow Pit Assessment (**Appendix 10.6 Volume IV**) and a summary is given below. Approximately 82,790 m³ of aggregate is required for upgraded or new access tracks and other windfarm infrastructure. Aggregate is will be extracted by easy to hard ripping techniques or possibly by blasting. Indicative dimensions and extraction volumes are detailed in **Table 10.10**.

Table 10.10 Indicative Borrow Pit Dimensions and Extraction Volumes

Pit ID	Approx footprint dimension (m)	Approx footprint area (m ²)	Max Depth of pit (m)	Approx volume (m ³)
BP1	40 x 75	3,000	15	25,590
BP2	40 x 80	3,200	7	11,900
BP3	40 x 80	3,200	15	27,300
BP4	60 x 60	3,600	10	18,000
Total Estimated volume (m³)				82,790

10.5.37 As shown in **Figure 10.1 Volume III**, the borrow pits are proposed to be located in the following catchments:

- Glenshalloch Burn catchment:
 - Borrow Pit 1 - located to the north of Meikle Hill at approximately 350 m AOD. This borrow pit is up gradient from an un-named tributary of the Carcow Burn, which is located approximately 70 m to the north.
 - Borrow Pit 2 – located on the western slope of Meikle Hill at approximately 380 m AOD. The Glenshalloch Burn is down gradient and approximately 120 m west of the borrow pit.
- Glenhastel Burn catchment:
 - Borrow Pit 3 – located on the western slopes of Achincally Hill at approximately 300 m AOD, Glenhastel Burn is down gradient and 230 m south west of the Glenhastel Burn.
- Lochingerroch Burn catchment:
 - Borrow Pit 4 – located to the north of Meikle Hill at approximately 370 m AOD. The borrow pit is up gradient of the Lochingerroch Burn which is located 300 m to the east.

10.5.38 Several factors have been considered when selecting borrow pit locations including the suitability and potential volume of aggregate at each location, geology, the potential thickness of overburden material that would need to be excavated, groundwater conditions, proximity to surface watercourses, visual impacts and proximity to proposed infrastructure. The selected four borrow pits are all at existing old borrow pits which have been abandoned adjacent to forestry tracks. They will all be located on the Kirkcolm formation which comprises interbedded sandstones and siltstones; however, at the proposed locations there appear to be a general lack of fine grained material. This would result in lower amounts of waste material being generated at the locations, if verified through further ground investigation. The borrow pits are generally on slopes with angles between 9° and 16°, which could be excavated within a single layer of excavation. The overburden depths at these sites are generally shallow and predominantly less than or equal to 0.5 m, therefore, there will be limited overburden material to be removed.

10.5.39 The construction and use of borrow pits have the potential to have the following impacts on hydrological, hydrogeological and geological receptors:

- A temporary decline in water quality of down gradient watercourses including the Glenshalloch, Glenhastel and Lochingerroch Burns (ultimately leading to the Afton Water and Water of Deugh) due to the generation of turbid runoff and potential spillages of oil, fuel and other potentially polluting substances;

- A decline in groundwater quality due to potential spillages of oil, fuel and other potentially polluting substances migrating to groundwater;
- Changes in the local groundwater recharge volumes and / or changes to groundwater flow patterns if dewatering is required. Any impacts are expected to be localised only and as groundwater flow within the low productivity aquifers beneath the application site is likely to be low, it is unlikely that significant quantities of groundwater would be encountered and any drawdown would be minimal.
- Disruption and disturbance of shallow soils and peat. This is expected to be minimal due to the shallow nature of soils and peat in borrow pit locations. There is no peat present at borrow pits 1, 2 and 4. At Borrow Pit 3, 1,598 m³ of peat will be excavated. All of this peat will be re-used for reinstatement at this borrow pit. Surplus peat excavated from other nearby areas will also be re-used at Borrow Pit 3 to a maximum depth of 1.8m. Peat will not be re-used at the other borrow pits, as there is no existing peat habitat at these locations.

10.5.40 Borrow Pit 2 is approximately 100 m up gradient from an area of M23 habitat. As this area is not sitting upon alluvium deposits and it is also likely to be beyond the furthest extent of any significant contribution to any groundwater within the alluvium deposits, no impacts from the borrow pit are considered likely to this area of M23.

Anemometry Masts

- 10.5.41 Three permanent anemometry masts are proposed to be installed – one to the north of Turbine T1 on a small hill named Meikle Hill; the second to the north of Turbine T12 on Auchincally Hill; and a third to the north of Turbine T17 on Milray Hill. The masts will be located on areas with 0.5 – 1.0 m of peat, 1.0 – 1.5 m of peat and less than 0.5 m of peat soil respectively.
- 10.5.42 The masts will require a concrete foundation, measuring approximately 6 m x 6 m and approximately 2.5 m deep and a crane hardstanding measuring approximately 20 m x 20 m. Material will be excavated for both the mast foundation and the adjacent hardstanding area and the depth of excavation will be dependent upon the competency of the underlying strata.
- 10.5.43 A total of 748 m³ of peat will be excavated at anemometry masts 1 and 3, with a large proportion of the material to be re-used at these locations to a length of approximately 100 m, with an average width of 5 m and height of 1 m. There will be a small surplus of peat at these locations which will be reused at nearby infrastructure.
- 10.5.44 Due to the minimal footprint of the mast and associated hardstanding area, significant impacts to downstream surface water and groundwater receptors and peat resources are not expected.

Summary of Potential Impacts - Construction

- 10.5.45 Potential impacts prior to mitigation during construction are summarised in **Table 10.11**; an indication of whether additional mitigation is required or not is also included.

Table 10.11 Summary of potential impacts - Construction

Activity	Potential impact	Receptor	Sensitivity of receptor	Magnitude of potential impact	Evaluation of potential impact	Likelihood of occurrence	Likely potential impact	Site specific mitigation required?	
Tree felling	Changes to surface water runoff patterns causing increase in flooding	Surface water	High	Low	Moderate	Possible	Minor	✘	
	Temporary decline in downstream water quality due to turbid and nutrient rich runoff due to increase soil erosion, spillages and leakages of oil, fuel and other potentially polluting substances and the removal of riparian vegetation.	Surface water	High	High	Major	Likely	Major	✔	
Construction of site infrastructure	Generation of turbid runoff which could cause a temporary decrease in water quality in down-gradient watercourses, water bodies and associated receptors	Surface water	High	High	Major	Likely	Major	✔	
	Disruption and degradation of soils including peat	Geology	Low	Medium	Minor	Likely	Minor	✘	
	Changes to surface water runoff and groundwater flow patterns and / or regimes	Surface water	High	Low	Moderate	Possible	Minor	✘	
		Groundwater	Low	Low	Negligible	Possible	Negligible	✘	
Construction of access tracks and turbine foundations	Change in groundwater flow regimes due to access track foundations which may reduce recharge to possible GWDTE	M6	Groundwater	Low	Medium to Low	Minor to Negligible	Likely	Minor to Negligible	✘
		M23	Groundwater	Low	Low	Negligible	Possible	Negligible	✘
	Decrease in water quality of watercourses / waterbodies located down gradient of a peat slide occurrence.	Surface water	High	Medium	Major	Unlikely	Minor	✘	

Activity	Potential impact	Receptor	Sensitivity of receptor	Magnitude of potential impact	Evaluation of potential impact	Likelihood of occurrence	Likely potential impact	Site specific mitigation required?
Construction of watercourse crossings	Disturbance of stream banks and / or substrate which could lead to increased erosion rates and local changes to fluvial geomorphology	Surface water	High	Low	Moderate	Possible	Minor	✘
	Blockage or constriction of watercourses causing an increase in flood risk		High	Low	Moderate	Unlikely	Negligible	✘
Construction of hardstanding areas such as tracks, compounds, turbine foundations and buildings	Increase in runoff rates to downstream watercourses causing an increase in flood risk downstream	Surface water	High	Low	Moderate	Possible	Minor	✘
Vehicular and plant movement onsite; storage and use of oils and chemicals; maintenance of plant	Spillage or leakage of fuels, oils or other potentially polluting substances which could migrate to groundwater and / or surface watercourses affecting water quality	Surface water	High	Medium	Major	Possible	Moderate	✓
		Groundwater	Low	Medium	Minor	Possible	Negligible	✘
Concrete construction of foundations and other hardstanding	Spillages of concrete during turbine foundation construction which could migrate to groundwater and / or surface watercourses affecting water quality	Surface water	High	Medium	Major	Possible	Moderate	✓
		Groundwater	Low	Medium	Minor	Possible	Negligible	✘

Mitigation

Standard practice measures – construction

10.5.46 Standard practice measures will be implemented during construction across the application site. Some of the key standard practice guidelines are referred to in **Section 10.2.1**. These have been taken into account when assessing the potential impact and the likelihood of significant environmental impacts. These standard practice measures are detailed in **Appendix 10.4 Volume IV**.

Site-specific mitigation measures – construction

10.5.47 The following details specific mitigation measures which will be implemented in addition to the standard practice measures outlined in **Appendix 10.4 Volume IV**.

Sediment and drainage control

10.5.48 Sediment and drainage control measures will be implemented during all construction activities that are likely to generate sediment laden water including:

- Tree-felling;
- Borrow pit construction and use; and
- Earthworks associated with the construction of tracks, turbine foundations, watercourse crossings and compounds.

10.5.49 Routine working and emergency procedures for the control of sediment and dust will incorporate the advice within the SEPA's PPG Notes, the CIRIA guidance and the DEFRA Guidelines for Handling Soils (MAFF, 2000). Standard practice measures (**Appendix 10.4 Volume IV**) including development and implementation of a sediment and drainage management plan (SDMP) and a CEMP (outline included in **Appendix 10.7 Volume IV**) will help to ensure that the water environment is protected from sediment laden runoff.

10.5.50 In addition to these standard practice measures, specific sediment and drainage control measures to be applied in key construction areas / activities (described in **Appendix 10.8 Volume IV**). The philosophy for sediment and drainage control will be to separate and treat sediment laden water to prevent contaminated runoff from entering down gradient surface watercourses.

10.5.51 In particular:

- There will be a permit to pump and a permit to dig system put into operation;
- There will be no direct discharges of water from works areas to existing drainage channels or surface watercourses within or downstream of the application site;
- Drainage from larger works areas such as the construction of turbine foundations, borrow pits and construction compounds will be directed to settlement lagoons;
- Drainage from other areas will be discharged to infiltration trenches, settlement swales or to ground for filtration through vegetation;
- Detailed drainage design will ensure that overland flows paths are routed around compounds and buildings. Further details on the control of runoff in these areas will be included in the CEMP (**Appendix 10.7 Volume IV**); and
- During excavation and storage of any excavated material, measures set out in the PMP will be adhered to.

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- 10.5.52 During felling operations, an Ecological Clerk of Works (ECoW) will be employed, unless where this is done as part of the normal forestry operations. Forestry pre-development tree clearance operations will be undertaken by the Forestry Commission Scotland (FCS) in accordance with the Forestry Commission's Forests and Climate Change Guidelines (2011) and the UK Forestry Standard (2011).
- 10.5.53 Under these measures it is envisaged that sediment erosion and entrainment in runoff can be controlled at least to a level comparable with existing rates of erosion occurring beneath the forest canopy. Potential for turbid runoff to enter watercourses as a result of pre-development tree clearance will be localised and short term only.
- 10.5.54 Operational procedures for forestry harvesting are closely controlled. In order to meet with the requirements of the UK Woodland Assurance Standard (UKWAS) and statutory environmental and health and safety legislation, all FCS harvesting operations will be carried out according to FCS best practice procedures laid out in various publications. Specific measures will incorporate consideration of the following:
- Pre-development tree clearance and extraction will be planned to minimise the number of stream and drain crossings required. Where a watercourse crossing is unavoidable, temporary log bridges or pipe crossings will be installed to protect the watercourse and minimise the release of sediments;
 - Timber will be stacked in drier areas and outside appropriate buffer zones from surface watercourses;
 - Long straight fall-line extraction routes will not be used on any steep slopes to prevent the creation of preferential flow paths for sediment laden runoff;
 - The use of tracked vehicles on forestry tracks will be avoided to prevent damage and erosion of the track surfaces;
 - Where pre-development tree clearance on soft soils or peat deposits is required, an adequate supporting brash mat will be provided and maintained to protect the underlying ground from vehicle movements;
 - Local watercourses will be inspected regularly for evidence of discoloration or sediment deposition originating from harvesting sites. Any pollution sources will be traced and appropriate remedial measures put in place to prevent further pollution;
 - Brash will be stored away from watercourses to prevent organic pollution; and
 - The location of any underground water pipes will be identified and protected from pre-development tree clearance operations.
- 10.5.55 To enable potential surface water pathways to downstream watercourses to be identified, a survey of major drainage channels and unmapped watercourses will be undertaken for all areas within 250 m of any proposed infrastructure, prior to construction commencing. This will be particularly important for drainage channels / watercourses which are hydraulically connected to mapped watercourses within the main sub-catchments within the application site will be identified. This will enable measures to be implemented around identified at risk areas.
- 10.5.56 The effectiveness of sediment and drainage control measures will be monitored through water quality monitoring of watercourses at key locations downstream of activities identified as likely to generate sediment laden runoff. This is described in more detail in paragraphs 10.5.70 to 10.5.71. The monitoring will allow the identification of any pollution incidences to occur, which will highlight whether any additional mitigation measures are required at certain locations.

Measures to prevent pollution from concrete

- 10.5.57 The concrete will most likely be batched onsite within one of the construction compounds. It is not known at this stage which construction compound the concrete will be batched within; however, all construction compounds are at least 50 m from the nearest watercourse. The Southern Construction Compound is the closest compound to a watercourse; it is 80 m north east of an un-named tributary to the Water of Deugh. Concrete batching will occur on an impermeable surface within the construction compound. Any drainage or water used for washing associated with concrete batching will be collected and directed to a sump for treatment prior to discharge. Any discharge will be in accordance with SEPA discharge licensing conditions.
- 10.5.58 Temporary bunds will be placed downslope of pouring operations to contain spillages and an Incident and Emergency Response Plan (detailed in the CEMP) will be developed for use by contractors and implemented in the event of a concrete spill.
- 10.5.59 Prior to pouring of concrete foundations, the degree of weathering or fracturing of bedrock will be assessed. It may be necessary to form a barrier within the excavation to ensure liquid concrete does not come into contact with underlying groundwater. Either a geotextile liner or a sand layer would restrict the flow of concrete into the surrounding groundwater.

Measures to prevent pollution from fuels, oils and other chemical substances

- 10.5.60 To reduce the likelihood of spills or leakages of oils, fuels or other potentially polluting substances that could cause significant impacts to down gradient watercourses and / or groundwater the following measures will be undertaken:
- Oil, fuel and other substances will be stored in a storage area within the construction compounds or other designated areas away from the main operational areas over 50 m from OS mapped watercourses. Potentially polluting substances will be stored within impervious storage bunds with 110% capacity, to ensure complete spill / leak retention. Further temporary bunds will be placed around the borrow pit areas to contain any spillages or contaminated surface water runoff.
 - Construction machinery will be routinely checked to ensure they are in good working order. Any maintenance required would occur over hardstanding areas within the construction compound or on an alternative designated impermeable ground cover.
 - Refuelling of machinery will be limited to a designated area which would also have an impermeable ground cover.
 - Drip trays will be mandatory beneath all stationary construction vehicles and spill kits comprising absorbent mats or absorbent sands will be available onsite at all times. All relevant staff will be trained in their appropriate use. Any spills will be cleaned up as soon as possible with any contaminated sands bagged up and disposed of correctly.
 - An Incident and Emergency Response Plan will be developed for use by contractors as part of the CEMP.
- 10.5.61 It will be particularly important to implement these measures effectively around construction activities where there is a direct pathway to groundwater and / or surface water and associated receptors, such as borrow pits or wind turbine excavations.

Measures to reduce the likelihood of peat slide risk and impact to downstream surface water quality

- 10.5.62 To reduce the likelihood of a peat slide occurring, the following measures will be implemented (as outlined in the Peatslide Hazard and Risk Assessment Interpretive Report (**Appendix 10.1b Volume IV**)):
- Micrositing of turbine T6, approximately 50m to the north west;

- Should turbine T6 remain in its current position, further detailed qualitative slope stability risk assessment prior to construction and further ground investigation may be necessary to determine the risk of instability affecting it. Adherence to strict engineering controls will be followed before construction is permitted to proceed.
- Where possible, the access track will be micro-sited to areas of lower risk. Any proposed track routes remaining within moderate risk zones may require further geotechnical assessment and adherence to strict engineering controls during construction.
- As far as possible, tracks follow routes parallel to slopes and avoid steep sidelong ground. Track routes will be approved by a geotechnical engineer before construction commences.
- Special drainage measures along the track route may be necessary during construction as advised by the geotechnical engineer.

10.5.63 It is recommended that additional peat depth probing is carried out along the proposed access track routes within the turbine envelope once track design details have been finalised. This will enable peat depths and peat slide risk to be re-evaluated in key sections.

Measures to reduce flood risk and impact to fluvial geomorphology

- 10.5.64 Although not assessed as a significant risk in terms of EIA the following sets out measures that will be followed when constructing watercourse crossings. All culverts will be designed and constructed in accordance with SEPA and CIRIA good practice guidance and the designs agreed with SEPA prior to construction. This will include:
- The conveyance of a 0.5% AEP flow (1 in 200 year flood event) through / under crossings, and including of an allowance for climate change on future rainfall intensities;
 - Considerations of overland flow routing so that in the event of a blockage, flow is able to be directed back into the watercourse downstream of any obstruction; and
 - Culverts will be embedded so that the base is at grade with the streambed or lower to maintain bed form processes and minimise disruption to wildlife migration.

10.5.65 The constriction of channels particularly around watercourse crossings will be minimised by regular inspections of crossings for blockages. If any blockages are identified, remedial actions will be undertaken to reinstate the full capacity of the crossing.

Measures to protect groundwater regime and dependent habitats

- 10.5.66 Although not assessed as a significant risk in terms of EIA the following sets out measures that will be followed to further reduce risk to GWDTEs. If dewatering of foundations is required, to limit the disruption to surrounding groundwater from dewatering, treated water will be discharged through an area of vegetated ground designated for drainage, in the immediate vicinity of the turbine in order to maintain local groundwater levels. Excavations will remain open for the shortest time practical to limit the effect of any dewatering.
- 10.5.67 To mitigate any potential reduction to groundwater recharge resulting from track construction, the tracks will comprise a semi-permeable surface to allow some infiltration. Trackside drainage will comprise either buffer strips or infiltration trenches which will be unlined to allow the standing water to infiltrate back into the ground.
- 10.5.68 While no significant impacts to M23 and M6 habitats (which have been identified as possible GWDTE) are expected, mitigation measures have been developed to reduce any potential impacts. Specific mitigation is proposed to reduce the potential minor to negligible impact to M6 identified in the eight down gradient areas at risk. **Figure 2 in Appendix 10.2 Volume IV** identifies where mitigation could usefully be applied to ensure maintenance habitats potentially at risk of impacts. These will comprise:
- Cross track drains where the access track intersects the habitat; and
 - Cut off drains and subsequent re wetting upgradient of M6 at risk from dewatering to maintain hydraulic continuity to down gradient areas.

- 10.5.69 Drainage will be passed through settlement tanks, systems such as silt busters or settlement lagoons as appropriate to maintain water quality and then discharged appropriately down gradient to allowing water to infiltrate back into the ground, thereby maintaining the overall volume of groundwater.
- 10.5.70 To reduce the likelihood of any indirect loss of habitats located down gradient of turbines, the period of dewatering, particularly at Turbine T5 and the adjacent crane hardstanding will be minimised during construction. This will reduce impacts to downgradient M6 habitats. Dewatering will also be designed to comply with the Water Environment (Controlled Activities) (Scotland) Regulations 2013 (CAR).

Measures to prevent the disturbance and degradation of peat and soils

- 10.5.71 For the construction phase, a final PMP will be prepared prior to any site activity, which will outline the management practices around the excavation and storage of soils, this document will be included within the CEMP, to ensure soil disturbance is minimised. An outline PMP is included in **Appendix 10.5 Volume IV**. As discussed in paragraph 10.5.15, the majority of excavated peat will be re-used across the application site in the reinstatement of infrastructure. There is an estimated surplus of approximately 10% of the volume of peat excavated. It is recognised that many assumptions have been made in the peat excavation and re-use calculations and that micro-siting and detailed design may lead to differences in peat excavation and re-use calculations such that this surplus volume can be removed.
- 10.5.72 The PMP outlines measures that will be followed when handling and temporarily storing excavated peat. Effective implementation of these measures will seek to reduce the volume of material to be excavated, minimise carbon losses and ensure that excavated material is kept as intact as possible for re-use. This will improve the use and restoration of peat within the application site. Where possible, excavated peat will be re-used as close to the area of excavation as possible. Excavated peat will be stored in low height stockpiles with low slope angles to minimise carbon losses and reduce the risk of peat slide during storage. In dry periods, when there is little or no rainfall, the peat will be kept moist by dampening and/or water spraying to prevent drying out and erosion. This will help to maintain the intrinsic water table and maintain peat hydrological processes. Further detail is outlined in the PMP.

Water quality monitoring

- 10.5.73 Water quality in the surface watercourses down gradient of works areas (including adjacent to key areas such as watercourse crossings, tracks, turbines and borrow pits) will be tested prior to works commencing in order to ascertain natural baseline conditions. Monitoring will also take place at control sites (outside the influence of works). A robust baseline of water quality in surface watercourses / drainage channels downstream of construction works will, therefore, be established prior to construction commencing. The purpose of this is to provide a comparison of 'natural' conditions against conditions potentially impacted by construction.
- 10.5.74 Data will be collected throughout construction and early phases of operation, particularly during rainfall events or after a spillage or release of sediment laden water. The data will be used to compare water quality during construction to baseline conditions and also to ascertain whether implemented mitigation measures are effective or not. During the early phase of operation, monitoring will continue to assess the quality of watercourses, comparing against baseline data. The monitoring scheme will include specific actions to be taken upon triggering environmental standards. Further detail on the programme of baseline and construction water quality monitoring will be detailed in the CEMP.

Residual Impacts

- 10.5.75 This section considers those potential effects identified in **Table 10.12** as being of significance i.e. of moderate or major potential impacts. Those impacts of minor or negligible significance have not been taken forward to this stage as they are not considered to represent likely significant effects as defined by the EIA Regulations. The results of the assessment of residual impacts are based on effective mitigation strategies (as described above) and a detailed CEMP (outline is included in **Appendix 10.7 Volume IV**).

Surface Water

- 10.5.76 Likely significant potential effects prior to mitigation on downstream water quality and associated receptors, were taken forward for the assessment of residual effects due to:
- Tree felling leading to the generation of turbid and nutrient rich runoff due to increased soil erosion and the removal of riparian vegetation from tree felling prior to construction;
 - The generation of turbid runoff from earthworks associated with the construction of site infrastructure;
 - Spillages or leakage of fuels, oils or other potentially polluting substances from vehicular movement onsite, the storage and use of oils and chemicals and the maintenance of plant; and
 - Spillages of concrete during turbine foundation construction.
- 10.5.77 Following the implementation of mitigation measures, the risk of significant potential effects relating to sedimentation of surface water has been reduced from major to minor as the control measures will both reduce the likelihood of a release of sediment to surface waters and also reduces the magnitude of any potential impact. Similarly, the risk of significant potential effects relating to pollution of surface waters from chemical or concrete spillages has been reduced from moderate to minor, due to the likelihood of any spillage reducing. There are therefore no predicted significant residual impacts to surface water during the construction phase. Measures to further control the reduced risks to surface water include:
- Development and implementation of a SMDP and a CEMP;
 - Additional mitigation measures around key construction activities including sediment and drainage control and measures to reduce the likelihood of spillages or leakages of oil, fuel or other potentially polluting substances or spillages of concrete; and
 - Development of an Incident and Emergency Response Plan which would be implemented in the event of a spillage.
- 10.5.78 Any minor impacts are likely to be restricted to high intensity rainfall events occurring over a short duration, with no significant long-term impact upon the local water environment or downstream sensitive environments, including the downstream fisheries. No discernible change in downstream water quality in the Afton Water catchments and Water of Deugh catchment is predicted. Water quality monitoring (as described in paragraphs 10.5.70 and 10.5.71) will be undertaken at strategic locations across and downstream of the application site prior to and during any construction activity. This will enable any changes in surface water quality to be identified and if required, additional focussed mitigation measures can be implemented to control any contaminated runoff.

Geology

- 10.5.79 There are no likely significant potential impacts on geology prior to mitigation to be taken forward for the assessment of residual impacts; however, it is noted that SEPA and SNH require detail regarding the reuse and management of peat excavated on site. The lack of significant impacts in relation to geological receptors is due largely to the development of a Peatslide Hazard and Risk Assessment (**Appendix 10.1 Volume IV**) and the reference to this throughout the design development for the windfarm.
- 10.5.80 Following the implementation of mitigation measures and adoption of best practice, the likelihood of potential impacts remains not significant for geological receptors. The outline Peat Management Plan (**Appendix 10.5 Volume IV**) demonstrates that all excavated peat will be reused constructively onsite, which further reinforces the lack of significant impact in relation to this receptor.

Groundwater

- 10.5.81 There are no likely significant potential impacts on groundwater, or groundwater related environments prior to mitigation to be forward for the assessment of residual impacts. The assessment of impact on GWDTE (**Appendix 10.2 Volume IV**) further reinforces the lack of significant impact in relation to this receptor.

Summary of Residual Impacts - Construction

- 10.5.82 Residual effects on surface water, groundwater and geological receptors during construction are summarised in Table 10.12.

Table 10.12 Summary of Residual Impacts - Construction

Activity	Potential impact	Receptor	Sensitivity of receptor	Pre-mitigation				After mitigation			
				Magnitude of potential impact	Evaluation of potential impact	Likelihood of occurrence	Likely potential impact	Magnitude of potential impact	Evaluation of potential impact	Likelihood of occurrence	Likely impact
Tree Felling	Temporary decline in downstream water quality due to turbid and nutrient rich runoff due to increase soil erosion, spillages and leakages of oil, fuel and other potentially polluting substances and the removal of riparian vegetation.	Surface water	High	High	Major	Likely	Major	Low	Moderate	Possible	Minor
Construction of site infrastructure	Generation of turbid runoff which could cause a temporary decrease in water quality in down-gradient watercourses, water bodies and associated receptors	Surface water	High	High	Major	Likely	Major	Low	Moderate	Possible	Minor
Vehicular and plant movement onsite; storage and use of oils and chemicals; maintenance of plant	Spillage or leakage of fuels, oils or other potentially polluting substances	Surface water	High	Medium	Major	Possible	Moderate	Medium	Major	Unlikely	Minor
Concrete construction of foundations and other hardstanding	Spillages of concrete during turbine foundation construction which could migrate to groundwater and / or surface watercourses affecting water quality	Surface water	High	Medium	Major	Possible	Moderate	Medium	Major	Unlikely	Minor

Cumulative Impacts

10.5.83 The potential for cumulative effects relates to proposed or existing developments which are either hydraulically connected to the application site or which drain to the same receiving environment. Potentially significant cumulative hydrological, hydrogeological or geological impacts are usually only likely if windfarms are to be constructed at the same time. There are seven other windfarms in the same wider catchments and within 5 km of the proposed Pencloe Windfarm. The details of these proposed windfarms are contained in **Table 10.13** and the location is shown on **Figures 7.4.1 and 7.4.2 Volume III**. Where there are potential for significant cumulative effects, it would be preferable for windfarms to be constructed at different times, to reduce the likelihood for any cumulative effects to hydrological, hydrogeological and geological receptors.

Table 10.13 Windfarms with potential for cumulative impacts

Name	Application status	Catchment	Location	Potential for cumulative effects?
Afton Windfarm	Planning application now consented. Meteorological masts installed.	Afton Water (and Afton Reservoir)	Immediately south east of site	✓
Ashmark Hill Windfarm	Planning application submitted and awaiting approval.	Afton Water	Immediately north west of site	✓
Monquhill Windfarm	In scoping – no application submitted.	Afton Water Water of Deugh	Immediately west of the site	✓
Windy Standard extension	Consented – construction to commence mid-2014 with pre-construction activities underway.	Water of Deugh	Immediately south of the site, opposite bank of Water of Deugh	* – Construction to be completed within the next year and the risk of impacts during the operational phase not anticipated. Pencloe construction will not coincide so unlikely for significant cumulative effects.
South Kyle Windfarm	Planning application submitted and awaiting approval.	Water of Deugh	Approx 1.5 km south west of the site	✓
Hare Hill Extension	Planning application now consented	River Nith (via Kello Water)	Approx. 3.75 km east of the site	* – Significant impacts unlikely due to distance from Pencloe Windfarm
Enoch Hill Windfarm	In scoping – no application submitted	River Nith	Approx. 5 km north west of the site	* – Significant impacts unlikely due to distance from Pencloe Windfarm

Afton Windfarm

10.5.84 A planning application has now been consented for Afton Windfarm, which would be located immediately south east of Pencloe Windfarm. Twelve turbines and associated track are proposed to be built in catchments that drain to Afton Water and Afton Reservoir. The majority of surface water runoff from the Pencloe windfarm flows into Afton Water via the Carcow Burn, Glenshalloch Burn and Lochingerroch Burn catchments (**Figure 10.1 Volume III**).

10.5.85 The potential for any cumulative significant impacts to hydrology, hydrogeology and geology receptors is highest during the construction phase of the two projects. The Afton Windfarm Non-technical Summary (E-on, 2004) states that following the implementation of a site Pollution Prevention and Incident Plan, the residual effects of the proposed Afton windfarm were assessed as minor or negligible. If construction of these two windfarms did occur at the same time, then there would be potential for cumulative effects to surface watercourses, particularly in relation to water quality impacts due to the generation of turbid runoff from site works.

Ashmark Hill Windfarm

10.5.86 This windfarm is proposed to be located immediately north west of Pencloe Windfarm, the planning application has been submitted and was refused in 2012. Surface water runoff from Ashmark Hill Windfarm drains to both Afton Water and the Water of Deugh.

10.5.87 Any significant cumulative impacts to hydrology, hydrogeology and geology receptors are highest during the construction phase of the two projects. The planning application for Ashmark Hill Windfarm is not available online; however it is likely that following mitigation the residual impacts are minor or less. If construction of Ashmark Windfarm occurred at the same time, then there would be potential for cumulative effects to surface watercourses.

Monquhill Windfarm

10.5.88 This windfarm is currently in the scoping stages and no planning application has been submitted. The proposed application site would be located immediately west of Pencloe Windfarm. The surface water runoff from this site drains to Afton Water and the Water of Deugh.

10.5.89 The ES for Monquhill Windfarm has not been completed; however it is likely that following mitigation the residual impacts would be restricted to potential impacts on surface water environments. If construction of Monquhill Windfarm occurred at the same time as for Pencloe, then there is potential for minor cumulative effects to surface watercourses.

South Kyle Windfarm

10.5.90 This windfarm is proposed to be located approximately 1.5 km south west of Pencloe Windfarm; the planning application has been submitted and is awaiting a response from East Ayrshire Council. Surface water runoff from South Kyle Windfarm would drain to the Water of Deugh.

10.5.91 The hydrology chapter of the South Kyle Windfarm ES (Vattenfall Wind Power Ltd, 2013) states that following the implementation of site layout, mitigation and monitoring, the residual effects of the windfarm are minor. If construction of these two windfarms did occur at the same time, then there would be potential for cumulative effects to the Water of Deugh.

Other Windfarms

10.5.92 The now consented Hare Hill Extension and proposed Enoch Hill windfarms both drain to the River Nith, downstream Afton Water. Pencloe Windfarm is over 7 km upstream of the convergence of Afton Water with the River Nith, and therefore all of these windfarms are at least 10 km upstream or downstream of the application site. Given this it is considered that any temporary decline in water quality caused by the construction of any of the windfarms would be diluted to the point that any potential cumulative effects would not be significant.

10.5.93 Windy Standard Windfarm has 30 turbines and is located immediately to the south and south east of the Pencloe application site boundary, and has been operational since 1996. It is proposed that an extension of 39 wind turbines are built as an extension to the windfarm to the south of the existing site, these have been consented and construction is to commence in mid-2014. Windy Standard windfarm and the proposed extension drains to the Water of Deugh. The likelihood of potential cumulative impacts from Windy Standard Windfarm and its extension and Pencloe Windfarm is greatest during construction. As Windy Standard is

already operational and the construction of the extension has already commenced and is expected to conclude next year, there is very little likelihood of significant cumulative effects between Windy Standard windfarm and the proposed extension and Pencloe Windfarm.

- 10.5.94 There are a number of other windfarms within 35 km radius of Pencloe Windfarm, as shown on **Figures 7.4.1 and 7.4.2 Volume III**. Some of these are operational windfarms; as previously mentioned the potential for impacts to hydrological, hydrogeological and geological receptors is more likely to occur during the construction phase and therefore any cumulative effects during the operational phases of these windfarms are considered to be negligible. There are also several other windfarms located either over 5 km away from the application site and/or drain into other catchments. There are no cumulative effects expected to hydrological, hydrogeological and geological receptors from these windfarms due to either their proximity to the Pencloe Windfarm or because there is no hydraulic connection for any impacts to occur.

10.6 Assessment of Operational Impacts

Predicted Impacts

- 10.6.1 This section provides a summary of potential impacts prior to mitigation measures being implemented, but on the basis that good site practices will be employed during operation.
- 10.6.2 A summary of the potential impacts (and the likelihood of them occurring) to identified sensitive receptors during the operation phase is included in **Table 10.14**, along with an assessment of their significance.

Site Activities

- 10.6.3 The windfarm will be operated in accordance with good working practices and measures to protect the water environment in accordance with those set out within SEPA's PPG notes. All vehicles visiting the application site will be equipped with sand trays to place below any oil or fuel filling activities and will be equipped with emergency oil spillage kits.
- 10.6.4 Routine maintenance of the operational windfarm will be undertaken, which will require access to the application site by maintenance crews. Potential impacts associated with maintenance are detailed under access tracks and watercourse crossings below.

Access tracks and watercourse crossings

- 10.6.5 The tracks are designed to last at the very minimum the life of the proposed development and only limited maintenance is envisaged during operation. The tracks will be constructed from compressed aggregate, which could be eroded by surface water over time. There will be relatively low volumes of traffic throughout the operational phase (see **Chapter 13: Traffic and Transport**).
- 10.6.6 Potential effects during operation of the windfarm from the presence of access tracks and watercourse crossings include:
- Decline in water quality of surface watercourses due to the generation of turbid runoff from tracks caused by traffic movement or the erosion of tracks and / or spills of potentially polluting substances such as fuels and oils from plant and vehicles;
 - Increased flood risk due the changes in ground permeability in the area of the tracks and / or blockages of watercourse crossings; and
 - Change in local groundwater flow regimes with may reduce recharge to possible GWDTE located down gradient of tracks. In particular, areas of M6 in mosaics around T10 and T15 and at the hill top near Saddle Hags (part of Auchincally Hill); and two areas of M23 in the Glenshalloch Burn valley which are bisected by the access track.

- 10.6.7 Compared with the construction phase, the likelihood of spillages or leaks of fuels or oils will be much reduced during operation of the windfarm. Sources will be limited to fuel from vehicles visiting the application site, lubricants and oils used in the turbines substation and transformers. The volume of sediment in runoff is also likely to be much less than during the construction phase due to the lower volumes of traffic and plant movement onsite.
- 10.6.8 All of the tracks and watercourse crossings are outside floodplain areas as identified by SEPA indicative flood mapping. However, the presence of tracks and watercourse crossings has the potential to increase flood risk during the operation of the proposed development. The presence of tracks will slightly decrease the overall permeability of the application site, resulting in slight increases in runoff rates during rainfall events. However, the change in permeability associated with the track represents negligible proportion of the total area of the surface water catchments within and downstream of the application site. This and the introduction of trackside drainage and runoff control means that the presence of tracks is unlikely to result in a measurable increase in surface water runoff rates from the application site.
- 10.6.9 Watercourse crossings have the potential to constrict flows, resulting in flow backing up behind the crossing, thereby increasing upstream flood risk. The design of crossings will reduce the likelihood of channels becoming constricted or crossings becoming blocked, with the actual design of crossings to be agreed at the detailed design stage. Crossings also have the potential to modify rates of erosion and deposition and can impact upstream and/or downstream landforms. On steeper streams, the end of pipe culverts can become elevated above the stream bed, with the additional velocity of water falling from the end of the pipe potentially exacerbating erosion on the downstream end of the culvert creating a plunge pool which could eventually undermine the track.

Wind Turbines, Foundations and Crane Hardstandings

- 10.6.10 After construction, the turbine foundations will be reinstated as described in **Chapter 4: Project Description**. Reinstatement of the turbine foundation area will comprise back filling the foundation area over the subsurface foundations with excavated soil and re-vegetating to allow for the natural infiltration of surface water. Foundations will be constructed using sulphate resistant concrete, which will ensure no degradation or subsequent pollution when in contact with acidic water.
- 10.6.11 The turbines would be designed with fluid catch basins and containment systems to prevent accidental releases from leaving the nacelle. Any accidental gear oil or other fluid leaks from the wind turbines would be contained inside the towers as they are sealed around the base, with the entrance situated above ground level.
- 10.6.12 Potential effects during operation of the windfarm from the presence of turbines, foundations and hardstandings include:
- Decline in water quality of surface watercourses due to spills of potentially polluting substances such as fuels and oils from plant and vehicles. The likelihood of this occurring is not expected to be high due to the design of the turbines;
 - Increased flood risk due the increase in impermeable area; and
 - Change in local groundwater flow regimes with may reduce recharge to GWDTE located down gradient of turbines. The impact on any GWDTEs is not expected to be significant as the placement of turbines has avoided direct impacts on possible GWDTEs. There are several small areas of M6 near turbines T5 and T10; however, significant impacts on these areas during operation are unlikely as mitigation put in place during construction will help to minimise impacts to these areas.

Control Building and Substation Compound

- 10.6.13 Potential impacts from the control building, substation building and hardstanding areas during operation are not considered to be high or likely. The buildings will be visited infrequently during operation of the windfarm and are located outside of a floodplain area. The small quantity of sewage arising from visits of maintenance staff will be stored in septic tanks and removed periodically by a licensed contractor.
- 10.6.14 Rainwater collection systems would be installed to provide water for flushing which, if necessary, would be topped up with water brought to site in containers. Excess rainwater falling on the roof of the buildings will be discharged to an infiltration drain or other SUDS based drainage system around the compounds. The buildings will not be of a size to intercept significant quantities of water and no impact is expected to groundwater/surface water at the application site.
- 10.6.15 SEPA Flood Maps show that the substation compound will be located in an area outside of indicative flood risk and as such the risk of flooding during operation will be limited to local surface water flows during rainfall events. Due to the sensitive nature of equipment to be placed within the substation building, regard for risk from surface water flooding is required within the design and detail on this is provided in the mitigation section.

Summary of Potential Impacts - Operation

- 10.6.16 Potential impacts prior to mitigation during operation are summarised in **Table 10.14**; an indication of whether additional mitigation is required or not is also included.

Table 10.14 Summary of potential impacts – Operation

Activity	Potential impact	Receptor	Sensitivity of receptor	Magnitude of potential impact	Evaluation of potential impact	Likelihood of occurrence	Likely potential impact	Site specific mitigation required?
Traffic movement along access tracks and watercourse crossings / other site activities	Turbid runoff polluting watercourses causing a temporary decrease in water quality	Surface water	High	Low	Moderate	Possible	Minor	✘
	Spills of polluting substances such as fuels and oils from plant and vehicles entering water environment	Surface water	High	Medium	Major	Unlikely	Minor	✘
		Groundwater	Low	Low	Negligible	Unlikely	Negligible	✘
Presence of watercourse crossings	Blockages causing a localised increase in flood risk downstream	Surface water	High	Low	Moderate	Possible	Minor	✘
	Restriction of lateral migration of the river channel	Surface water	High	Low	Moderate	Possible	Minor	✘
	Erosion at downstream end of culverts		High	Low	Moderate	Possible	Minor	✘
Presence of turbines, foundations, access tracks hardstanding and buildings	Change in local groundwater flow regimes which may reduce recharge to GWDTEs located downstream of turbines	Groundwater	Low	Low	Negligible	Unlikely	Negligible	✘
	Increased flood risk due to the increase in impermeable area causing changes to surface water runoff patterns and rates	Surface water	High	Low	Moderate	Unlikely	Negligible	✘
Use of control building and substation	Spills or leakage of fuels, oils or other potentially polluting substances such as sewage	Surface water	High	Medium	Major	Unlikely	Negligible	✘
		Groundwater	Low	Low	Negligible	Unlikely	Negligible	✘

Mitigation

Site-specific mitigation measures – operation

- 10.6.17 This section describes the measures that will be incorporated into the proposed windfarm to reduce impacts on the water environment and soil during the operational phase. Although the likely potential impacts have been assessed as being either minor or negligible during operation, the following measures will be implemented to reduce the likelihood of potential impacts even further.

Sediment and drainage control

- 10.6.18 Surface water will be managed during the operational phase in a similar manner as during construction. Tracks have been designed to effectively manage runoff, for the lifetime of the development, to reduce the potential for impacts to downstream surface watercourses and associated receptors from the generation of turbid runoff caused by vehicular movement during operation. Drainage will be shed to trackside drains and there will be no direct discharges from areas of tracks to surface watercourses or drainage channels. Tracks will be regularly inspected and maintained throughout the lifetime of the development. Sediment and drainage control will be managed in a similar way as during construction, further details are available in the CEMP (**Appendix 10.7 Volume IV**).
- 10.6.19 A description of turbine foundations and the proposed method of reinstatement is provided in **Chapter 4: Project Description**. Reinstatement of the turbine foundation area will comprise back filling the foundation area over the subsurface foundations with excavated soil and re-vegetating to allow for the natural infiltration of surface water.

Measures to prevent pollution from fuels, oils and other chemical substances

- 10.6.20 The electrical substation and control building will be designed (see **Chapter 4: Project Description**) in accordance with good practice will be such that there will be no potential for leaks or pollution incidences from the building. The buildings will also be subject to routine checks and maintenance.
- 10.6.21 The small quantity of sewage arising from the infrequent visits of maintenance staff will be removed periodically by a licensed contractor to be discharged off site. A rainwater collection system would be installed to provide water for flushing which, if necessary, would be topped up with water brought to site in containers.
- 10.6.22 Excess rainwater falling on the roof of the building will be discharged to an infiltration drain or other Sustainable Urban Drainage System (SUDS) based system around the substation. The building will not be of a size to intercept significant quantities of water and no impact is expected to groundwater/surface water at the application site.
- 10.6.23 The turbines will be designed with fluid catch basins and containment systems to prevent accidental releases from leaving the nacelle. Any accidental gear oil or other fluid leaks from the wind turbines would be contained inside the towers as they are sealed around the base, with the entrance situated above ground level. Any spillage or leaks would be cleaned up once detected.
- 10.6.24 The windfarm will be operated in accordance with good working practices and measures to protect the water environment in accordance with those set out within SEPA's PPG notes. All vehicles visiting the application site will be equipped with sand trays to place below any oil or fuel filling activities and will be equipped with emergency oil spillage kits.

Measures to reduce flood risk and impact to fluvial geomorphology

- 10.6.25 Flood risk and geomorphology will be managed during the operational phase in a similar manner as during construction. Culverts have been designed to convey a 0.5% AEP flow with the inclusion of a climate change allowance on future rainfall intensities. These culverts will be regularly inspected to check for any blockages, and any observed blockages removed. In addition the substation will be designed to prevent any damage to sensitive equipment from surface water flooding.

Water quality monitoring

- 10.6.26 During the early phase of operation, monitoring (as outlined in paragraphs 10.7.70 to 10.7.71) will continue to assess the quality of watercourses, comparing against baseline data. The monitoring scheme will include specific actions to be taken upon triggering environmental standards.

Residual Impacts

- 10.6.27 Prior to mitigation, there were no likely significant potential effects to surface water, groundwater or geology during the operational phase. Therefore, no potential effects were taken forward for the assessment of residual effects and no residual significant effects to surface water, groundwater or geology are expected during operation.

Cumulative Impacts

- 10.6.28 Any cumulative effects during the operational phases of the windfarms identified in **Table 10.13** are considered to be negligible.

10.7 Assessment of Decommissioning Impacts

Predicted Impacts

- 10.7.1 The proposed development has a planned operational life of up to 25 years and at the end of this period, either planning permission will be sought to repower the development or the development will be decommissioned. It is assumed for the purposes of the EIA that the proposed development will be decommissioned at the end of its operational life.
- 10.7.2 During decommissioning, turbines, the anemometry mast and the substation and control building would be removed. The majority of each turbine foundation will be left in situ. The top metre of the turbine, masts and building foundation base will be removed and disposed of appropriately. The areas will be re-surfaced with topsoil or peat and restored appropriately. All other infrastructure such as the cabling, hardstanding areas and site access will remain in situ. It is proposed that the access tracks and watercourse crossings will either remain in place for use by the landowner or be removed should they no longer be required. Buried cables will remain in place to prevent further disruption to the land or removed for recycling.
- 10.7.3 Potential impacts during the decommissioning phase will reflect the impacts predicted for construction; however, substantially less activity is anticipated during this period. There will be some limited earthworks associated with the removal of turbines, buildings and the anemometry mast. The removal of site infrastructure has the potential to cause a temporary decline in water quality from the generation of turbid runoff migrating to down gradient surface watercourses and associated receptors. If tracks are to be removed then there may be some impacts associated with the removal of tracks and watercourse crossings.
- 10.7.4 There is also potential for minor impacts associated with a temporary decrease in water quality from accidental spills or leakage of fuels, oils or other potentially polluting substances from vehicular and plant movement onsite, the storage and use of chemicals and the maintenance of plant.

Summary of Potential Impacts - Decommissioning

- 10.7.5 Potential impacts prior to mitigation during decommissioning are summarised in **Table 10.15**; an indication of whether additional mitigation is required or not is also included.

Table 10.15 Summary of Potential Impacts - Decommissioning

Activity	Potential impact	Receptor	Sensitivity of receptor	Magnitude of potential impact	Evaluation of potential impact	Likelihood of occurrence	Likely potential impact	Site specific mitigation required?
Removal of site infrastructure	A temporary decrease in water quality from the generation of turbid runoff migrating to down gradient surface watercourses and associated receptors	Surface water	High	Medium	Major	Likely	Major	✓
Potential removal of watercourse crossings	Disturbance to stream banks causing changes in erosion rates and local morphology	Surface water	High	Low	Moderate	Possible	Minor	✗
	Blockage or constriction of watercourses causing an increase in flood risk	Surface water	High	Low	Moderate	Unlikely	Negligible	✗
Vehicular and plant movement onsite; storage and use of oils and chemicals; maintenance of plant	A temporary decrease in water quality from spills or leakage of fuels, oils or other potentially polluting substances	Surface water	High	Medium	Major	Possible	Moderate	✓
		Groundwater	Low	Low	Negligible	Possible	Negligible	✗

Mitigation

- 10.7.6 Some small scale excavations may be required as part of the decommissioning phase. Similar precautionary measures to those proposed for the construction phase will be implemented as necessary, in accordance with good practice at that time.

Residual Impacts

- 10.7.7 Likely significant potential effects prior to mitigation that were taken forward for the assessment of residual effects during decommissioning are limited to the moderate risk of impact to surface water through the following:
- A temporary decrease in water quality from the generation of turbid runoff migrating to down gradient surface watercourses and associated receptors from the removal of site infrastructure; and
 - A temporary decrease in water quality from spills or leakage of fuels, oils or other potentially polluting substances from vehicular and plant movement onsite.
- 10.7.8 Following the implementation of mitigation measures, the likelihood of potential effects has been reduced from moderate to minor and therefore no residual significant effects remain to surface water during decommissioning.

Summary of Residual Impacts - Decommissioning

- 10.7.9 **Table 10.16** summarises expected residual impacts during the decommissioning of the proposed windfarm. Decommissioning residual impacts are limited to minor impacts on the surface water environment.

Table 10.16 Summary of Residual Impacts - Decommissioning

Activity	Potential impact	Receptor	Sensitivity of receptor	Pre-mitigation				After mitigation			
				Magnitude of potential impact	Evaluation of potential impact	Likelihood of occurrence	Likely potential impact	Magnitude of potential impact	Evaluation of potential impact	Likelihood of occurrence	Likely impact
Removal of site infrastructure	A temporary decrease in water quality from the generation of turbid runoff migrating to down gradient surface watercourses and associated receptors	Surface water	High	Medium	Major	Likely	Major	Low	Moderate	Possible	Minor
Vehicular and plant movement onsite; storage and use of oils and chemicals; maintenance of plant	A temporary decrease in water quality from spills or leakage of fuels, oils or other potentially polluting substances	Surface water	High	Medium	Major	Possible	Moderate	Medium	Major	Unlikely	Minor

Cumulative Impacts

10.7.10 The potential for cumulative impacts relates to proposed or existing developments which are either hydraulically connected to the application site or which drain to the same receiving environment. During decommissioning, potentially significant cumulative hydrological, hydrogeological or geological impacts are usually only likely if windfarms are to be decommissioned at the same time. As outlined in Section 10.5.83 and 10.5.94 there are seven other windfarms in the same wider catchments and within 5 km of the proposed Pencloe Windfarm. If any of these windfarms or any others that may be built within the same wider catchments and within 5 km of the proposed development are decommissioned at the same time as Pencloe, there would be potential for significant cumulative impacts to hydrological, hydrogeological and geological receptors. However, any cumulative impacts are expected to be less than during construction due to the scale of decommissioning activities being smaller than construction activities. Any cumulative impacts to hydrological, hydrogeological and geological receptors are not expected to be significant.

10.8 Summary and Conclusions

- 10.8.1 Design of the proposed development has taken into account hydrological, hydrogeological and geological constraints where possible and potential impacts on sensitive environments have been avoided through consideration of sensitive receptors in the layout of the wind farm. This has included minimising the number of watercourse crossings and provision of 50 m buffer zones around significant watercourses where possible, including Afton Water, the Water of Deugh and associated significant tributaries. Sensitive areas such as deep peat or GWDTEs have also been avoided where other design constraints permit. Where possible, avoidance of these areas of habitat has ensured that sensitive groundwater regimes have been afforded a level of protection, as required under the WFD.
- 10.8.2 Standard practice measures combined with additional site specific mitigation measures will be used to minimise impacts, especially during construction.
- 10.8.3 Residual impacts following the consideration of proposed mitigation measures are limited to Minor impacts on the surface water environment during the construction and decommissioning phases. There are therefore no predicted significant residual impacts on hydrological, hydrogeological or geological environments from the proposed development. The potential for minor impacts is likely to be restricted to high intensity rainfall events occurring over a short duration, with no significant long-term impact upon the local water environment or downstream sensitive environments, including the downstream fisheries.
- 10.8.4 Water quality monitoring is recommended for surface watercourses down gradient of the site to establish a detailed understanding of baseline water chemistry prior to any site activity. This baseline will form a benchmark for monitoring of the site during the construction and early operational phases of the wind farm and will be used to assess the effectiveness of mitigation and control measures and to highlight areas of concern where intervention may be required in order to prevent, reduce or control impacts to downstream receptors.

10.9 References

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11 Archaeology and Cultural Heritage

11.1 Introduction

- 11.1.1 This chapter addresses the potential impacts of the proposed development on cultural heritage assets, here defined as all relict man-made features pre-dating the First Edition Ordnance Survey mapping (surveyed 1857 in this area) and selected sites post-1857, such as war-time or industrial sites. This includes all scheduled monuments, listed buildings, inventory gardens and designed landscapes, inventory battlefields and conservation areas. This chapter therefore includes all types of historic buildings and archaeological sites.
- 11.1.2 There is the potential for windfarm developments to impact upon cultural heritage assets. Such impacts could comprise:
- Physical damage to the fabric of cultural heritage assets, generally resulting from groundworks associated with the construction of the proposed development; and
 - Adverse impacts upon the setting of cultural heritage assets, largely this relates to visual impacts.
- 11.1.3 Cultural heritage assets considered are listed in a Gazetteer and Concordance (**Appendix 11.1 Volume IV**) and in the interests of clarity all assets inside the application site are referred to by Asset (A) numbers issued in the course of this assessment.

11.2 Policy, Legislation and Guidance

- 11.2.1 This assessment has been undertaken within reference to relevant legislation, which includes National Planning Policy, together with Regional and Local planning guidance relating to cultural heritage. An overview of relevant legislation and planning policy that have been consulted is provided below.
- 11.2.2 The Scottish Government's planning policy in relation to Cultural Heritage is set out in paragraphs 135-151 of Scottish Planning Policy (SPP) (June 2014), which is supported by the Scottish Historic Environment Policy (SHEP) (December 2011). Further guidance is given in the form of the Managing Change in the Historic Environment series (2010) from Historic Scotland and PAN2/2011 Planning and Archaeology (July 2011). The underlying aim of these policies and guidance documents is to manage development in such a way that the special character and values of the historic environment are preserved. The SPP provides guidance for the protection of the historic environment within the context of the planning system. It requires planning authorities to take into account the planning policy and guidance regarding the historic environment when determining planning applications and developers to do likewise whilst formulating development proposals. The SPP (para 137) states that *'the planning system should enable positive change in the historic environment which is informed by a clear understanding of the importance of the heritage assets affected and ensure their future use. Change should be sensitively managed to avoid or minimise adverse impacts on the fabric and setting of the asset, and ensure that its special characteristics are protected, conserved or enhanced'*. SHEP (Annex 7) states that *"in the case of impact on the setting of the monument, securing the preservation of the monument 'within an appropriate setting' as required by national policy is solely a matter for the planning system"*.
- 11.2.3 The Ancient Monuments and Archaeological Areas Act 1979: Scheduled ancient monuments are sites of national importance that the Scottish Ministers have given legal protection under 'The Ancient Monuments and Archaeological Areas Act 1979'. Historic Scotland works on behalf of the Scottish Ministers to compile, maintain and publish a schedule of these monuments. Any work directly affecting

these sites can only be carried out with the consent of the Scottish Ministers, following guidance by Historic Scotland.

- 11.2.4 Listed Buildings and Conservation Areas (Scotland) Act 1997 - Listed Buildings are defined as buildings of special architectural or historic interest in the Planning (Listed Buildings and Conservation Areas) (Scotland) Act 1997 (as amended). The Act states that: “*The planning authority, in determining any application for planning permission for development that affects a listed building or its setting, is required to have special regard to the desirability of preserving the building, or its setting, or any features of special architectural or historic interest which it possesses.*” (Section 59(1).

11.3 Methodology

Overview

- 11.3.1 This cultural heritage assessment comprises a baseline survey undertaken through documentary research and field survey. This is followed by an assessment of the potential direct and indirect impacts of the construction, operational and decommissioning phases of the proposed development. Mitigation is proposed and the significance of the residual impacts assessed.
- 11.3.2 The desk-based assessment covered all known cultural heritage assets within the application site and the surrounding 5 km. A field survey was carried out to verify the findings of the desk-based assessment and to identify any additional unrecorded assets. Cultural heritage assets in the wider landscape that are considered to be susceptible to impacts upon their setting were visited.

Study Areas

- 11.3.3 The study took in three concentric areas:
- The Inner Study Area. This is based on the application site (**Figure 11.1 Volume III**). Within this study area all cultural heritage assets are considered in relation to both physical and setting impacts. Also considered is the potential for previously unrecorded assets to be affected by the development;
 - The Middle Study Area. This extends 5 km from the boundary of the application site (**Figure 11.2 Volume III**). Within this area all nationally important assets (Scheduled Monuments and Listed Buildings and Historic Gardens and Designed Landscapes) and regionally important sites of schedulable quality were considered in relation to potential operational impacts upon setting and to inform the potential for previously unrecorded cultural heritage assets within the Inner Study Area. The extent of the study area is based on experience, which indicates that significant impacts will be rare beyond this distance; and
 - The Outer Study Area. This is based on the Zone of Theoretical Visibility (ZTV), as defined in the **Landscape and Visual Amenity Chapter 7**, within which cultural heritage assets highlighted specifically by consultees or identified as being at risk of significant impacts upon setting were considered (**Figure 11.3 Volume III**).

Data Sources

- 11.3.4 The desk-based study has been based on readily available and relevant documentary sources. The following archives were referred to:
- National Monuments Record of Scotland (NMRS);
 - Vertical aerial photographs held by the Royal Commission on the Ancient and Historical Monuments of Scotland (RCAHMS);

- West of Scotland Archaeology Service (WoSAS) Sites and Monuments Record;
- Databases of designated cultural heritage assets (scheduled monuments, listed buildings, inventory gardens and designed landscapes, inventory battlefields and conservation areas) maintained by Historic Scotland;
- Maps held by the National Library of Scotland; and
- Other readily accessible published sources.

Consultation

- 11.3.5 Historic Scotland in their scoping opinion (16th January 2013) stated that “*while it may be possible to accommodate a wind farm development in this location, there are certain aspects of the proposal which we would require to be assessed*”. They went on to request an assessment of the potential impacts on setting of the following designated assets:

Scheduled Monuments

- Index No. 1034 Lamford Burn Cairn
- Index No. 1046 The King’s Cairn

Category A Listed Buildings

- HB 96 Dumfries House Temple
- HB 14413 Dumfries House
- HB 14414 Dumfries House Avenue Bridge
- HB14416 Dumfries House Dovecot
- HB18793 Craigengillan House
- HB 18794 Craigengillan Stables

Gardens and Designed Landscapes

- Craigengillan
- Dumfries House

- 11.3.6 The potential effects on the setting of these assets have been included within the Assessment of Operational Impacts section below.
- 11.3.7 West of Scotland Archaeology Service (WoSAS), as archaeological advisors to East Ayrshire Council, in their scoping response (15th October 2013) requested that “*the definition of sites that will be assessed for setting impact in the middle study area should be extended to include at the very least sites of potentially-schedulable quality (which could be considered as being the equivalent of regional importance)*”. With regard to the walkover survey WoSAS stated that though it was aware of the difficulties of carrying out a walkover survey through plantation forestry the lack of walkover in this area would result in the Council being asked to determine the application on the basis of partial information. WoSAS therefore requested “*that the ES should identify how this deficiency will be addressed, possibly through further survey post-felling but pre-construction*”. WoSAS’s requests have been incorporated into this assessment.
- 11.3.8 Dumfries and Galloway Council Archaeology Service in their scoping response (16th January 2013) stated “*that there are a number of designated sites around Carsphairn that may be affected, notably the industrial remains at Woodhead lead mines and the King’s Cairn at Waterhead. However these are located at around 15 km and 8 km from the proposal respectively. It is considered extremely unlikely that*

any effects identified will be of more than minor significance.” These assets have been included in the Assessment of Operational Impacts section below.

Field Survey Methodology

- 11.3.9 A targeted walkover survey of the Inner Study Area was carried out on the 16 and 17 January 2013 guided by modern mapping and a handheld GPS. Due to the density of plantation forestry within the study area, the walkover was targeted on areas that are clear of forestry. It was considered that a walkover through plantation forestry would not be informative at this stage due to the highly restricted visibility within the woods (post-felling, pre-construction surveys are proposed in paragraph 11.5.11). The intention of this walkover was to assess the presence/absence, character, extent and condition of known assets and to identify any previously unrecorded assets.

Archaeological Potential

- 11.3.10 An assessment of the potential for currently unknown assets within the inner study area is based on an appraisal of known assets recorded in the WoSAS HER within 2 km of the site boundary, and any previous archaeological work. Potential is here defined as the likelihood of previously unknown heritage assets being discovered if the entire inner study area was to be excavated archaeologically, and the likely cultural significance of any such assets.
- 11.3.11 The distribution and type of known sites in the vicinity, considered in relation to environmental factors such as geology, topography and soil quality, is most relevant to this assessment. Regard is also paid to the distribution of fieldwork and the likely accuracy and relevance of its results in regard to the inner study area. Landuse factors affecting survival or visibility of archaeological remains, such as arable agriculture or forestry, are also taken into account. Archaeological potential is then assigned to one of the five categories outlined in **Table 11.1**. The examples are provided as an aid to decision making and allow for professional judgement to be exercised.

Table 11.1: Archaeological potential

Potential	Definition	Example
High	The study area almost certainly contains numerous undiscovered heritage assets, some of which are likely to be of high cultural significance.	The inner study area lies in an extensive area of cropmarks, but local landuse is not conducive to the formation of cropmarks. Features associated with the cropmarks almost certainly extend into the inner study area but have not been identified because of these local conditions.
Moderate	The study area is likely to contain undiscovered heritage assets of more than negligible cultural significance, and it is possible, though unlikely, that some of these may be of high cultural significance.	The inner study area lies in an area with scattered, but discrete areas of prehistoric settlement, identified in the course of watching briefs on large-scale topsoil strips. No fieldwork has been undertaken within the inner study area. The topography and geology of the inner study area are suitable for settlement.
Low	The study area may contain undiscovered heritage assets, but these are unlikely to be numerous and any assets present are highly unlikely to be of high cultural significance.	The inner study area lies in an area with very few known archaeological sites that has seen a substantial amount of fieldwork. It matches the tested areas in terms of topography, geology and known landuse history.

Potential	Definition	Example
Negligible	The study area is highly unlikely to contain undiscovered heritage assets of more than negligible cultural significance.	The inner study area lies in an upland region well above the historic limit of cultivation with no sites in comparable areas nearby. Archaeological sites survive as upstanding features in the absence of agriculture and hence are relatively easily identified in these conditions. It has been subject to professional pre-forestry survey, which identified no new sites.
Nil	There is no possibility of undiscovered heritage assets existing within the study area.	The entire inner study area has been subject to extensive ground disturbance known to have been of sufficient depth to remove all archaeological features, e.g. opencast mining.

Identification of Predicted Impacts

- 11.3.12 Potential impacts include direct or indirect impacts on the physical fabric of heritage assets, and impacts on their settings.
- 11.3.13 Construction works have the potential to damage or destroy cultural heritage assets. Physical impacts on the fabric of assets may occur either as a result of the design of the development or as an accidental consequence of construction plant movement. The impacts may be direct, for instance where an archaeological deposit is removed or damaged during ground-breaking works; or indirect, for example where changes in hydrology lead to waterlogged archaeological deposits becoming desiccated and degraded. The location and extent of disturbance, and the likely physical impacts on both known and unknown assets, have been predicted from the footprint of the proposed development.
- 11.3.14 Operational impacts relate largely to impacts on the setting of heritage assets and are primarily (though not exclusively) a result of visual intrusion. Plans of the proposed development, ZTVs, wirelines and photomontages have been examined in relation to the cultural heritage baseline to predict the likely visual impacts on designated heritage assets.

Assessment of Sensitivity

- 11.3.15 The sensitivity of a cultural heritage asset reflects the level of cultural significance assigned to it by statutory designation or, in the case of undesignated assets, the professional judgement of the assessor. 'Cultural significance' is a concept defined in SHEP Annex 1, Section 3 which should not be confused with the unrelated usage of 'significance' in referring to impacts in EIA. Assets of National Importance (as defined in SHEP Annex 1, 7-10), which include Scheduled Monuments, non-designated assets considered to be of schedulable quality, Category A Listed Buildings, Inventory Gardens and Designed Landscapes and Inventory Battlefields, are assigned the highest level of cultural significance and their sensitivity is high. Assets of regional or more than local importance are considered of medium sensitivity, while assets of local importance are considered of low sensitivity. Category B and C Listed Buildings are categorised, respectively, as being of regional and local importance (Historic Scotland 2011, 12).

Table 11.2: Guideline Criteria for Assessing the Sensitivity of Cultural Heritage Assets

Sensitivity of Receptor	Guideline Criteria
High	Scheduled Monuments, Category A Listed Buildings and undesignated archaeological assets of national importance
Medium	Category B Listed Buildings and undesignated archaeological assets of regional importance
Low	Category C Listed Buildings and undesignated archaeological assets of local importance
Negligible	A badly preserved or extremely common type of archaeological asset or building of little value at local, regional or national levels

11.3.16 The cultural significance of monuments and other heritage assets derives from a wide range of characteristics which, following SHEP Annex 1, Section 5, are grouped into three categories:

- Intrinsic - those relating to the fabric of the asset;
- Contextual – those relating to the monument’s place in the landscape or in the body of existing knowledge; and
- Associative – more subjective assessments of the associations of the monument, including with current or past aesthetic preferences.

11.3.17 The assessment of sensitivity consists in an analysis of the characteristics that contribute to the overall cultural significance of the asset, and their relative weighting. Not all the characteristics listed in SHEP Annex 1 need be present for an asset to be assigned to a certain level of importance; and different characteristics will contribute to a greater or lesser extent depending on the type of asset and its unique attributes. Generally an asset will have certain ‘key’ characteristics, which cannot be compromised without an asset losing much or all of its cultural significance; these need to be carefully defined and distinguished from other characteristics which are less valued.

11.3.18 The cultural significance of a heritage asset derives both from its physical fabric and from its setting. Setting is defined by Historic Scotland (2010, paragraph 2.1) as *‘the way in which the surroundings of a historic asset or place contribute to how it is experienced, understood and appreciated’* and accounts for much of the contextual character of an asset. All heritage assets have a setting, inasmuch as they survive as recognisable places in a wider landscape; however the extent to which setting contributes to the overall cultural significance of heritage assets varies widely. Setting may not be among the key characteristics that contribute to an asset’s cultural significance, and even where it is, only certain attributes of that setting will be relevant.

11.3.19 Attributes of an asset’s setting that have significantly influenced its design and function are considered particularly relevant and are likely to be among its key characteristics. Such ‘functional’ relationships can also exist between an asset and later features where, for example, a church or castle acts as the focus for a developing town, continuing to shape its surroundings through time. Setting may include localised factors, such as the integrity of a rural settlement and its related field system, or a more distant visual relationship, such as a designed vista or the view from, for example, one Roman signal station to another. The former is referred to in this assessment as immediate setting and the latter as landscape setting. In many cases, only the immediate setting will be functionally relevant in this way and more distant visual relationships will be fortuitous.

- 11.3.20 Valued setting characteristics of some assets may reside largely in aesthetic/artistic factors or a site-specific and subjective 'sense of place' that is more or less unrelated to their original function. For example, a building surviving as a 'romantic ruin', which has become linked to the work of a famous artist, may be valued for views which have much to do with the way it has been depicted, but little to do with the character of the building when in use. Such considerations, which generally fall under the heading of 'associative' characteristics, may be difficult to define, but are relevant and can sometimes be corroborated by previous written accounts of an asset and its contribution to the wider landscape.
- 11.3.21 The relevance of setting to the cultural significance of a heritage asset does not depend on it being visited (Historic Scotland 2010, 4.10), accessible to the public, or recognisable by the average visitor. Nevertheless, setting is likely to contribute more to the cultural significance of an asset that provides a rich and informative experience for potential visitors. Setting is therefore considered particularly relevant in the case of well-preserved assets that are prominent features in the landscape.
- 11.3.22 The integrity and preservation of the setting is also a factor: where a heritage asset survives as part of a well-preserved historic landscape that includes many related features, setting is accorded greater weight than in cases where more recent land use has disrupted the coherence of the asset's setting, making the location of the asset more difficult to appreciate. Settings that have experienced change may nevertheless continue to contribute to the value of a heritage asset and therefore remain sensitive to further change.

Assessment of the Magnitude of Identified Impacts

- 11.3.23 Magnitude of impact is a measure of the degree to which the significance of a heritage asset will be increased or diminished by the proposed development. The magnitude of an impact reflects the extent to which relevant characteristics of the cultural heritage asset's fabric or setting are changed by the development, and the effect that this has upon the cultural significance of the asset as a whole. The magnitude of impacts is assessed as high/medium/low, and adverse/beneficial, or negligible, using the criteria in **Table 11.3** as a guide.
- 11.3.24 In cases where only the setting of an asset is changed, it should be noted that the magnitude of impact refers to the consequences of those changes for the overall cultural significance of the asset. If the most valued characteristics of an asset derive from its setting, even small changes to that setting can result in a significant impact. Conversely, in cases where setting is considered largely irrelevant to an asset's cultural significance, changes to that setting can affect only that small part of its significance that is derived from its setting, and a significant impact is unlikely to occur. Changes within the 'visual envelope' of an asset do not necessarily result in an impact on setting, since to do so they would have to affect one or more of the characteristics from which the asset derives its significance; where such relevant characteristics are unaffected, there is considered to be 'no impact' even if the asset is intervisible with the development. The magnitude of impacts on setting is assessed in relation to the factors listed in Historic Scotland 2010, paragraph 4.14, taking account of changes to views both from and towards the asset, and changes to the character of the landscape.

Table 11.3: Guideline Criteria for Assessing the Magnitude of Impacts on Cultural Heritage Assets

Magnitude of effect	Guideline Criteria
High beneficial	The asset is preserved in situ, where it would be lost if the 'do nothing' scenario was played out; or the cultural significance of the asset is substantially enhanced by changes to its setting which restore key characteristics which were previously lost or obscured.
Medium beneficial	The asset is preserved by record, where it would be lost if the 'do nothing' scenario was played out; or the cultural significance of the asset is appreciably enhanced by changes which make key characteristics of the asset's setting easier to appreciate.
Low beneficial	The asset is preserved by record where it would otherwise continue to naturally degrade; or the development leads to a slight improvement in the asset's setting, but in ways that do not substantially affect its key characteristics, slightly enhancing the asset's cultural significance.
Negligible	The asset's fabric and/or setting is changed, but in ways which do not substantially affect any of the characteristics from which its cultural significance derives, and with no appreciable reduction or enhancement in the asset's cultural significance.
Low adverse	Parts of the asset's fabric and/or setting are lost or changed, but without substantially affecting key characteristics, leading to a slight reduction in the asset's cultural significance.
Medium adverse	One or more key characteristics of the asset's fabric and/or setting is considerably degraded, substantially reducing the asset's cultural significance.
High adverse	Key characteristics of the asset's fabric and/or setting are lost or fundamentally altered, leading to total or near-total loss of the asset's cultural significance.

Assessment of the Significance of Impacts

11.3.25 The significance of an effect on a cultural heritage asset, whether a physical effect (direct or indirect) or an effect on its setting, is assessed by combining the magnitude of the effect and the sensitivity of the cultural heritage asset. The matrix in **Table 11.4** provides a guide to decision-making but is not a substitute for professional judgement and interpretation, particularly where the sensitivity or effect magnitude levels are not clear or are borderline between categories. In particular, certain combinations of sensitivity and magnitude can give rise to either minor or negligible impacts. Predicted impacts of moderate or major significance are considered significant for the purpose of the EIA regulations and will require mitigation or management measures to reduce the level of the impact.

Table 11.4: Guideline Criteria for Assessing the Significance of Impacts on Cultural Heritage Assets

		Sensitivity			
		Negligible	Low	Medium	High
Magnitude	High	Minor or Negligible	Moderate	Major	Major
	Medium	Negligible	Minor	Moderate	Major
	Low	Negligible	Negligible	Minor	Moderate
	Negligible	Negligible	Negligible	Negligible	Minor or Negligible

Mitigation Measures and Recognition of Residual Impacts

- 11.3.26 Impacts on the fabric of heritage assets can be mitigated in many cases by avoiding or minimising the extent of physical disturbance, and this form of mitigation is proposed where possible.
- 11.3.27 In other cases where mitigation by avoidance is impossible, or not justified by the significance of the impact, proposals are made for mitigation by an appropriate level of survey, excavation, recording, analysis and publication of the results (PAN2/2011, sections 25-27). Archaeological investigation can reduce the impacts on the cultural significance of an asset as a source of information about the past (broadly corresponding to ‘intrinsic characteristics’), although it does not eliminate those impacts, since the possibility of future investigation with alternative techniques or perspectives is lost.

11.4 Baseline Conditions

- 11.4.1 This area of East Ayrshire has seen a relatively large amount of archaeological investigation for such a rural upland environment. This is as a result of the walkover surveys and programmes of archaeological work in advance of afforestation, windfarm construction and associated grid connection routes. This work indicates that man’s presence here relates largely to the pastoral exploitation of this upland landscape, marked largely by the remains of sheepfolds of post-medieval or later date.
- 11.4.2 There is little evidence dating to the prehistoric period in the Middle Study Area. The assets recorded by the HER include a possible long barrow (HER9066) and three cairns (HER 9049, 9070 & 9071). However, two of these assets (HER 9070 & 9071) are no longer upstanding and the remaining two (HER 9049 & 9066) were recorded in antiquity and their location can no longer be confirmed. The relative scarcity of prehistoric assets within this part of East Ayrshire may reflect the interior upland location of the application site. The distribution of known sites would suggest that this area was not attractive to settlement in the prehistoric period.
- 11.4.3 Assets of medieval date are similarly poorly represented in the Middle Study Area. The ruins of Cumnock Castle, in New Cumnock, were finally removed in the late 18th or early 19th century and all that survives are low traces of its surrounding moat. There are no further confirmed medieval assets within the Middle Study Area although it is probable that some of the farmsteads have their origins in the medieval period. Within the Inner Study Area, it is probable that the previously unrecorded enclosure (A1), identified during the course of the current walkover survey, dates to the medieval period or earlier.
- 11.4.4 Glen Afton, which runs to the north and east of the application area, is associated with a number of key characters from Scottish History; William Wallace, Robert the Bruce, Mary Queen of Scots and Robert Burns.
- 11.4.5 Blind Harry’s account of Wallace places him possibly at Blackcraig Hill in Glen Afton:
- “And Wallace past in Cumno with blith will,
At the Blak Rok, quhar he was wont to be,
Apon that sted a ryall house held he”.*
- 11.4.6 Local folklore has named a natural rock formation “Castle William” after this connection. However this was clearly not the location of a castle but a natural rock outcrop.
- 11.4.7 Robert the Bruce is also believed to have taken refuge in Glen Afton after the battle of Loudon Hill in 1307. John Barbour’s poem, “The Brus”, states that:

*“in Cumnok quhair it straitast was
thidder went James of Douglas
and wes rycht welcum to the king”.*

- 11.4.8 There is a local tradition that the rock face named Stayamera on Craigraneoch Rig was named as a taunt to the English commander Vallence with ‘Stay Amery’ meaning ‘stay, keep chasing Bruce’. However, it is also suggested that Stayamrie results from the combination of a Scots word and a Gaelic word for steep which translates as the doubly steep rock. (http://members.tripod.com/bob_newcumnock/pnwallace/welcomex.html).
- 11.4.9 There is also some suggestion that Mary Queen of Scots travelled through Glen Afton on her flight south to England after the battle of Langside in 1568. However, the exact route of Mary’s journey is unknown and Glen Afton can only be one of a number of possible routes taken.
- 11.4.10 In the 18th century Robert Burns wrote the famous poem “Sweet Afton”, a lyrical poem which appears to place Burns courting his sweetheart ‘Mary’ along the banks and in Glen Afton.
- 11.4.11 Throughout the post-medieval and modern period, upland grazing has continued as a dominant feature of the surrounding countryside. However, the main employer in the area has been the coal industry and, although no collieries are located in the Inner Study Area, there are a number of mines in the Middle Study Area. More recently, the area has seen the introduction of commercial forestry, windfarms and a hydro-electric scheme.

Designated cultural heritage assets within the Inner Study Area

- 11.4.12 There are no designated cultural heritage assets in the Inner Study Area.

Undesignated cultural heritage assets within the Inner Study Area

- 11.4.13 There are no previously recorded cultural heritage assets in the Inner Study Area.
- 11.4.14 A total of seven previously unrecorded cultural heritage assets were identified within the Inner Study Area during the course of this assessment (**Table 11.5, Figure 11.1 Volume III**). These comprise four post-medieval sheepfolds, two modern shepherds’ or navigation cairns and one enclosure.

Table 11.5: Cultural heritage assets in the Inner Study Area

A No	Type
1	Enclosure
2	Sheepfold
3	Sheepfold
4	Sheepfold
5	Shepherds’ cairn
6	Shepherds’ cairn
7	Sheepfold

- 11.4.15 The enclosure (A1) was recorded during the walkover survey and it does not appear on any of the early maps of the area. This, in addition to its location, size and shape, suggests that it is probably of medieval or earlier date; as such this asset has the potential to be of up to regional importance and medium sensitivity.
- 11.4.16 The remaining assets (A2 – A7) are all post-medieval to modern common site types which are found throughout rural upland Scotland. As such these assets are considered to be of, at most local importance and negligible sensitivity.

Potential for previously unrecorded cultural heritage assets within the Inner Study Area

- 11.4.17 The Inner Study Area can be divided into areas of differing potential by reference to altitude. Previous archaeological surveys in similar landscapes, as well as the archaeological background of the surrounding area, suggest that the potential for unrecorded assets above 400m AOD is very low as such areas would never have been attractive to settlement or agriculture. It is concluded that the potential for unrecorded assets above 400m AOD is negligible.
- 11.4.18 Below 400m AOD, along the slopes and floors of the glens, known assets are more common throughout the Middle Study Area. These largely relate to late medieval to early modern farming activity. Within the Inner Study Area, below 400m AOD where the land is improved grazing, it is considered that any substantial earthworks would survive upstanding and would have been recorded during the walkover survey or through the examination of aerial photographs, although there has presumably been a level of ploughing within this area in the past which may have removed or degraded some upstanding assets. It is possible that the remains of less substantial features will survive subsurface in this area. It is considered that there is low to moderate potential for previously unrecorded cultural heritage assets to survive.
- 11.4.19 Below 400m AOD where the land is plantation forestry it is considered that any substantial earthworks would have largely been removed by forestry works. It is however possible that the remains of assets will survive subsurface. It is considered that there is low potential for previously unrecorded cultural heritage assets to survive in the area of plantation forestry below 400m AOD.

Designated cultural heritage assets within the Middle Study Area

- 11.4.20 There are six listed buildings within the Middle Study Area; three are Category B and three are Category C listed (**Table 11.6, Figure 11.2 Volume III**). The listed buildings are located in the town of New Cumnock and the neighbouring settlement of East Polquhirter.

Table 11.6: Listed Buildings in the Middle Study Area

HB No.	Name	Category
14246	Martyrs Parish Church	B
14247	Ruins of Old Church and Graveyard	B
14248	Nith Bridge	B
14249	Mossmark of Oldmill Farm	C
14250	East Polquhirter Farm	C
50128	15 and 17 Castle St: Town Hall and Police Station	C

- 11.4.21 There are no scheduled monuments, inventory gardens and designed landscapes or inventory battlefields within the Middle Study Area.

Designated Heritage Assets in the Outer Study Area

- 11.4.22 Historic Scotland and Dumfries and Galloway Council identified eleven designated cultural heritage assets in consultation which they considered may be susceptible to impacts on their setting from the proposed development (**Table 11.7, Figure 11.3 Volume III**). These include three scheduled monuments as well as the inventory gardens and designed landscapes of Dumfries House and Craigengillan House and the Category A listed buildings within these gardens.

Table 11.7: Designated Heritage Assets Considered in the Outer Study Area

Ref No.	Name	Designation
SM1034	Lamford Burn Cairn	Scheduled Monument
SM1046	The King's Cairn	Scheduled Monument
SM5184	Woodhead lead mines	Scheduled Monument
HB96	Dumfries House Temple	Category A Listed Building
HB14413	Dumfries House	Category A Listed Building
HB14414	Dumfries House Avenue Bridge	Category A Listed Building
HB14416	Dumfries House Dovecote	Category A Listed Building
HB18793	Craigengillan House	Category A Listed Building
HB18794	Craigengillan Stables	Category A Listed Building
N/A	Craigengillan	Inventory Garden and Designed Landscape
N/A	Dumfries House	Inventory Garden and Designed Landscape

11.5 Assessment of Construction Impacts

Predicted Impacts

- 11.5.1 One cultural heritage asset – the shepherds' cairn (A5) – will be affected by the construction of the proposed development at Turbine 4, where the turbine and its adjacent access track will remove the shepherds' cairn. This is a relatively modern cairn, built as a navigation aid. Such cairns are common site types throughout rural upland Scotland and are considered to be of negligible sensitivity. The removal of this cairn will be an impact of high magnitude and negligible significance.
- 11.5.2 The remaining known cultural heritage assets within the Inner Study Area have been avoided through design and will not be subject to direct construction impacts.
- 11.5.3 Effect significance cannot be meaningfully assessed for unknown assets, as neither the sensitivity of the receptor nor the magnitude of the effect can be known. Consequently, only the likelihood of construction impacts is considered here.
- 11.5.4 Above 400m it is considered that there is negligible potential for previously unrecorded cultural heritage assets. It is considered that there is equally negligible potential for previously unrecorded cultural heritage assets to be subject to construction impacts. As this resource is unknown, the magnitude of this impact cannot be assessed.
- 11.5.5 Below 400m in the area of plantation forestry it is considered that there is low potential for previously unrecorded cultural heritage assets. It is considered that there is equally low potential for previously unrecorded cultural heritage assets to be subject to construction impacts. As this resource is unknown, the magnitude of this impact cannot be assessed.
- 11.5.6 Below 400m in the area of improved grazing it is considered that there is low to moderate potential for previously unrecorded cultural heritage assets. Only the access track will be constructed in this area, and as it will follow the route of the current farm and forestry track, it is considered that there is low potential for previously unrecorded cultural heritage assets to be subject to construction impacts. As this resource is unknown, the magnitude of this impact cannot be assessed.

Mitigation

- 11.5.7 There will be an impact of negligible significance on a small modern shepherd / walker's cairn (A5). It is not proposed to mitigate this impact.

- 11.5.8 Impact significance cannot be meaningfully assessed for unknown assets, as neither the sensitivity of the receptor nor the magnitude of the effect is known. Consequently, only the likelihood of construction impact is considered here.
- 11.5.9 Above 400m AOD the potential for previously unrecorded assets to lie within the construction footprint and vulnerable to being affected by ground works is considered to be negligible. It is therefore considered that no mitigation is required within this area.
- 11.5.10 Below 400m AOD in the area of improved grazing and farmland it is considered that there is low to moderate potential for previously unrecorded cultural heritage assets to survive. Construction works in this area involves the construction of the access track: approximately 600m of this track will be a new construction, while 660m will involve improving the existing farm and forestry track. Any construction impacts upon previously unrecorded cultural heritage assets will be mitigated through a programme of archaeological works, to be agreed with the WoSAS as archaeological advisors to East Ayrshire Council. This programme will allow for features to be recorded appropriately and is likely to comprise a watching brief on ground-breaking works with further work being undertaken as appropriate.
- 11.5.11 Below 400m AOD in the area of plantation forestry it is considered that there is low potential for previously unrecorded cultural heritage assets. This area was not subject to a walkover survey in advance of this assessment as the nature of plantation forestry restricts visibility and the potential to carry out a successful survey. It is therefore proposed that a walkover survey of the construction footprint is carried out post-felling, yet prior to construction, to further inform the archaeological record. Any potential construction impacts identified through this survey will be taken into account and will be mitigated through a programme of archaeological works, to be agreed with the WoSAS. This programme will allow for features to be recorded appropriately and is likely to comprise a watching brief on ground-breaking works with further work being undertaken as appropriate.

Residual Impacts

- 11.5.12 No mitigation is proposed for the impact on the shepherds' cairn (A5). This impact will remain of negligible significance.
- 11.5.13 Following mitigation there will be no adverse residual construction impacts on any other cultural heritage assets.

Cumulative Impacts

- 11.5.14 The potential for cumulative construction impacts to arise from the proposed development in combination with other developments in the surrounding area has been considered. It is concluded that due to the distance between the developments and the nature of the cultural heritage assets in the area that there is no potential for cumulative construction impacts to occur.

11.6 Assessment of Operational Impacts

Predicted Impacts

- 11.6.1 The potential for the operational phase of the proposed development to affect cultural heritage assets has been considered. Setting issues are the only operational effect of the proposed development that have the potential to have significant impacts on cultural heritage assets. The starting point for the assessment of setting impacts is reference to the ZTV (as described in **Chapter 7 Landscape and Visual Assessment**), which is used to identify those assets where views to or from the asset may be changed by the proposed development. It should be noted that the ZTV is based on a bare earth model that does not allow for the masking

effects of local topography, vegetation and buildings. It is therefore possible for assets that are within the ZTV to, in reality, have no views which include the proposed development due to local conditions. This phase of work was therefore supported by site visits.

- 11.6.2 The setting of assets within the ZTV, or with relevant views to the asset within the ZTV, has been defined and the spatial / visual relationship of the proposed development to the asset and its setting briefly described. Where the development has the potential to have impacts on the setting of an asset, this has been taken forward to a detailed assessment.

Potential for Operational Impacts within the Middle Study Area

- 11.6.3 There are no designated assets of national importance within the middle study area. The only designated assets in the middle study area which are also in the ZTV of the proposed development are the Category B and C listed buildings in the town of New Cumnock. These assets include a Parish Church (HB14246), the ruins of an old church and graveyard (HB14247), a bridge (HB14248) and a town hall and police station (HB50128). The settings of these assets are all linked to their location within New Cumnock. The nearest turbine on Meikle Hill will be more than 6 km to the south of these listed buildings and the wind farm will not impact on the views which are of cultural significance to these assets, namely those in and around the surrounding town. It is therefore considered that the proposed development will not impact on the setting of the designated assets within the Middle Study Area.
- 11.6.4 No regionally important sites of schedulable quality are recorded within the middle study area.
- 11.6.5 Although not a cultural heritage asset itself, Glen Afton gains cultural heritage significance due to its associations with key characters of Scotland's history; William Wallace, Robert the Bruce, Mary Queen of Scots and Robert Burns. Glen Afton is considered to be an area of medium cultural heritage sensitivity.
- 11.6.6 Glen Afton remains largely used for upland grazing. It therefore may be presumed that the appearance of this glen has not changed much since the time in which the historical characters visited it. However there have been changes to this Glen including plantation forestry and overhead lines. Perhaps the modern feature which will have most greatly altered the setting of Glen Afton is the Hydro Electric Dam at Afton Reservoir which is likely to have changed the flow of water along Afton Water.
- 11.6.7 The proposed development will be visible from some areas within Glen Afton. However, it is considered that for those that look to associate this glen with William Wallace, Robert the Bruce, Mary Queen of Scots and Robert Burns, the character of the glen will not be lost. The different characteristics of beauty, isolation, safety and a route southwards which drew these characters to this glen will still be readily appreciated. It is considered that the addition of the proposed development on the hills above Glen Afton will have an impact of low magnitude on the setting of the glen. It is therefore considered that the proposed development will have an impact of minor significance on the cultural heritage significance of Glen Afton.

Potential for Operational Impacts in the Outer Study Area

- 11.6.8 The cultural heritage assets raised by consultees have been considered for potential impacts on their setting. Of the eleven assets, six (**Table 11.8**) lie fully outwith the ZTV of the proposed development and nor are there any third party viewpoints of cultural significance from which these assets will be viewed in combination with the proposed development. These assets will not be subject to an impact on their setting from the proposed windfarm and are therefore not considered further.

Table 11.8: Designated Heritage Assets in the Outer Study Area outwith ZTV

Ref No.	Name	Visibility
SM1034	Lamford Burn Cairn	Outwith ZTV and no third viewpoints from which the cairn and the turbines will be visible
HB14413	Dumfries House	Outwith ZTV and no third viewpoints from which the asset and the turbines will be visible
HB14414	Dumfries House Avenue Bridge	Outwith ZTV and no third viewpoints from which the asset and the turbines will be visible
HB14416	Dumfries House Dovecote	Outwith ZTV and no third viewpoints from which the asset and the turbines will be visible
HB18793	Craigengillan House	Outwith ZTV and no third viewpoints from which the asset and the turbines will be visible
HB18794	Craigengillan Stables	Outwith ZTV and no third viewpoints from which the asset and the turbines will be visible

11.6.9 The remaining five assets (Kings Cairn [SM-1046], Woodhead Lead Mines and Smelter [SM-5184], Craigengillan IGDL, Dumfries House IGDL and The Temple [HB-96]) raised in the outer study area (**Figure 11.3 Volume III**) are taken through to full assessment for operational impacts on their setting below.

11.6.10 The **King's Cairn** (index No. 1046) is the scheduled remains of a large circular chambered burial cairn with a smaller second cairn 330m to its southwest. The larger cairn has been robbed to the level of the chambers and was excavated in 1928. The second cairn appears to survive intact with a small modern cairn built on its east side. These cairns are located on a rise above the Water of Deugh. The area was formerly moorland but at present they are located within a clearing in forestry. Forestry felling is currently ongoing in the surrounding area and it can be presumed the plantation surrounding the cairns will be harvested in the near future.

11.6.11 These cairns both have intrinsic value as their fabric is a potential data source on funerary practices and ritual beliefs of the Neolithic to Bronze Age. This value has been slightly diminished for the larger of the two cairns due to the previous excavation and robbing of stones.

11.6.12 The contextual value of these cairns lies in their relationship with the surrounding landscape. The larger cairn is an example of a Bargrennan-type cairn. This group was initially classified based on their construction techniques (Henshall 1972, 6) and were later classified by their landscape setting (Cummings 2002). Cummings' (2002, 134-136) study recognised the following landscape features common to all Bargrennan-type cairns:

- They are located in areas of moorland
- They are roughly along rivers and river valleys but not right next to them (within 1.5 km)
- They are close to two streams (within 500 m)
- They have no views to the sea
- There is no intervisibility between Bargrennan cairns
- They are not highly visible in the landscape

- Views from the cairns are restricted (closed) in one direction, meaning that all but the immediate landscape is hidden from view
- 11.6.13 The King's Cairn falls into this description in that it is located in an area of moorland (planted with forestry), it is near to the river of the Water of Deugh, there are no views to the sea, there is no intervisibility to another Bargrennan cairn, and the King's Cairn would not have been highly visible in the landscape as it does not sit on the skyline but on the slopes of Brownhill Rig. Finally, views from this cairn would have been relatively restricted due to the rising ground to the east and west. The views from this cairn would have been along the valley of the Water of Deugh.
- 11.6.14 The King's Cairn has associative value in that it is promoted by Dumfries and Galloway Council as part of the Water of Deugh Trail. As a scheduled monument these cairns are considered to be of high sensitivity.
- 11.6.15 The hub of turbine 18 and the tips of turbines 17, 18, 19 & 20 will be visible from these cairns (once the forestry has been felled) at a distance of 5.6 km to the northeast (**Figure 11.4 Volume III**). At this distance, and with the limited visibility of the turbines, it is considered that they will have little effect on the cultural significance of these cairns. There are no important third viewpoints in the wider landscape toward this cairn, as views to this cairn are only possible from its immediate surroundings. The proposed development will have an adverse impact of negligible magnitude on the setting of the King's Cairn, constituting an impact of negligible significance.
- 11.6.16 **Woodhead Lead Mines and Smelter** (index No. 5184) are the scheduled remains of a lead mine dating to the mid-19th century. In addition to the mines, there is a well-preserved lead smelter with stone chimney and workers' cottages within the scheduled area. This asset is of intrinsic value as its fabric has the potential to enhance our knowledge of mining practices and welfare during the Industrial Revolution in southwest Scotland. As a purely functional development, this lead mine was positioned at a geological source of lead. It therefore only has a contextual relationship with its immediate surroundings. There is no associative value to this asset. The proposed development is 12.9 km northeast of the lead mines. The ZTV shows that the proposed development will only be visible from the very northwest corner of this asset. It is therefore considered that the proposed development will not impact the cultural heritage value of Woodhead Lead Mines and Smelter.
- 11.6.17 **Craigengillan** inventory garden and designed landscape is included in the inventory as "*an example of a complete and unfragmented estate started in the 16th century and held by one family (McAdam) for almost 400 years*" (Historic Scotland Craigengillan Inventory Report <http://data.historic-scotland.gov.uk/pls/htmldb/f?p=2400:15:0::::GARDEN:GDL00111>, accessed 11.10.2013). While the estate of Craigengillan has existed since the 16th century, the layout of the gardens and designed landscape dates to the late 18th to early 20th century. Craigengillan IGDL is a site of national importance and high sensitivity.
- 11.6.18 The proposed development will not be visible from any of the designated buildings within the IGDL; nor will it be visible from the designed approaches or routes around the IGDL which is located over 10 km from the nearest turbine. The ZTV demonstrates that Auchenroy Hill in the north west of the gardens is the only area within the Craigengillan inventory garden and designed landscape from which the proposed development will be visible. Even from the top of the Auchenroy Hill the visibility of the proposed development will be limited with only the very tips of five turbines (11, 12, 13, 19 & 20) visible on the wireline of the view (**Figure 11.5 Volume III**). The level to which the turbine blades appear over the horizon in the bare earth wireline suggests that any intervening woodland would block the view to the proposed development.

- 11.6.19 Due to the very limited visibility of the proposed development from Craigengillan IGDL, it is considered there will not be an impact on the setting of this asset.
- 11.6.20 **Dumfries House IGDL** is included in the inventory as “*the gardens, parkland and woodland make an enormous contribution to the surrounding Ayrshire valley scenery and date from the 17th century or earlier*”. The designed landscape also forms a very impressive setting for the category A listed Dumfries House. Dumfries House IGDL is a site of national importance and high sensitivity to impacts.
- 11.6.21 The ZTV demonstrates that with the exception of the north and east edge the IGDL lies outside the ZTV of the proposed development. This means that with the exception of the Temple (HB96), the proposed windfarm will not be visible in any of the views to or from the designated buildings within the IGDL. The only defined area from which the turbines may be visible is the drive, known as The Avenue, which enters the grounds from the north. As this is a tree-lined avenue it is unlikely that the turbines will be visible from this route except in the mid-winter or if there is tree blow. In the absence of trees the view from the avenue would be as that shown in the wireline **Figure 11.6 Volume III**, with the tips of 16 turbines appearing just above the horizon approximately 15 km to the southeast of the IGDL. There are no directed views from this avenue which will be affected by the proposed development. There will be very limited views to the proposed development from within Dumfries House IGDL and none of the key views to the house itself will be affected. It is therefore considered that the proposed windfarm will not have an impact on the cultural significance of Dumfries House IGDL.
- 11.6.22 The Category A listed building, known as **The Temple** (HB96), was originally intended to form a gateway at the end of the avenue on the main access north from Dumfries House. However, access from it to the main road to the north was denied by the owner of the intervening land, and it instead became a folly known as the Temple (<http://dumfries-house.org.uk/about/vision>, accessed 11.10.13). This highly ornamental gateway is now in a ruinous state. However, in June 2013 the temple secured grant-aid funding from Historic Scotland’s Building Repair Fund (<http://www.buildingsatrisk.org.uk/details/910077>, accessed 11.10.13). At present the Temple is overgrown with vegetation in an area of deciduous woodland at the very northern limit of Dumfries House IGDL. There are no significant views into or from this monument to other buildings within the IGDL. The cultural significance of this gateway derives largely from its architectural character and its part in the history of the IGDL.
- 11.6.23 The current intervening woodland will block views to the proposed development. If the trees are felled or subject to wind blow, the tips of 16 of the proposed turbines will be visible at a distance of 15 km to the southeast, this would be a similar view to that provided from the avenue **Figure 11.6 Volume III**. It is considered that this will not affect the cultural significance of this building and there will be no impact on the Temple.

Mitigation

- 11.6.24 There will be no operational impacts of greater than negligible significance. No mitigation is therefore proposed.

Residual Impacts

- 11.6.25 No mitigation is proposed for operational impacts. Where impacts have been identified they will remain of negligible significance.

Cumulative Impacts

- 11.6.26 The potential for cumulative operational impacts has been considered, taking into account the operational, consented, planning applications and scoping for

windfarms in the surrounding area as laid out in **Chapter 7 Landscape and Visual Assessment**. No operational impacts of greater than minor significance on cultural heritage assets have been identified during the course of this assessment. It is therefore considered that no significant cumulative impacts on the setting of cultural heritage assets will arise from the combination of the proposed development with any of the other windfarms.

11.7 Assessment of Decommissioning Impacts

Predicted Impacts

- 11.7.1 There will be no direct decommissioning impacts on cultural heritage assets. The shepherds' cairn (A5) will have been removed during the construction and there are no other recorded cultural heritage assets within the footprint of the proposed development.
- 11.7.2 Any previously unrecorded cultural heritage assets within the footprint of the development will have been recorded and removed during the construction phase. There will therefore be no decommissioning impacts on previously unrecorded cultural heritage assets.
- 11.7.3 Decommissioning will remove the operational impacts on the setting of cultural heritage assets. Therefore following decommissioning the impacts of negligible significance on the setting of the King's Cairn (index No. 1046) and minor significance on the setting of Glen Afton will be removed.

Mitigation

- 11.7.4 No mitigation is required for cultural heritage assets during the decommissioning phase of the development.

Residual Impact

- 11.7.5 There will be no residual impacts on cultural heritage assets as a result of decommissioning.

Cumulative Impact

- 11.7.6 No cumulative impacts will result from the decommissioning of the development.

11.8 Summary and Conclusions

- 11.8.1 Potential impacts of the proposed development upon cultural heritage assets resulting from its construction, operation and decommissioning have been considered (summarised **Table 11.9**).
- 11.8.2 Direct construction impacts are predicted for one cultural heritage asset within the inner study area, a shepherds' cairn (A5). This will result in an impact of negligible significance; as this will not be mitigated the residual impact will remain of negligible significance.
- 11.8.3 There is low to moderate potential for the construction phase to impact on previously unrecorded cultural heritage assets below 400 m AOD in the Inner Study Area. A programme of archaeological works for this area will be agreed with the West of Scotland Archaeology Service to mitigate such effects through preservation by record.
- 11.8.4 Potential operational effects upon the setting of cultural heritage assets in the surrounding area have been considered. The effect on the setting of cultural heritage assets is considered to be of no greater than of minor significance.

11.8.5 No cumulative impacts are predicted.

11.8.6 No potential decommissioning impacts are predicted.

Table 11.9 Summary of Impacts

Potential Impact	Significance	Mitigation	Residual Impact
Construction			
Direct construction impact on the shepherds' cairn (A5)	Negligible	None	Negligible
Low to moderate potential for previously unrecorded cultural heritage assets below 400m AOD	Unknown	Programme of archaeological works to be agreed with the West of Scotland Archaeology Service	None
Operational			
Operational impact on the setting of the King's Cairn (index No. 1046)	Negligible	None	Negligible
Glen Afton	Minor	None	Minor

11.9 References

- Burns R, 1791, Sweet Afton
- Historic Scotland, 2011, Scottish Historic Environment Policy
- Historic Scotland, 2010, Managing Change in the Historic Environment; Setting

Websites

- Barbour J, 1307, The Brus (ed AAM Duncan) from <http://www.arts.gla.ac.uk/STELLA/STARN/poetry/BRUS/contents.htm> accessed 02.10.13
- <http://newcumnock.wordpress.com/wars-of-independence/sir-william-wallace/blind-hary> accessed 18.10.13
- http://members.tripod.com/bob_newcumnock /pnwallace/welcomex.html
- <http://data.historic-scotland.gov.uk/pls/htmldb/f?p=2400:15:0:::GARDEN:GDL00111> accessed 11.10.2013
- <http://dumfries-house.org.uk/about/vision> accessed 11.10.13
- <http://www.buildingsatrisk.org.uk/details/910077> accessed 11.10.13

Early Maps (in chronological order)

- Pont T, ca 1583-1614, Nithsdale: part of Teviotdale
- Gordon R, 1636-1652, Cuningham
- Gordon R, 1644, Nithsdail descryved to Mr Timothe Pont his papers/be R.Gordon

- Blaeu J, 1654, Nithia Vicecomitatus, The Shirrifdome of Nidis-dail/aucture Timotheo Pont
- Roy W, 1747 – 1755, Military Survey of Scotland
- Ordnance Survey, Pub 1860, Ayrshire sheet XLVIII, Surveyed 1843-52, 1:10560
- Ordnance Survey, Pub 1896, Ayrshire sheet XLVIII.SW, Surveyed 1894, 1:10560
- Ordnance Survey, Pub 1897, Ayrshire sheet XLVIII.NW, Surveyed 1894, 1:10560
- Ordnance Survey, Pub 1910, Ayrshire sheet XLVIII.NW, Surveyed 1908, 1:10560
- Ordnance Survey, Pub 1910, Ayrshire sheet XLVIII.SW, Surveyed 1907, 1:10560

Aerial Photographs

Sortie	Frame	Date
106G_UK_0090	4251-4253	12.05.46
ASS_621_88	0237 - 0239	10.06.88

12 Noise and Vibration

12.1 Introduction

- 12.1.1 This chapter assesses the potential noise and vibration impacts of the proposed development at nearby sensitive receptors.
- 12.1.2 The assessment considers the construction and operation phases of the proposed development, and has been conducted in accordance with current Scottish Government policy on windfarm noise, relevant standards and best practice guidance. The assessment determines whether the potential noise and vibration impacts of the development are significant and, where necessary, outlines measures to mitigate any significant adverse impacts.
- 12.1.3 Although designed to operate quietly, modern wind turbines emit noise in the audible frequency range whilst operating. Noise is primarily generated by the blades passing through the air, which is referred to as ‘aerodynamic noise’ and by the rotating parts such as the gearbox and generator in the nacelle which is referred to as ‘mechanical noise’. Mechanical noise from a modern wind turbine is negligible, as the nacelles are insulated to reduce noise emissions and the various mechanical components housed within the nacelle are acoustically isolated to prevent structure-borne noise. Thus the level of turbine noise is generally determined by aerodynamic noise and is related to the speed at which the blades rotate. Noise emissions typically increase with wind speed until the rated power output is reached, after which, there little or no increase in noise associated with further increases in wind speed.
- 12.1.4 Whilst every effort has been made to make this chapter clear and concise, acoustics is a branch of physics and the use of technical terms is unavoidable. To aid readers without a background in acoustics an introduction to fundamental noise and vibration concepts, metrics and terminology is provided in **Appendix 12.1 Volume IV**.

Proposed Development

- 12.1.5 The application site lies within part of an extensive area of forestry plantation known as Carsphairn Forest. New Cumnock is the closest settlement to the site, lying approximately 2.5 km to the north at its nearest point. Afton Reservoir is located about 1.5 km to the south east.
- 12.1.6 In summary, the proposed development comprises 21 wind turbines with a potential generation capacity of around 3.2 megawatts (MW) each. The development also includes access tracks, a control building and substation compound, a construction compound, and four borrow pits. This assessment is based on the project description provided in **Chapter 4**.
- 12.1.7 The candidate turbine for the proposed development is the Siemens SWT 3.2MW with a hub height of 74.5 m. The final choice of turbine may differ from the candidate; however the turbine proposed is considered typical of its class.
- 12.1.8 The turbine coordinates, types and hub heights for the proposed development and all cumulative wind developments considered in this assessment are presented in **Chapter 4**. A map showing location of the turbine in relation to local noise receptors is provided in **Figure 12.1 Volume III**.
- 12.1.9 The area can be characterised as rural / agricultural with few sources of transport noise in the vicinity of the receptors, other than the A76 which runs through New Cumnock, and one minor road (Afton Road).
- 12.1.10 In the vicinity of the noise receptors there are some remote farms (e.g. Craigdarroch Farm, Lochingerroch Farm and Pencloe Farm). To the south east of the development is Afton Reservoir, which has filter station / water works buildings located at its northern end.

- 12.1.11 In general, the area can be said to have a very low background noise climate due to the absence of significant sources of background noise.

12.2 Policy, Legislation and Guidance

- 12.2.1 Relevant national and local policies have been reviewed with regards to potential noise impacts for the proposed development and an assessment made as to the compliance of the project with these in the **Planning Statement** which accompanies the S36 application.

Planning Advice Note PAN 1/2011

- 12.2.2 Planning Advice Note PAN 1/2011 provides advice on the role of the Scottish planning system in helping to prevent and limit the adverse effects of noise from development.

- 12.2.3 In respect of wind farms PAN 1/2011 identifies that the two main sources of noise are mechanical noise from the turbines and aerodynamic noise from the blades. For further detail on this planning issue, PAN 1/2011 directs the reader to The Scottish Government web site online guidance entitled 'Onshore wind turbines'. The online guidance 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. 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.

- 12.2.4 The online guidance also refers to several other notable reports on wind farm noise issues:

- An Analysis of How Noise Impacts are Considered in the Determination of Wind Farm Planning Applications, Research Contract 01.08.09.01/492A (Analysis), 6 April 2011, Hayes McKenzie Partnership Limited for DECC;
- Research into Aerodynamic Modulation of Wind Turbine Noise: Final report, Contract number NANR233, July 2007, University of Salford for DBERR; and
- The Measurement of Low Frequency Noise at Three UK Wind Farms, Contract Number W/45/00656/00/00, URN Number 06/1412, 2006, Hayes McKenzie Partnership Limited for DTi

Ayrshire Local Policy

- 12.2.5 'Supplementary Planning Guidance (SPG) on Wind Farm Development' published by Ayrshire Councils provides developers with greater clarity regarding those areas where the principle of development is likely to be acceptable and to provide further explanation regarding the criteria against which new development will be assessed.

- 12.2.6 In relation to noise, the document states the following:

"Noise - as a general rule a minimum separation distance of 700m from a dwelling house, work place or community facility to a turbine will be required. Exceptionally if turbines are to be located closer than this, the developer will be required to demonstrate that the impacts are acceptable. Good acoustic design and siting of turbines is essential to ensure there is no significant increase in ambient noise levels such that it can affect the amenity. Properties in the vicinity of a windfarm should not experience noise levels in excess of 35dB(A) under all wind conditions."

ETSU-R-97

- 12.2.7 A working group established by the Energy Technology Support Unit (ETSU) of the former Department of Trade and Industry (the functions of which are now performed by the Department of Business, Innovation and Skills) considered in detail the issues associated with wind turbine noise and subsequently published a report entitled 'The Assessment and Rating of Noise from Wind Farms' (ETSU-R-97) in 1996.
- 12.2.8 The working group recommended the application of separate daytime and night time noise limits at the nearest residential properties and indicated that these limits should generally be set relative to the background noise levels at the dwellings. However, in particularly quiet areas where it is not appropriate to use the margin above background approach in order to provide a reasonable degree of protection to the wind farm neighbour, ETSU-R-97 also recommends fixed noise limits. In all cases the ETSU-R-97 noise limits are aimed at protecting the daytime amenity of outdoor areas near dwellings and sleep indoors during the night time.
- 12.2.9 It should be noted that the ETSU-R-97 noise limits are intended to offer a reasonable degree of protection to residents, but do not guarantee inaudibility.
- 12.2.10 The acceptable noise limits for wind turbine noise at different times of the day are defined in ETSU-R-97. Quiet daytime periods are defined as:
- Every evening between 18:00 to 23:00hours;
 - Saturday afternoon from 13:00 to 18:00hours; and,
 - Sundays from 07:00 to 23:00hours.
- 12.2.11 The night time period is defined as 23:00 to 07:00hours.
- 12.2.12 For residential properties where the measured quiet daytime (often called amenity hours) period noise levels exceed 30-35dB L_{A90} or during the night time exceed 38dB L_{A90} , noise limits are derived from background noise levels. The quiet daytime and night time relative noise limits derived from the background noise levels are set to a level 5 dB(A) above the best fit curve to the background noise data for that period over a wind speed range of up to 12m/s.
- 12.2.13 At properties in particularly quiet areas where the daytime amenity noise levels may be less than 30-35 dB(A), it is generally appropriate to adopt the lower fixed ETSU-R-97 noise limits i.e. 35-40 dB(A) daytime and 43 dB(A) night time. The precise choice of the daytime lower fixed level within the range 35–40 dB(A) depends on a number of factors:
- The number of noise affected properties;
 - The likely duration and level of exposure; and
 - The potential power output of the wind turbine(s).
- 12.2.14 At night, ETSU-R-97 prescribes an external lower fixed noise limit of 43 dB(A). This is higher than during the day because at night most people are indoors and additional attenuation of wind farm noise is afforded by the building envelope, even assuming an open window. The lower fixed noise limit of 43 dB(A) outside at night is based on achieving an internal noise level of 35 dB(A) within the bedroom with an open window.
- 12.2.15 At residential properties where the occupier has a financial involvement in the proposed wind farm, a fixed noise limit of 45dB L_{A90} , is considered appropriate by ETSU-R-97 for both the daytime and night time periods. These increased noise limits recognise that disturbance and annoyance by noise are influenced by the resident's attitude towards the noise source.

BS5228:2009 + A1 2014

- 12.2.16 Construction noise sources may be either stationary or mobile, may produce impulsive or steady noise and the noise is temporary in duration.
- 12.2.17 British Standard 5228: 2009 “Code of Practice for Noise and Vibration Control on Construction and Open Sites – Part 1: Noise” provides methods of estimating construction noise for the three situations described above, a database of heavy plant noise emissions and advice for noise control on construction sites.
- 12.2.18 The Standard also includes several example methods for determining the thresholds at which ‘significant effects’ (which to avoid confusion with EIA Terminology can be considered to be the threshold of the potential for disturbance) may occur at residential dwellings. The most sophisticated of these methods is the ‘ABC’ method, which is based on the existing ambient noise level with cut-offs, and is set out in **Table 12.7**.

International Standard ISO 9613:1996

- 12.2.19 ISO 9613 is established as the primary Standard used in Britain, Northern Ireland and much of Europe for the calculation of environmental sound propagation. The Standard is divided into two parts: Part 1 provides a method for calculating the attenuation of sound due to atmospheric effects, while Part 2 provides a general method of calculation for environmental sound propagation.
- 12.2.20 The noise prediction method described in Part 2 of the standard is general and is intended to be suitable for a wide range of engineering applications where the noise level outdoors is of interest. A joint European Commission research project into noise prediction methods for wind farms found the ISO 9613-2:1996 method to give the best agreement with measured wind farm noise levels at large separation distances for flat, rolling and complex terrain sites.
- 12.2.21 The method predicts noise levels under metrological conditions favourable to noise propagation from the sound source to the receiver, such as downwind propagation, or equivalently, propagation under a well-developed moderate ground based (surface) temperature inversion as can occur during low wind conditions at night. Downwind propagation conditions are quantified as those where the wind direction is within 45 degrees of line between the turbine and the receiver, at wind speeds in the range 1- 5 m/s.
- 12.2.22 Alternatively, the method can be corrected to predict the long term average noise level over a period, often several months, which considers a variety of metrological conditions. Calculation of the long term average noise level requires statistical information on wind speed, wind direction and atmospheric temperature gradients.

Institute of Acoustics Good Practice Guide

- 12.2.23 In 2010, the Department of Energy and Climate Change (DECC) initiated a review of how noise impacts are considered in the determination of wind farm planning applications. The review identified many variances in the noise assessments for different sites, highlighting differences in the structure of reports and how information was presented, with varying interpretations of ETSU-R-97 resulting in different approaches to issues such as measuring background noise levels, undertaking noise predictions, assumed input variables and how noise limits at properties were formulated. It concluded that the details of the way the assessments were carried out could be difficult to establish, even for those who are familiar with the issues, and this may be challenging for a planner or environmental health officer tasked with reviewing an application. The review recommended that further best practice guidance on the application of ETSU-R-97 and related issues should be provided.

- 12.2.24 Accordingly, the Institute of Acoustics (IoA) was tasked by DECC to take forward (where possible) the recommendations of the 2011 review. This exercise resulted in the 'Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise' (GPG) which was published in May 2013 and which aims to confirm clarify and add to the way ETSU-R-97 should be implemented in practice.
- 12.2.25 While ETSU-R-97 remains the document that sets out government policy in relation to wind turbine noise limits, the GPG represents the current good practice in its implementation. It is intended that as further developments in good practice develop, the guide will be revised accordingly.
- 12.2.26 Issues covered by the GPG include:
- Stakeholder Engagement;
 - Definition of Study Area;
 - A framework for stakeholder engagement;
 - Survey methodology;
 - Treatment of measured data;
 - Appropriate noise prediction methods; and
 - Advice for cumulative assessments.
- 12.2.27 It should be noted that the GPG was published during the course of this project. In particular, the monitoring was undertaken prior to its publication, and some of the advice in the document was not known at the time of the survey.

12.3 Methodology

Consultation

- 12.3.1 The scope of the noise assessment for the proposed development was set out in the Scoping Request submitted to East Ayrshire Council (EAC) in 2012. It was proposed that the operational noise assessment of predicted turbine noise levels and formulation of noise limits derived from background noise data would be undertaken in accordance with ETSU-R-97.
- 12.3.2 Operational vibration was scoped out of the project in the scoping report due to the low potential for impact.
- 12.3.3 The scoping response received stated the following in relation to noise:
- Noise predictions should be carried out to evaluate the likely impacts of airborne noise from the wind turbines and associated construction activities including noise from blasting or piling activities which may affect local residents, during construction, operational and decommissioning stages of the project. Advice should be sought from the relevant Council planning and/or environmental health departments in respect to the potential impacts on the local community.*
- The applicant should be aware of the guidance produced by ETSU on behalf of the DTI titled "The Assessment and Rating of Noise from Wind Farms". This publication provides applicants with best practice noise monitoring and reporting techniques. Cumulative noise effects should also be considered in assessing the specific circumstances prevailing at the development site. Applicants may also want refer to PAN 1/2011 in this respect.*
- 12.3.4 A letter was written by SKM (now Jacobs) to Bill Gilchrist of East Ayrshire Council dated 29th January 2013 setting out the proposed assessment approach, monitoring methodology, and sites identified for cumulative assessment.

- 12.3.5 East Ayrshire Council were also invited to attend the set-up of the noise monitoring equipment, but were unavailable to do so.
- 12.3.6 Further correspondence was undertaken in relation to the background monitoring locations. An email from East Ayrshire Council dated 07/03/13 advised that the assessment should list all properties that were approached to accommodate noise monitoring equipment, in order to demonstrate the attempts that were made.

Operational Noise Assessment Scenarios

- 12.3.7 The operational scenarios detailed in **Table 12.1** below have been agreed with East Ayrshire Council and are considered in this assessment.

Table 12.1: Operational Noise Assessment Scenarios

Wind Farm	Planning Status*	Scheme Only	Cumulative
Pencloe	(S)	✓	✓
Afton	(C)		✓
Ashmark Hill	(A)		✓
Hare Hill Extension	(C)		✓
Hare Hill	(E)		✓
Windy Standard Extension	(C)		✓
Windy Standard	(E)		✓

* Key:

- (E) Existing
- (C) Consented
- (A) Application submitted
- (S) Scoping report submitted

Data Sources

Turbine Sound Power Data

- 12.3.8 The sound power levels for the turbines used in the assessment have been detailed by the manufacturers through measurement in accordance with International Standard IEC 61400-11 Wind turbine generator systems – Part 11: Acoustic noise measurement techniques.
- 12.3.9 The sound power data sources for each are described in **Table 12.2**. Also shown are the uncertainty corrections that have been applied to each set of sound power data, as recommended by the manufacturers for each turbine.

Table 12.2: Turbine Sound Power Data Sources & Uncertainty Corrections

Windfarm Development	Turbine Model	Sound Power Data Source	Uncertainty Correction added to data
Pencloe	Siemens SWT-3.2-101 (74.5 m Hub Height)	SWT-3.2-101, Rev. 0, Hub Height 74.5 m Standard Acoustic Emission. Document ID: E W ON UNA COE LS GS-10-0000-0000-00 dated 27/05/2014	+2 dB
Afton	NEG Micon NM80 2750 kW (80 m Hub Height)	Sound Power Level Wind Turbine NM80/2750 Report no. P8.012.02	+ 2 dB
Ashmark Hill	Vestas V90 3.0 MW (80 m Hub Height)	General Specification V90-3.0 MW Mk 9 Document no: 0029-5249 V01 dated 06/11/2012	+ 2 dB
Hare Hill	Vestas V47 660 kW (40.5 m Hub Height)	General Specification 660 kW Variable Slip Wind Turbines, Vestas document 943111.R4 dated 02/05/00	+ 2 dB
Hare Hill Extension	Vestas V52 850 kW (60 m Hub Height)	V52-850kW Noise Emission Report, Vestas document 946517.R0 dated 22/08/00	+ 2 dB
Windy Standard	Vestas V47 660 kW (40.5 m Hub Height)	General Specification 660 kW Variable Slip Wind Turbines, Vestas, 943111.R4 dated 02/05/00	+ 2 dB
Windy Standard Extension	Vestas V90 3.0 MW (80 m Hub Height)	General Specification V90-3.0 MW Mk 9 Document no: 0029-5249 V01 dated 06/11/2012	+ 2 dB

Table 12.3 details the sound power levels from the data sources detailed above that have been used in the assessment. These values include the uncertainty corrections detailed above.

Table 12.3: Overall sound power levels for assessed turbines

Turbine Model	Sound Power Value								
	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10 m/s	11 m/s	12 m/s
Siemens SWT-3.2-101 (74.5 m Hub Height)	101.6	106.3	108.5	109.0	109.0	109.0	109.0	109.0	101.6
NEG Micon NM80 2750 kW (80 m Hub Height)	92.3	96.1	101.2	103.1	103.9	104.7	105.5	105.5	105.8
Vestas V90 3.0 MW (80 m Hub Height)	99.9	102.9	106.2	108.1	109.0	108.9	107.6	107.2	107.3
Vestas V47 660 kW (40.5 m Hub Height)	100.3	100.7	101.1	101.4	101.8	102.2	102.5	102.9	103.3
Vestas V52 850 kW (60 m Hub Height)	101.7	102.8	103.9	105.0	106.1	107.2	108.3	109.4	110.5

- 12.3.10 The octave band data for the proposed turbine at 8m/s wind speed are presented below in **Table 12.4**.

Table 12.4: Octave band sound power spectra

Turbine Model	Sounds Power Spectrum at 8 m/s							
	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz
Siemens SWT-3.2-101 (74.5 m Hub Height)	89.4	95.8	99.7	101.5	104.5	102.6	96.5	82.9
NEG Micon NM80 2750 kW (80 m Hub Height)	87.2	94.2	96.5	100.1	99.3	95.5	85.2	71.6
Vestas V90 3.0 MW (80 m Hub Height)	93.8	96.0	99.3	101.6	103.8	102.5	98.7	88.7
Vestas V47 660 kW (40.5 m Hub Height)	78.5	86.1	92.6	97.9	96.7	91.7	85.7	70.7
Vestas V52 850 kW (60 m Hub Height)	82.4	90.3	96.1	101.7	101.4	97.5	91.1	80.9

Baseline Data Collection Procedure

Monitoring Locations

- 12.3.11 A baseline noise survey has been undertaken to characterise the existing background noise levels at residential receptors in the vicinity of the proposed development.
- 12.3.12 The closest existing residential properties to the proposed development have been identified using the Ordnance Survey Address Layer 2 product which provides land use class data for buildings. A planning search has also been conducted to identify any dwellings that are proposed or consented and thus may be built in the future. This search identified no such dwellings.
- 12.3.13 These properties were then assessed as to their requirement for a background noise survey by testing against a 35 dB L_{A90} criterion. The guidance from ETSU-R-97 states that where it can be demonstrated that the expected levels of wind turbine noise would not exceed 35dB L_{A90} at a property for wind speeds of up to 12 m/s at 10 m height, then no background noise survey is required for that property; where predicted noise levels exceed 35 dB L_{A90} the background noise levels need to be determined by measurement.
- 12.3.14 The address, identification number (ID), and co-ordinates of each of the residential receptors considered by this noise assessment are presented in **Table 12.5**. Residents at the following addresses were contacted in order to request permission to undertake noise monitoring at their properties.

Table 12.5: Properties in Study Area

ID	Address	BNG Coordinate		Closest Turbine	Distance (m)
		X (m)	Y (m)		
ID1	Lynn View, New Cumnock,	262718	605712	T4	1300
ID2	Craig Braneoch, New Cumnock	263160	606413	T4	1590
ID3	Corbyhill, New Cumnock	263165	606422	T4	1596
ID4	Craigdarroch Farm, New Cumnock	263316	606543	T4	1757
ID5	Craig An Dhu, New Cumnock,	263433	606463	T4	1866
ID6	The Craigs, New Cumnock	263441	606451	T4	1873
ID7	Black Craig Farm, New Cumnock	263425	608153	T1	2334
ID8	Pencloe Farm Cottage, New Cumnock	261858	609486	T1	2334
ID9	Pencloe Farm, New Cumnock	261851	609529	T1	2374
ID10	Lochingerroch Farm, New Cumnock	262292	609447	T1	2441
ID11	Lochbrowan Farm, New Cumnock	262212	609754	T1	2695

12.3.15 Positive responses were received from two locations, which were judged to adequately represent the noise environments at the receptors where the preliminary noise modelling identified potential turbine noise levels in excess of 35 dB(A). The background noise monitoring locations are detailed in **Table 12.6** and shown on **Figure 12.2 Volume III**.

Table 12.6: Noise Monitoring Locations

NML	Address and Identification (ID) number	Monitoring Position	Subjective Noise Assessment	Location represents background noise at which receptors
NML1	ID5 Craig An Dhu, Afton Road, New Cumnock	SLM set up within the rear garden of the property. NS 62703 05697	No significant noise sources audible, other than wind noise in coniferous trees at Carsphairn Forest. No noise audible from water works during set up.	ID1 ID5
NML2	ID4 Craigdarroch Farm, Afton Road, New Cumnock	SLM set up >4m from northernmost outbuilding at Farm. NS 63294 06590	No significant noise sources audible. Noise from Afton Burn faintly audible in general area, but measurement location selected to minimise any noise from Burn affecting measurements, by using screening provided by nearby farm building. No noise audible from agricultural activity during site attendance.	ID2 ID3 ID4 ID6

12.3.16 It should be noted that the background noise levels for ID8 – ID11 have previously been quantified and are reported in the ES for Ashmark Hill Windfarm. This is discussed in greater detail in **Section 12.4.10**.

Noise Data

- 12.3.17 A background noise monitoring survey was undertaken between Monday 14th March 2013 and Monday 22nd April 2013. The monitoring period was determined by the length of time required to measure a sufficient range of wind speeds (0 – 12m/s) as defined in ETSU-R-97. Copies of the calibration certificates for the sound level meters used during the monitoring survey are provided in **Appendix 12.2 Volume IV**.
- 12.3.18 Norsonic Type Nor140 and Nor118 Precision Integrating Sound Level Meters (SLM) fitted with Nor1212 outdoor microphone kits were used for the survey. These systems retain their Class 1 specifications according to IEC6051 and IEC61672-1 with the weather protection in place.
- 12.3.19 Each SLM was powered by a 12v battery pack and housed within a sealed and locked weather enclosure. The timing clocks on the sound level meters were synchronised to Co-ordinated Universal Time (UTC).
- 12.3.20 Each monitoring point was set up more than 3 m from the nearest building façade, with the microphone approximately 1.5 m above ground level. All microphones were located away from reflective façades in a location deemed to be representative of background noise at the property. The microphones were located away from any obvious local sources of noise, for example boiler flues. The SLMs were set to log at the required 10 minute averaging periods, logging the L_{A90} , L_{Aeq} and a range of other parameters. The sound level meters were field calibrated on deployment and recovery, and exhibited drift of less than 0.1 dB.

Wind Data

- 12.3.21 Wind data was recorded on the temporary meteorological instrument mast located on the application site at grid reference NS 61186 05688 using anemometers located at 60 m and 40 m. The wind data was logged and time stamped relative to UTC and the 10 minute wind speed samples were synchronised with the noise measurements.
- 12.3.22 The wind speed measurements were undertaken and processed in accordance with the guidance in the Institute of Acoustics GPG and form the basis of subsequent calculations to determine the wind shear at the site. The wind speeds at 10 m height against which the noise data are correlated are derived as follows:
- The wind speeds at 40 m and 60 m have been measured for each measured 10-minute period and used to calculate the wind shear exponent;
 - The calculated exponent was then applied to the 60 m data to predict wind speed at the hub height of 74.5 m; and
 - The 74.5 m hub height wind speed was then converted to a 10 m height wind speed using the standard level of shear assumed by turbine manufacturers in certifying turbine noise emissions, to maintain the requirement of ETSU-R-97 of deriving noise limits referenced to a 10 m height wind speed.

Rain data

- 12.3.23 Rainfall was measured throughout the monitoring period using a tipping bucket rain gauge located at Noise Monitoring Location 2.
- 12.3.24 This rain gauge (manufactured by Logic) activates on 0.25 mm rainfall. Where it is evident that rainfall has occurred during a sample period, background noise levels have been removed from the quiet daytime and night time periods. An additional 10 minute period either side of those rain affected periods has also been excluded from the regression analysis in recognition that the time of rainfall may vary across the extent of the study area.

Significance Criteria

Construction Noise Assessment Significance Criteria

- 12.3.25 BS 5228-1 (2009) + A1 (2014) includes example thresholds of 'significant effects'. These thresholds can be based on the 'ABC' method, which takes into account the existing ambient noise levels in the area, along with predicted construction noise levels. It should be noted that the thresholds in BS 5228-1:2009 are examples and therefore there is scope for them to be adapted, if deemed necessary to local circumstances.
- 12.3.26 Example thresholds of significant effects (or potential disturbance), using the ABC methodology as set out in Annex E of BS5228-1:2009, are detailed in **Table 12.7**.

Table 12.7: Construction Noise Thresholds

Assessment category and threshold value period (L _{Aeq})	Threshold Value, in decibels (dB)		
	Category A ^{A)}	Category B ^{B)}	Category C ^{C)}
Night-time (2300 – 0700)	45	50	55
Evenings and weekends ^{D)}	55	60	65
Daytime (0700 – 1900) and Saturdays (0700 – 1300)	65	70	75
NOTE 1:	A significant effect has been deemed to occur if the total L _{Aeq} noise level, including construction, exceeds the threshold level for the Category appropriate to the ambient noise level		
NOTE 2:	If the ambient noise level exceeds the threshold values given in the table (i.e. if the ambient noise level is higher than the above values), then a significant effect is deemed to occur if the total L _{Aeq} noise level for the period increases by more than 3 dB due to construction activity		
NOTE 3:	Applied to residential receptors only		
A)	Category A: Threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are less than these values		
B)	Category B: Threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are the same as Category A values		
C)	Category C: Threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are higher than Category A values		
D)	1900 – 2300 weekdays, 1300 – 2300 Saturdays and 0700 – 2300 Sundays		

- 12.3.27 The appropriate noise limit for a project in an area such as the Application site, based on the likely background noise levels in rural areas, would be 65dB L_{Aeq,12hrs} (or L_{Aeq,T}). For the purposes of this assessment, any construction noise level exceeding this limit is considered to comprise a significant impact under the terms of the EIA Regulations.

Operational Noise Assessment Significance Criteria

- 12.3.28 It is acknowledged that the majority of noise related guidance and standards, along with ETSU-R-97, are not directly related to the concepts of 'significant' and 'not significant' that underpin the EIA process. However in order to comply with EIA regulations, all 'significant' effects must be identified. For the purposes of this study, however, the assessment of significant operational noise effects is based upon compliance with the ETSU-R-97 limits, and a breach of the noise limits indicates a 'significant' effect, whereas compliance with noise limits indicates that the effect is 'not significant'.

Noise Prediction Methodology

Construction Noise Predictions

- 12.3.29 Indicative predictions of construction noise have been undertaken using the BS5228 methodology, and assume that all plant is located at the closest approach to each receptor (i.e. at the nearest turbine location, substation, lay down area, or access track). The conservative assumption of acoustically hard ground has also been made.
- 12.3.30 For each plant item details of sound power levels for the construction plant have been taken from BS 5228:2009 + A1 2014 which incorporates the updated DEFRA database (DEFRA, 2005).

Operational Noise Predictions

- 12.3.31 The noise modelling software SoundPlan v7.2 has been used in this assessment, which implements the noise propagation algorithms detailed within ISO 9613-2:1996.
- 12.3.32 SoundPlan uses topographical information to generate a model of the study area. A digital terrain model (DTM) was derived from the Ordnance Survey Land-Form PROFILE 10 m interval point data using ArcGIS spatial analyst tools.
- 12.3.33 ISO 9613 is established as the primary standard used in the UK and much of Europe for the calculation of environmental sound propagation. The ISO 9613 method considers the following major mechanisms of noise attenuation:
- Geometrical divergence (also known as distance loss) (Adiv);
 - Atmospheric absorption (Aatm);
 - Ground effect (Agr);
 - Reflection from surfaces;
 - Screening by obstacles (Abar); and
 - Miscellaneous effect (Amisc).
- 12.3.34 The method predicts noise levels under meteorological conditions favourable to noise propagation from the sound source to the receiver, such as downwind propagation or alternatively, propagation under a well-developed moderate ground based (surface) temperature inversion as can occur during low wind conditions at night.
- 12.3.35 Additional guidance on appropriate calculation methodologies and input parameters was proposed in July 2012 by the IoA in their 'Good Practice Guide to the application of ETSU-R-97 for Wind Turbine Noise Assessment' (GPG), and these have been implemented for this assessment.

12.3.36 In particular, the following guidance has been followed:

- LA90 levels have been determined from calculated LAeq levels by subtraction of 2 dB;
- Predictions have been based on octave band frequency data;
- Equation 9 of ISO9613-2 has been used to calculate ground effects;
- A ground factor of $G=0.5$ has been used, in combination with emission levels which include a margin of uncertainty;
- A receiver height of 4.0 m, and atmospheric conditions of 10°C and 70% humidity have been used;
- Topographic screening effects of the terrain has been limited to a reduction of no more than 2 dB, and then only if there is no direct line of sight between the highest point on the turbine rotor and the receiver location.
- A further correction of +3 dB has been added to the calculated overall A-weighted noise level for propagation across a concave ground profile (this was not judged to occur for any of the considered receptors).

Calculation of Wind Shear

12.3.37 The level of wind shear at a particular location defines the relationship between wind speeds at different heights. A low level of wind shear means that the wind speed at the hub height of the turbines is not much greater than that near the ground, whereas a high level of wind shear means that the wind speed at hub height is significantly greater than that near the ground.

12.3.38 ETSU-R-97 recommends using wind data recorded at 10 m height to determine how background noise levels at receptors vary with wind speed at a site. However this has raised concerns that this methodology may not accurately predict turbine noise, since turbine hub heights have increased significantly since ETSU-R-97 was published and thus wind speeds at the hub height may be significantly greater than at 10 m above ground level.

12.3.39 To overcome this potential issue, the GPG suggests wind speeds are logged at various anemometer heights. This allows the calculation of site specific wind shear exponents which can be used to estimate hub height wind speeds from the measured wind speeds and which can then be referenced to wind speeds at a standardised height of 10 m above ground level.

Other Issues Associated with Wind Turbine Noise Assessment

Infrasound and Low Frequency Noise

12.3.40 Infrasound is often described as sound that is lower in frequency than 20 Hz. The frequency of 20 Hz used to be regarded as the lower threshold of hearing, however, more recent research has demonstrated that the threshold of hearing may be as low as 4 Hz in special listening conditions if the level is sufficient (Watanabe and Møller, 1990). Low frequency noise is taken to be sound in the range around 20 – 200 Hz, which is at the lower end of the normal hearing range exhibited by adults.

12.3.41 Infrasound is primarily sensed by the ear, the sensitivity of which decreases with frequency. To be perceived, the sound pressure level of the infrasound must exceed the threshold of hearing. At higher intensities, infrasound may also be felt as vibrations in other parts of the body. Infrasound is typically measured using the 'G' weighting network.

- 12.3.42 There are many natural sources of infrasound, such as wind, waves acting on a beach and rapids/waterfalls in a river. Infrasound may also be caused by human activities such as transportation (road, rail and aircraft) and by other machinery including wind farms.
- 12.3.43 The biological effects of infrasound have not been extensively studied, but it is not considered damaging to hearing at levels below 120 dB (WHO, 1995). There are reports of infrasound causing adverse health effects such as stress, irritation, fatigue and sleep disturbance, but the levels at which these effects may occur are much greater than the thresholds of audibility. There is no reliable evidence that infrasound below the hearing threshold produces physiological or psychological effects (WHO, 1995).
- 12.3.44 An ETSU study published in 1997 undertook measurements at a wind farm in the UK which consisted of eleven 450 kilowatt (kW) machines. The study concluded that infrasound was well below accepted thresholds of perception, and low frequency noise was also found to comply with recommended residential criteria, even on the wind farm site itself.
- 12.3.45 More recently the former Department of Trade and Industry commissioned Hayes McKenzie Partnership Limited to investigate infrasound and low frequency noise from wind turbines. Measurements of noise levels were undertaken at three wind farms where infrasound had previously been identified by neighbours as a source of annoyance. The report (Hayes Mackenzie Partnership) which was published in 2006 concluded that the infrasound emissions from wind farms are significantly below the threshold for perception, and that the levels of infrasound are not significant. The report did however note that it was likely that the complaints were not caused by low frequency noise, but by amplitude modulation of aerodynamic noise from the wind turbines.

Amplitude Modulation

- 12.3.46 Elements of wind turbine noise are described as having a 'whooshing' or 'swishing' characteristic. This is a description of how the noise from turbines rises and falls, at the rate at which the blades rotate. The noise level (or amplitude) varies with time in a regular way and this phenomenon is often referred to as Amplitude Modulation (AM – also called aerodynamic modulation). This is noticeable close to a turbine and generally reduces as the distance from the turbine increases. This phenomenon was considered by the Noise Working Group when the noise limits defined in ETSU-R-97 were established.
- 12.3.47 In a response to the 2006 low frequency noise report by Hayes McKenzie Partnership Limited, Defra (Department for Environment, Food and Rural Affairs), BERR (Business Enterprise and Regulatory Reform, now Department for Business Innovation & Skills) and CLG (Department for Communities and Local Government) jointly commissioned Salford University to further study the aerodynamic modulation of wind turbine noise. The resulting report (University of Salford, 2007) concludes that the incidence of AM at wind farms is very limited in terms of the number of people affected. In response to this, the Government decided not to commission any further research but to 'continue to keep the issue under review'.
- 12.3.48 The causes of AM are still the subject of debate and it is not currently possible to fully predict AM. There is an ongoing research project on AM commissioned by Renewable UK. The project aims to improve understanding of the phenomenon, so that key drivers that lead to AM can be identified, and control or avoidance strategies can be formulated if necessary. The project will also develop a suitable planning condition for inclusion in applicable wind farm consents. The project has yet to be completed, and the report is currently awaited.

Wind Turbine Health Effects

- 12.3.49 An international expert panel comprising doctors, audiologists and acoustic professionals undertook extensive review, analysis, and discussion of the large body of peer reviewed literature on sound and health effects in general and on sound produced by wind turbines.
- 12.3.50 Following this review, the panel reached consensus and in “Wind Turbine Sound and Health Effects - An Expert Panel Review”, Colby et al., 2009 reported the following conclusions:
- There is no evidence that the audible or sub-audible sounds emitted by wind turbines have any direct adverse physiological effects.
 - The ground-borne vibrations from wind turbines are too weak to be detected by, or to affect, humans.
 - The sounds emitted by wind turbines are not unique. There is no reason to believe, based on the levels and frequencies of the sounds and the panel’s experience with sound exposures in occupational settings, that the sounds from wind turbines could plausibly have direct adverse health consequences.
- 12.3.51 Based on the evidence described in the preceding paragraphs, no significant impacts are considered likely to occur due to infrasound or amplitude modulation, and these issues are not considered further in this assessment

12.4 Baseline Conditions

Summary of Measured Levels

- 12.4.1 **Appendix 12.3 Volume IV** contains graphs which detail the results of the full wind speed, rain and noise monitoring for the two locations with wind speed data corrected to 10 m height for the monitoring period.
- 12.4.2 The relationship between the background noise level and wind speed (measured in m/s, corrected to 10 m, over the range 0 to 12 m/s) is shown by plots of measured background noise levels as $L_{A90,10min}$ values versus wind speed in m/s, including rain results for the two monitoring locations.
- 12.4.3 Background noise level curves have been obtained by filtering the data for these time periods, i.e. removing those times when the sound of rainfall may have increased the background noise level and fitting a polynomial regression curve to the data, as required by ETSU-R-97. The regression analysis is a simple statistical analysis that gives an indication of the relationship that exists between background noise levels and wind speeds.
- 12.4.4 The corresponding regression analysis graphs are shown as within **Appendix 12.4 Volume IV**.
- 12.4.5 The background noise levels at integer wind speeds measured at 10 m height above ground level are presented in **Table 12.8**.

Table 12.8: Summary of Background Noise Levels

Period	NML	Derived background Noise Level ($L_{A90,10min}$) by 10 m wind speed								
		4m/s	5m/s	6m/s	7m/s	8m/s	9m/s	10m/s	11m/s	12m/s
Amenity Hours	NML1	33.4	34.3	35.4	36.8	38.5	40.3	42.2	44.3	46.5
	NML2	27.3	27.8	29.1	31.0	33.5	36.4	39.6	43.0	46.4
Night Hours	NML1	33.1	34.3	35.3	36.3	37.2	38.1	39.0	39.9	40.9
	NML2	28.4	28.9	30.0	31.7	33.9	36.4	39.2	42.0	44.9

Derived ETSU-R-97 Limits

- 12.4.6 Based on the background noise levels presented in **Table 12.8**, noise limits have been derived in accordance with the principles in ETSU-R-97 and the GPG. The limits are presented in **Table 12.9 - Table 12.10**.
- 12.4.7 An amenity lower fixed limit of 37.5 dB L_{A90} has been adopted when considering Pencloe Windfarm in isolation. For the cumulative assessment, an amenity lower fixed limit of 40 dB L_{A90} has been adopted.
- 12.4.8 These values are selected due to the relatively low number of dwellings in the neighbourhood of the windfarms, the reduction in kWh that would be generated if lower limits were set, and the limited duration that any particular receptor would be directly downwind of all turbines (and therefore the limited duration during which noise levels would have the potential to meet the amenity period lower fixed limits).

Table 12.9: Summary of Derived ETSU-R-97 Limits (Amenity Hours)

NML	Lower Fixed Limit	ETSU-R-97 Limit ($L_{A90,10min}$) by 10 m wind speed								
		4m/s	5m/s	6m/s	7m/s	8m/s	9m/s	10m/s	11m/s	12m/s
NML1	37.5 dB	38.4	39.3	40.4	41.8	43.5	45.3	47.2	49.3	51.5
	40 dB	40.0	40.0	40.4	41.8	43.5	45.3	47.2	49.3	51.5
NML2	37.5 dB	37.5	37.5	37.5	37.5	38.5	41.4	44.6	48.0	51.4
	40 dB	40.0	40.0	40.0	40.0	40.0	41.4	44.6	48.0	51.4

Table 12.10: Summary of Derived ETSU-R-97 Limits (Night Hours)

NML	ETSU-R-97 Limit ($L_{A90,10min}$) by 10 m wind speed								
	4m/s	5m/s	6m/s	7m/s	8m/s	9m/s	10m/s	11m/s	12m/s
NML1	43.0	43.0	43.0	43.0	43.0	43.1	44.0	44.9	45.9
NML2	43.0	43.0	43.0	43.0	43.0	43.0	44.2	47.0	49.9

Financially Involved Limits

- 12.4.9 No properties are financially involved with the scheme.

Limits from Ashmark Hill Windfarm Environmental Statement

- 12.4.10 The properties at ID8 and ID9 have previously been considered in the noise assessment presented in the Environmental Statement (ES) for Ashmark Hill Windfarm, and were allocated limits in that assessment based on measurements undertaken at ID8 by Arcus Renewable Energy Consulting Ltd during July - August 2011. The full details of these measurements are presented in the ES. The properties at ID10 and ID11 are also in close proximity to these locations, and will experience a similar noise climate.
- 12.4.11 Therefore for the purpose of this assessment, the background noise levels measured at ID8 and reported in the ES for Ashmark Hill Windfarm have been used to derive limits for ID8-ID11. These limits are summarised in **Table 12.11**.
- 12.4.12 This is in accordance with the principles set out in Sections 5.4.2 - 5.4.5 of the IoA Good Practice Guide for concurrent applications that impact the same set of receptors.

Table 12.11: ETSU-R-97 Limits based on measurements at ID8

Period	Lower Fixed Limit	ETSU-R-97 Limit ($L_{A90,10min}$) by 10 m wind speed								
		4m/s	5m/s	6m/s	7m/s	8m/s	9m/s	10m/s	11m/s	12m/s
Amenity	37.5 dB	37.5	37.5	38.6	40.6	42.7	45.0	47.4	49.9	52.5
	40 dB	40.0	40.0	40.0	40.6	42.7	45.0	47.4	49.9	52.5
Night	43 dB	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0

12.5 Assessment of Construction Impacts

Predicted impacts

Description of Anticipated Works

12.5.1 The main construction works are outlined in the project description in **Chapter 4** of this document. In summary, the main construction activities with respect to noise are likely to be the:

- Construction of access tracks, hardstandings and construction compounds;
- Construction of turbine and substation foundations;
- Borrow pit excavation;
- Excavation of trenches and cable laying; and
- Erection of wind turbines.

12.5.2 Construction working hours for the site will be limited those detailed in **Chapter 4**. Typical construction plant would be used on site, including:

- Earth moving plant to include excavators and dump trucks;
- Lifting equipment such as cranes and hoists;
- Miscellaneous equipment such as compressors, hand tools and generators; and,
- Heavy Goods Vehicles (HGVs) delivering equipment.

12.5.3 The construction programme for the proposed development will not be finalised until such time as a contractor is commissioned and, as such, the actual heavy plant to be used is not yet known. Detailed construction noise calculations are not, therefore, possible at this time. However, from experience of other windfarm construction projects, it has been possible to identify a potential plant list for two broad phases of the proposed development: site preparation and turbine installation.

12.5.4 Activities at the substation and construction compound areas have been considered for the site preparation phase, and the closest of these or turbine locations has been assessed for each receptor.

Assessment of Construction Impacts

12.5.5 A number of receptors have the potential to experience construction noise impacts. This assessment considers selected representative receptors, including the worst affected from each area.

12.5.6 Predictions have been undertaken using the plant list and noise source levels given in **Table 12.12** for the nearest properties to the proposed turbines, substation, laydown area and onsite access tracks.

Table 12.12: Site Construction Noise Assessment Source Levels

Activity	BS5228 Ref.	Plant Description	Equipment			Adjusted LAeq @ 10m, dB	Activity LAeq @ 10m
			LAeq @ 10m, dB	No.	% Use		
Earthworks / Site Preparation	C2.3	Tracked excavator; 102kW; 22 t	78	6	75	84.5	91.6
	C2.26	Wheeled loader; 209kW	79	6	75	85.5	
	C2.30	Dump truck (tipping fill); 306kW; 29 t	79	6	75	85.5	
	C2.10	Dozer; 239kW; 41 t	80	6	75	86.5	
Tree Felling	-	Felling Chainsaw	85	10	75	93.8	93.8
Construction of Foundations	C4.33	Poker vibrator	78	2	75	79.8	83.7
	C4.18	Cement mixer truck (discharging)	75	2	75	76.8	
	C4.32	Concrete mixer truck + truck mounted concrete pump + boom arm	78	2	75	79.8	
Tower Erection	C2.26	Wheeled loader; 209kW	79	4	30	79.8	80.4
	C4.50	Tracked mobile crane; 390kW; 600 t / 125 m	71	4	30	71.8	
Creation of Access Roads	C5.14	Bulldozer; 250kW; 35 t	86	2	75	87.8	88.3
	C5.20	Vibratory roller; 98kW; 8.9 t	75	2	75	76.8	
	C5.35	Tracked excavator; 27kW	74	2	75	75.8	

12.5.7 Predictions have been undertaken using the plant list and noise source levels given in **Table 12.13** for the nearest properties to the proposed turbines, substation, laydown area, and onsite access tracks.

Table 12.13: Site Construction Noise Levels at Receivers

Activity	Earthworks / Site Preparation	Tree Felling	Construction of Foundations	Tower Erection	Creation of Access Roads
Activity L _{Aeq} @ 10m	92 dB	94 dB	84 dB	80 dB	88 dB
ID1	45 dB	48 dB	38 dB	34 dB	42 dB
ID2	45 dB	47 dB	37 dB	34 dB	42 dB
ID3	45 dB	47 dB	37 dB	34 dB	42 dB
ID4	44 dB	46 dB	36 dB	33 dB	41 dB
ID5	45 dB	47 dB	37 dB	34 dB	42 dB
ID6	42 dB	45 dB	35 dB	31 dB	39 dB
ID7	38 dB	41 dB	31 dB	27 dB	35 dB
ID8	38 dB	40 dB	30 dB	27 dB	35 dB
ID9	38 dB	40 dB	30 dB	27 dB	35 dB
ID10	37 dB	39 dB	29 dB	26 dB	34 dB
ID11	36 dB	38 dB	28 dB	25 dB	33 dB

12.5.8 The predictions of noise levels during site construction activities demonstrate that whilst noise effects may occur when work is closest to the receptors, due to the high separation distances (a minimum of approximately 800m) between the construction noise sources and the nearest receptors, the minimum noise guideline value of 65 dB(A) quoted in BS5228-1:2009 would not be exceeded.

12.5.9 Taking into account the scale of the development, it is considered that the overall impact of construction works is minor.

Mitigation

12.5.10 The assessment has predicted that there will not be significant construction noise impacts at residential properties, and it will not therefore be necessary to develop specific mitigation measures. However, the best practicable methods for managing noise impacts on receptors will be adopted and in this respect guidance is given in BS 5228: 2009 as follows:

- For any particular task, the quietest plant and/or machinery will be used where practicable. Where appropriate, plant/machinery must be constructed to meet the requirements of EC directives (e.g. Directive 2001/14/EC on noise emission in the environment by equipment use outdoors);
- All equipment will be maintained in good working order and fitted with the appropriate silencers, mufflers or acoustic covers where applicable;
- Stationary noise sources will be sited as far away as possible from noise sensitive residential properties and will be compliant with BS 5228:2009;
- The movement of vehicles to and from the application site will be controlled and employees will be supervised to ensure compliance with the noise control measures adopted.
- The proposed hours of construction will be limited to those detailed in **Chapter 4**.
- Residual impacts

12.5.11 The initial assessment for construction noise did not identify any likely significant effects on receptors. The mitigation detailed above comprises standard good practice measures for the management of construction noise. The assessment of residual impacts for construction noise is also therefore that no significant effects are likely.

Cumulative impacts

12.5.12 No other construction noise projects are known that would cause cumulative construction noise impacts. Therefore no cumulative assessment of construction noise is required. Even if the construction of the consented Afton Windfarm were to occur simultaneously with the proposed development, the separation distances and the significant margin below the BS5228-1:2009 guideline limit values mean that no significant impacts would be expected to occur.

12.6 Assessment of Operational Impacts

Predicted impacts

Impact of Proposed Development

12.6.1 The operational noise levels have been predicted at each identified residential property within the study area due to the simultaneous operation of the 21 wind turbines within the proposed development. The calculations assume that the candidate turbine is not operating in a reduced noise emission mode.

12.6.2 **Table 12.** provides a comparison of the predicted turbine noise levels due to the operation of the proposed Pencloe Windfarm (in isolation) with the ETSU-R-97 limits for receptors within the study area.

Table 12.14: Comparison of Predicted Noise Levels with Limits (Just Pencloe)

ID		10 m wind speed (m/s)									
		4	5	6	7	8	9	10	11	12	
ID1	Predicted Turbine Level	25.5	30.0	34.7	36.9	37.4	37.4	37.4	37.4	37.4	
	Amenity hours ETSU-R-97 Limits (NML1)	38.4	39.3	40.4	41.8	43.5	45.3	47.2	49.3	51.5	
	Exceedance during amenity hours	-	-	-	-	-	-	-	-	-	
	Night hours ETSU-R-97 Limits (NML1)	43.0	43.0	43.0	43.0	43.0	43.1	44.0	44.9	45.9	
	Exceedance during night hours	-	-	-	-	-	-	-	-	-	
ID2	Predicted Turbine Level	22.1	26.6	31.3	33.5	34.0	34.0	34.0	34.0	34.0	
	Amenity hours ETSU-R-97 Limits (NML2)	37.5	37.5	37.5	37.5	38.5	41.4	44.6	48.0	51.4	
	Exceedance during amenity hours	-	-	-	-	-	-	-	-	-	
	Night hours ETSU-R-97 Limits (NML2)	43.0	43.0	43.0	43.0	43.0	43.0	44.2	47.0	49.9	
	Exceedance during night hours	-	-	-	-	-	-	-	-	-	
ID3	Predicted Turbine Level	22.0	26.5	31.2	33.4	33.9	33.9	33.9	33.9	33.9	
	Amenity hours ETSU-R-97 Limits (NML2)	37.5	37.5	37.5	37.5	38.5	41.4	44.6	48.0	51.4	
	Exceedance during amenity hours	-	-	-	-	-	-	-	-	-	
	Night hours ETSU-R-97 Limits (NML2)	43.0	43.0	43.0	43.0	43.0	43.0	44.2	47.0	49.9	
	Exceedance during night hours	-	-	-	-	-	-	-	-	-	
ID4	Predicted Turbine Level	21.4	25.9	30.6	32.8	33.3	33.3	33.3	33.3	33.3	
	Amenity hours ETSU-R-97 Limits (NML2)	37.5	37.5	37.5	37.5	38.5	41.4	44.6	48.0	51.4	

ID		10 m wind speed (m/s)								
		4	5	6	7	8	9	10	11	12
	Exceedance during amenity hours	-	-	-	-	-	-	-	-	-
	Night hours ETSU-R-97 Limits (NML2)	43.0	43.0	43.0	43.0	43.0	43.0	44.2	47.0	49.9
	Exceedance during night hours	-	-	-	-	-	-	-	-	-
ID5	Predicted Turbine Level	21.4	25.9	30.6	32.8	33.3	33.3	33.3	33.3	33.3
	Amenity hours ETSU-R-97 Limits (NML1)	38.4	39.3	40.4	41.8	43.5	45.3	47.2	49.3	51.5
	Exceedance during amenity hours	-	-	-	-	-	-	-	-	-
	Night hours ETSU-R-97 Limits (NML1)	43.0	43.0	43.0	43.0	43.0	43.1	44.0	44.9	45.9
	Exceedance during night hours	-	-	-	-	-	-	-	-	-
ID6	Predicted Turbine Level	21.3	25.8	30.5	32.7	33.2	33.2	33.2	33.2	33.2
	Amenity hours ETSU-R-97 Limits (NML1)	38.4	39.3	40.4	41.8	43.5	45.3	47.2	49.3	51.5
	Exceedance during amenity hours	-	-	-	-	-	-	-	-	-
	Night hours ETSU-R-97 Limits (NML1)	43.0	43.0	43.0	43.0	43.0	43.1	44.0	44.9	45.9
	Exceedance during night hours	-	-	-	-	-	-	-	-	-
ID7	Predicted Turbine Level	19.5	24.0	28.7	30.9	31.4	31.4	31.4	31.4	31.4
	Amenity hours ETSU-R-97 Limits (NML2)	37.5	37.5	37.5	37.5	38.5	41.4	44.6	48.0	51.4
	Exceedance during amenity hours	-	-	-	-	-	-	-	-	-
	Night hours ETSU-R-97 Limits (NML2)	43.0	43.0	43.0	43.0	43.0	43.0	44.2	47.0	49.9
	Exceedance during night hours	-	-	-	-	-	-	-	-	-
ID8	Predicted Turbine Level	19.1	23.6	28.3	30.5	31.0	31.0	31.0	31.0	31.0
	Amenity hours ETSU-R-97 Limits (AH)	37.5	37.5	38.6	40.6	42.7	45.0	47.4	49.9	52.5
	Exceedance during amenity hours	-	-	-	-	-	-	-	-	-
	Night hours ETSU-R-97 Limits (AH)	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Exceedance during night hours	-	-	-	-	-	-	-	-	-
ID9	Predicted Turbine Level	17.8	22.3	27.0	29.2	29.7	29.7	29.7	29.7	29.7
	Amenity hours ETSU-R-97 Limits (AH)	37.5	37.5	38.6	40.6	42.7	45.0	47.4	49.9	52.5
	Exceedance during amenity hours	-	-	-	-	-	-	-	-	-
	Night hours ETSU-R-97 Limits (AH)	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Exceedance during night hours	-	-	-	-	-	-	-	-	-
ID10	Predicted Turbine Level	17.2	21.7	26.4	28.6	29.1	29.1	29.1	29.1	29.1
	Amenity hours ETSU-R-97 Limits (AH)	37.5	37.5	38.6	40.6	42.7	45.0	47.4	49.9	52.5
	Exceedance during amenity hours	-	-	-	-	-	-	-	-	-
	Night hours ETSU-R-97 Limits (AH)	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Exceedance during night hours	-	-	-	-	-	-	-	-	-
ID11	Predicted Turbine Level	17.6	22.1	26.8	29.0	29.5	29.5	29.5	29.5	29.5
	Amenity hours ETSU-R-97 Limits (AH)	37.5	37.5	38.6	40.6	42.7	45.0	47.4	49.9	52.5
	Exceedance during amenity hours	-	-	-	-	-	-	-	-	-
	Night hours ETSU-R-97 Limits (AH)	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Exceedance during night hours	-	-	-	-	-	-	-	-	-

- 12.6.3 Where predicted turbine noise levels meet the ETSU-R-97 noise limits, the potential impact is classified as 'not significant'.
- 12.6.4 As **Table 12.4** demonstrates, with the candidate turbine operating in an unrestricted mode, the ETSU-R-97 limits are met at all receptors during operation of Pencloe Windfarm during both day time and amenity hours.

Impact of Cumulative Developments

Table 12.14: Comparison of Predicted Noise Levels with Limits (Cumulative)

ID		10m wind speed (m/s)								
		4	5	6	7	8	9	10	11	12
ID1	Predicted Turbine Level	31.9	35.2	39.5	41.5	42.2	42.6	43.1	43.1	43.4
	Amenity hours ETSU-R-97 Limits (NML1 Cumulative)	40.0	40.0	40.4	41.8	43.5	45.3	47.2	49.3	51.5
	Exceedance during amenity hours	-	-	-	-	-	-	-	-	-
	Night hours ETSU-R-97 Limits (NML1 Cumulative)	43.0	43.0	43.0	43.0	43.0	43.1	44.0	44.9	45.9
	Exceedance during night hours	-	-	-	-	-	-	-	-	-
ID2	Predicted Turbine Level	30.0	32.5	36.1	37.9	38.6	39.0	39.4	39.5	39.9
	Amenity hours ETSU-R-97 Limits (NML2 Cumulative)	40.0	40.0	40.0	40.0	40.0	41.4	44.6	48.0	51.4
	Exceedance during amenity hours	-	-	-	-	-	-	-	-	-
	Night hours ETSU-R-97 Limits (NML2 Cumulative)	43.0	43.0	43.0	43.0	43.0	43.0	44.2	47.0	49.9
	Exceedance during night hours	-	-	-	-	-	-	-	-	-
ID3	Predicted Turbine Level	30.0	32.4	36.0	37.8	38.6	39.0	39.3	39.5	39.9
	Amenity hours ETSU-R-97 Limits (NML2 Cumulative)	40.0	40.0	40.0	40.0	40.0	41.4	44.6	48.0	51.4
	Exceedance during amenity hours	-	-	-	-	-	-	-	-	-
	Night hours ETSU-R-97 Limits (NML2 Cumulative)	43.0	43.0	43.0	43.0	43.0	43.0	44.2	47.0	49.9
	Exceedance during night hours	-	-	-	-	-	-	-	-	-
ID4	Predicted Turbine Level	29.8	32.1	35.5	37.3	38.0	38.4	38.8	39.0	39.4
	Amenity hours ETSU-R-97 Limits (NML2 Cumulative)	40.0	40.0	40.0	40.0	40.0	41.4	44.6	48.0	51.4
	Exceedance during amenity hours	-	-	-	-	-	-	-	-	-
	Night hours ETSU-R-97 Limits (NML2 Cumulative)	43.0	43.0	43.0	43.0	43.0	43.0	44.2	47.0	49.9
	Exceedance during night hours	-	-	-	-	-	-	-	-	-
ID5	Predicted Turbine Level	29.7	32.1	35.4	37.2	37.9	38.3	38.7	38.9	39.3
	Amenity hours ETSU-R-97 Limits (NML1 Cumulative)	40.0	40.0	40.4	41.8	43.5	45.3	47.2	49.3	51.5
	Exceedance during amenity hours	-	-	-	-	-	-	-	-	-
	Night hours ETSU-R-97 Limits (NML1 Cumulative)	43.0	43.0	43.0	43.0	43.0	43.1	44.0	44.9	45.9
	Exceedance during night hours	-	-	-	-	-	-	-	-	-
ID6	Predicted Turbine Level	29.7	32.0	35.4	37.1	37.9	38.3	38.7	38.9	39.3
	Amenity hours ETSU-R-97 Limits (NML1 Cumulative)	40.0	40.0	40.4	41.8	43.5	45.3	47.2	49.3	51.5
	Exceedance during amenity hours	-	-	-	-	-	-	-	-	-
	Night hours ETSU-R-97 Limits (NML1 Cumulative)	43.0	43.0	43.0	43.0	43.0	43.1	44.0	44.9	45.9

ID		10m wind speed (m/s)								
		4	5	6	7	8	9	10	11	12
	Exceedance during night hours	-	-	-	-	-	-	-	-	-
ID7	Predicted Turbine Level	32.1	33.5	35.4	36.8	37.6	38.1	38.5	39.0	39.6
	Amenity hours ETSU-R-97 Limits (NML2 Cumulative)	40.0	40.0	40.0	40.0	40.0	41.4	44.6	48.0	51.4
	Exceedance during amenity hours	-	-	-	-	-	-	-	-	-
	Night hours ETSU-R-97 Limits (NML2 Cumulative)	43.0	43.0	43.0	43.0	43.0	43.0	44.2	47.0	49.9
	Exceedance during night hours	-	-	-	-	-	-	-	-	-
ID8	Predicted Turbine Level	30.7	33.1	36.1	37.9	38.7	38.7	38.1	38.1	38.4
	Amenity hours ETSU-R-97 Limits (AH Cumulative)	40.0	40.0	40.0	40.6	42.7	45.0	47.4	49.9	52.5
	Exceedance during amenity hours	-	-	-	-	-	-	-	-	-
	Night hours ETSU-R-97 Limits (AH Cumulative)	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Exceedance during night hours	-	-	-	-	-	-	-	-	-
ID9	Predicted Turbine Level	30.0	32.5	35.5	37.3	38.1	38.2	37.5	37.5	37.8
	Amenity hours ETSU-R-97 Limits (AH Cumulative)	40.0	40.0	40.0	40.6	42.7	45.0	47.4	49.9	52.5
	Exceedance during amenity hours	-	-	-	-	-	-	-	-	-
	Night hours ETSU-R-97 Limits (AH Cumulative)	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Exceedance during night hours	-	-	-	-	-	-	-	-	-
ID10	Predicted Turbine Level	29.9	31.7	34.3	35.9	36.7	36.9	36.6	36.8	37.2
	Amenity hours ETSU-R-97 Limits (AH Cumulative)	40.0	40.0	40.0	40.6	42.7	45.0	47.4	49.9	52.5
	Exceedance during amenity hours	-	-	-	-	-	-	-	-	-
	Night hours ETSU-R-97 Limits (AH Cumulative)	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Exceedance during night hours	-	-	-	-	-	-	-	-	-
ID11	Predicted Turbine Level	29.4	31.3	33.9	35.6	36.4	36.6	36.3	36.5	36.9
	Amenity hours ETSU-R-97 Limits (AH Cumulative)	40.0	40.0	40.0	40.6	42.7	45.0	47.4	49.9	52.5
	Exceedance during amenity hours	-	-	-	-	-	-	-	-	-
	Night hours ETSU-R-97 Limits (AH Cumulative)	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Exceedance during night hours	-	-	-	-	-	-	-	-	-

12.6.5 Where predicted turbine noise levels meet the ETSU-R-97 noise limits, the potential impact is classified as 'not significant'.

12.6.6 As **Table 12.14** demonstrates, with the candidate turbine in an unrestricted mode, the ETSU-R-97 limits are met during operation of the cumulatively assessed developments at all receptors during both day time and amenity hours.

Mitigation and Residual Impact

12.6.7 As it has been demonstrated that the ETSU-R-97 limits can be met during the operation of the proposed development in an unrestricted mode during both day and night periods, there is no requirement to consider mitigation.

12.7 Summary and Conclusions

- 12.7.1 An assessment of the noise impacts that are predicted to occur during the construction, operation and decommissioning of the proposed development has been undertaken. The assessment of operational noise has relied principally on current guidance contained in the ETSU-R-97 report (DTI, 1996) 'The Assessment and Rating of Noise from Wind Farms', but has taken into account other relevant guidance, particularly that contained in the 'Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise'.
- 12.7.2 It is concluded that there will be no significant adverse noise impacts at nearby residential properties due to the operation of the proposed development. Operational noise levels at all the identified residential properties are predicted to meet the adopted criteria during the quiet daytime and night time periods ensuring an acceptable level of protection to local residents.
- 12.7.3 The likelihood of disturbance at identified residential properties due to construction and decommissioning activities is likely to be small given the separation distances involved. Guidance given in BS 5228:2009 (BSI, 2009) will be used to ensure that the best practicable method of managing noise on the site will be adopted.
- 12.7.4 Consequently, it is concluded that the proposed development scheme will have no significant adverse effects in relation to noise.

12.8 References

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13 Traffic and Transport

13.1 Introduction

- 13.1.1 This chapter evaluates the effects of the proposed development on traffic and transportation. It identifies the potential effects of increased road traffic predicted during construction of the proposed development and also reviews potential effects during operation and decommissioning. This chapter addresses the significance of these effects against recognised guidelines and, where required, appropriate mitigation measures are considered. No visitor traffic is expected for the proposed development.
- 13.1.2 An Abnormal Loads Route Assessment (ALRA) which considers the options for delivering turbine components to the proposed application site has been undertaken and is contained within **Appendix 13.1 Volume III**. It is anticipated that the Turbine Delivery Vehicles (TDVs) will travel by road from the Port of Ayr, which is the closest port in the region capable of handling wind turbine equipment. The Port of Ayr has been used regularly for the delivery of wind turbine components for windfarm developments in this region and is the selected port of entry for turbine components for the consented Afton and proposed Ashmark Hill Windfarms, both of which would be located adjacent to the proposed development.
- 13.1.3 ALRAs have been undertaken for the Afton and Ashmark Hill Windfarms. Afton Windfarm was consented in October 2014 and Ashmark Hill is currently in planning. The TDV access route for Afton Windfarm passes the application site access on Afton Road, consequently it is proposed that TDVs will utilise the route established for Afton Windfarm. Furthermore Ashmark Hill Windfarm, the access for which is proposed further north on Afton Road, also proposes to utilise the same abnormal load route as Afton Windfarm. Despite the route already being assessed by other developments, a re-assessment was required as the size of the turbine components for the proposed development differ from those for the previously assessed. The proposed TDV access route from Port of Ayr to the proposed development access is illustrated in **Figure 13.1 Volume III** and is as follows:

Proposed Route from the Port of Ayr

- Exit Griffen Dock in Port of Ayr;
 - East on Waggon Road;
 - South on A79 Allison Street;
 - East on A719;
 - Northeast on the A77;
 - Southeast on A76;
 - Southwest on B741 Mossmark;
 - South on Afton Road and
 - Proposed site access off Afton Road, approximately 3.5 km south of the B741 Mossmark / Afton Road priority junction.
- 13.1.4 While the above route will be used by TDVs it is anticipated that some construction traffic i.e. light goods vehicles and staff cars etc. will be able to make use of the local road network within the vicinity of the application site and there will therefore be a number of possible routes to the proposed development for these vehicle types. While the sources of raw materials have still to be confirmed there is the potential for a number of routes to be used by construction traffic. Therefore on this basis and in order to ensure a robust assessment, it has been assumed that all construction traffic will potentially route via each of the surveyed sections of road, the locations of which are detailed in **Table 13.5**.

13.2 Policy, Legislation and Guidance

- 13.2.1 The majority of the roads considered within this study are strategic trunk roads and regional roads and by their nature have a greater traffic capacity and better general safety record when compared with more rural roads. On this basis it is preferable to use the strategic routes where possible. Transport Scotland also promotes the use of sea ports to reduce the effects of abnormal load movements on the road network.
- 13.2.2 In undertaking the assessment of the potential traffic and transport effects on the local road network, the following guidance documents have been taken into account:
- Guidelines for the Environmental Assessment of Road Traffic, by the Institute of Environmental Management and Assessment (IEMA, 1993) (the IEMA Guidelines) and
 - Guidelines for Traffic Impact Assessment, The Institution of Highways and Transportation, September 1994 (IHT, 1994).
- 13.2.3 Reference has also been made to the 'Transport Assessment Guidance' published by Transport Scotland (Transport Scotland 2012). This document outlines the necessary considerations in the production of a Transport Assessment. This chapter explains that the proposed development will not generate any significant long-term traffic movements and as such a Transport Assessment is not deemed necessary. Notwithstanding this, there are similarities between certain information required for this chapter and that usually provided within a Transport Assessment.
- 13.2.4 Scottish Planning Policy has been referred to in dealing with the traffic and transportation issues associated with the proposed development. Paragraphs 174 and 175 of the guidance note:
- "Development proposals that have the potential to affect the performance or safety of the strategic transport network need to be appraised to determine their effects. If required, mitigation measures should be agreed with Transport Scotland that would, where practicable, achieve no net detriment to safety or in overall performance, including journey times and connections, emissions reduction and accessibility."*
- "Direct access onto any strategic road should be avoided as far as practicable. Access should be from a secondary road unless there is no alternative."*
- 13.2.5 Direct access to the proposed development would not be taken from a strategic road and there would, therefore, be no long-term effects on the road network. The nature of the proposed development is such that it falls out with the remit for the requirement of a Transport Assessment due to its very low level of traffic generation during operation.

13.3 Methodology

Assessment Methodology

- 13.3.1 The traffic impact of the proposed development has been assessed utilising the following approach:
- Relevant transport policies have been reviewed to establish any local or regional Heavy Goods Vehicle (HGV) or freight access strategies;
 - The road sections likely to be affected by the traffic associated with the proposed development have been identified;
 - The existing character of the road network has been determined;
 - Existing traffic levels on the road network have been determined;
 - The additional traffic generated by all stages of the proposed development has been estimated;

- The effect of the additional traffic has been assessed and
- An appropriate mitigation strategy was prepared to ensure that any potential traffic effects are kept to a minimum.

Consultation

- 13.3.2 A scoping and consultation exercise has been undertaken as part of the EIA process for the proposed development and the traffic and transport responses are summarised in **Table 13.1**:

Table 13.1 Consultation Responses

Consultee	Response
Transport Scotland	No objection to the proposed development.
Amey	No objection to the proposed development.
East Ayrshire Council (EAC)	No objection in theory to the proposed development, however will comment further upon receipt of the planning application. EAC are keen to ensure that proposed mitigation on the TDV access route is undertaken in conjunction with the proposed Ashmark Hill and consented Afton Windfarm sites that are to be located adjacent to the application site.

Significance Criteria

- 13.3.3 The IEMA Guidelines referred to in paragraph 13.2.2 suggests that two broad principles be used as a screening process to focus the scale and extent of the assessment. These are:

“include highway links where traffic flows will increase by more than 30% (or the number of heavy goods vehicles will increase by more than 30%) and

“Include any other specifically sensitive areas where traffic flows will increase by 10% or more.”

- 13.3.4 Criteria for assessing the significance of the increases in traffic volumes as a result of the proposed development, based on these guidelines, are categorised in **Table 13.2**.

Table 13.2 Significance of Effects in Relation to Traffic Flow Increase

Magnitude	Increase in Traffic Flow
Major	Above 90%
Moderate	Between 60% and 90%
Minor	Between 30% and 60%
Negligible	Less than 30%

- 13.3.5 Impacts that are major or moderate in magnitude are considered to be significant under the terms of the EIA Regulations.
- 13.3.6 Where existing traffic levels are exceptionally low (e.g. on some unclassified roads), any increase in traffic flow is likely to result in a predicted increase in traffic levels which exceeds these thresholds. Where this situation is identified it is important to consider any increase both in terms of its relative increase in respect of existing traffic flows, as well as the overall total flow in respect of the available capacity of the section of road being considered. For example a 100% increase in traffic flow on a road which currently only carries 90 vehicles, Annual Average Daily Traffic (AADT) flow would potentially indicate a major significance effect, if it were considered simply, in terms of the IEMA Guidelines, as detailed in **Table 13.2**.
- 13.3.7 However, a typical 7.3 m wide rural road is capable of accommodating approximately 57,600 two-way vehicles per day, in accordance with thresholds contained in Volume 15 Economic Assessment of Road Schemes in Scotland; Section 1 The NESAs Manual (2009). Therefore, such an increase would be unlikely to create major effects given the road's overall capacity. **Table 13.3** refers to the link speed and link capacity of varying road types.

Table 13.3 Link Speed and Link Capacity

Road Category	Description	Speed Limit (mph)	Capacity (two way per day)
2	Urban – single 6.0m	30	38,400
3	Urban – single 10.0m	30	38,400
14	Urban – Motorway – D2	70	182,400
15	Urban – Motorway – D3	70	273,600
21	Rural – poor single 4.0m	60	6,720
22	Rural – poor single 5.5m	60	38,400
23	Rural – poor single 6.0m	60	43,200
24	Rural – typical single 6.0m	60	43,200
25	Rural – poor single 7.3m	60	57,600
26	Rural – typical single 7.3m	60	57,600
27	Rural – good single 7.3m	60	57,600

- 13.3.8 Any potential environmental effects including accidents and safety, driver delay, pedestrian amenity, pedestrian delay and severance are, therefore, considered on a case by case basis using professional judgement and reasoned argument. The significance of any effect, the scale of which is outlined within **Table 13.2** is

assessed on the basis of the magnitude of the effect and the likelihood of the effect occurring.

Sensitive Receptors

- 13.3.9 A site visit and desktop assessment were undertaken to identify potential sensitive receptors e.g. settlements, schools etc. along the potential construction traffic access routes.

Settlements

New Cumnock

- 13.3.10 The settlement of New Cumnock is located approximately 3.5 km north of the proposed development and as such is considered as a sensitive receptor. There are two primary schools located within New Cumnock, both of which are considered as sensitive receptors, most notably New Cumnock Primary School which is located on the A76. Cairnhill Primary School, although not located directly on an access route, will be considered a sensitive receptor given that there is potential for pupil and staff interaction with the construction traffic on the journey to / from school. The residencies on the eastern side of Afton Road, to the immediate south of the B741, are considered as key sensitive receptors as they are located directly on the proposed access route to the application site. All other residencies on Afton Road, within the extents of the study area, are considered to be sensitive receptors.
- 13.3.11 Afton Cemetery, located off the eastern side of Afton Road, approximately 650m south of the junction with the B741 in New Cumnock, is also considered a sensitive receptor given that it is frequently used for funerals and visiting relatives.

Mauchline on the A76

- 13.3.12 The A76, which is predicted to be utilised by a proportion of construction traffic associated with the proposed development, passes through the settlement of Mauchline which is consequently considered a sensitive receptor. Mauchline Primary School, although not located directly on the A76, is considered a sensitive receptor given that there is potential for pupil and staff interaction with the A76 on the journey to / from school.

Patna on the A713

- 13.3.13 The A713, which may be utilised by a proportion of construction traffic associated with the proposed development, passes through the settlement of Patna which in turn is considered to be a sensitive receptor. Patna Primary School, although not located directly on the A713 is considered a sensitive receptor given that there is potential for pupil and staff interaction with the A76 on the journey to / from school.

Waterside on the A713

- 13.3.14 The A713, which may be utilised by a proportion of construction traffic associated with the proposed development, passes through the settlement of Waterside which in turn is considered to be a sensitive receptor. St Xavier's Primary School is located directly on the A713 and as such is considered a sensitive receptor.

Dalmellington on the A713 and B741

13.3.15 The A713 and B741, which may be utilised by a proportion of construction traffic associated with the proposed development, pass through the settlement of Dalmellington which in turn is considered to be a sensitive receptor. There are two schools located in Dalmellington, Doon Academy and Dalmellington Primary School, both of which are located directly on the A713 and as such are considered to be sensitive receptors. Dalmellington Health Centre, located on the B741, is also considered a sensitive receptor.

Coylton on the A70

13.3.16 The A70, which may be utilised by a proportion of construction traffic associated with the proposed development, passes through the settlement of Coylton which in turn is considered a sensitive receptor. Coylton Primary School is located directly on the A70 and as such is considered to be a sensitive receptor.

Coalhall on the A70

13.3.17 The A70, which may be utilised by a proportion of construction traffic associated with the proposed development, passes through the settlement of Coalhall which in turn is considered a sensitive receptor.

Ochiltree on the A70

13.3.18 The A70, which may accommodate a proportion of construction traffic associated with the proposed development, passes through the settlement of Ochiltree which in turn is considered a sensitive receptor. Ochiltree Primary School, although not located directly on the A70 is considered a sensitive receptor given that there is potential for pupil and staff interaction with the A70 on the journey to / from school.

13.3.19 The means by which the effects of the proposed development, on any such sensitive receptors, are to be mitigated are considered later in the chapter.

Study Area

Application Site

13.3.20 The proposed development is located on agricultural and forestry land, approximately 3.5 km to the south of New Cumnock in East Ayrshire.

13.3.21 The sections of the road network included within this assessment have been determined on the basis of the potential effect of increased traffic associated with the construction, operation and decommissioning phases of the proposed development on identified sensitive receptors.

13.3.22 The traffic impact study area was defined as comprising the following sections of the road network:

- A76 Trunk Road;
- A70;
- A713;
- B741 and
- Afton Road.

13.3.23 The study area was not expanded any further as it is expected that construction traffic would disperse and be integrated within the strategic and local road network without any significant delay or effects.

Access Routes

Route Review Methodology

- 13.3.24 To define baseline conditions for the proposed development in terms of access, traffic and transportation, a baseline study comprising a strategic route review and ALRA was undertaken. The ALRA within **Appendix 13.1 Volume IV** provides full details of the selected route and minor road modifications required for turbine delivery.

Abnormal Loads and Construction Access

- 13.3.25 The wind turbine components would be classified as abnormal loads when being delivered to the application site. The abnormal load components may be subject to change and for the purposes of the ALRA a turbine blade of 52 m in length has been assessed. The abnormal loads would also consist of tower sections totalling 85 m in length and the nacelle which, due to their respective sizes and weights, would need to be transported on specialist vehicles:

- Turbine Blades – 52 m in length;
- Tower Sections – a maximum section length of 30 m; and
- Nacelles - Overall vehicle length 30 m and overall max load (including vehicle) up to 130 tonnes.

13.4 Baseline Conditions

- 13.4.1 The sections of the road network included within this assessment have been determined, as described in Section 13.3, on the basis of the potential effect of increased traffic associated with the construction, operation and commissioning of the proposed development.

Local Road Network

- 13.4.2 The A76 Trunk Road is a route of regional significance which links Dumfries in the south with Kilmarnock in the north. The road is generally single carriageway and of a good standard with a minimum width of 7.3 m, however there are a number of overtaking sections at various locations on the route. Moreover, the route currently carries a large number of Heavy Goods Vehicles (HGVs).
- 13.4.3 The A713 is a rural distributor road travelling between Ayr in the north and Castle Douglas in the south. The road is a single carriageway along its entire extents and has a road width of approximately 7 m.
- 13.4.4 The A70 is a strategic distributor road which links the A77 Trunk Road at Ayr, to the west, with Junction 12 of the A74 (M) to the east. The A70 also links the A77 with the A76 at Cumnock. The road is generally single carriageway and of a good standard with an average width of 7 m. The road is predominantly subject to the National Speed Limit, however, this reduces to 30 mph within the residential settlements along the route.
- 13.4.5 The B741 is a rural single carriageway which travels between Girvan in the west and New Cumnock, approximately 3.5 km north of the application site. In the vicinity of the proposed development the B741 is approximately 7 m wide and is subject to a 30 mph speed limit within New Cumnock while the National Speed Limit applies on the rural sections.

13.4.6 Afton Road, from where the proposed development will be accessed, is mainly rural in nature, with the exception of the approach to the junction with the B741. The northern section of the road, between the junction with the B741 and New Cumnock cemetery, is approximately 6 m wide before reducing to 5 m between this point and the proposed site access. The National Speed Limit applies to the majority of Afton Road, with the exception of the northern section with residential frontage where a 30 mph speed limit applies.

Baseline Traffic Data

13.4.7 Traffic flow data in Automatic Traffic Count (ATC) format was obtained for 2011 and 2012 from:

- Transport Scotland (TS) on the A70 and A76, as detailed within **Table 13.4** and
- Commissioned classified traffic surveys on the A713, B741 and Afton Road as detailed within **Table 13.5**.

13.4.8 For each site the data has been processed to provide AADT flows in each direction. The location of each counter is illustrated in **Figure 13.1 Volume III**.

13.4.9 Projected baseline traffic flows for the expected year of construction have been derived by applying the National Road Traffic Forecast (NRTF) low-growth (all vehicles) factors. Using a low-growth factor maximises the effects of the proposed development traffic and in essence present a worst case scenario. **Table 13.4** highlights the growth factors applied to the base AADT flows. A growth factor of 1.057 and 1.046 was applied to 2011 and 2012 base flows respectively to forecast the traffic levels for the year 2016, which for the purposes of this assessment has been assumed to be the year of construction.

Table 13.4 NRTF Low Growth Factors Applied To AADT Flows

Year	Vehicle Type	Growth Factor
2011 – 2016	All	1.057
2012 – 2016	All	1.046

13.4.10 The traffic flow characteristics for each counter location are summarised in **Table 13.5**.

Table 13.5 Baseline and Projected AADT Flows

No.	Route	Northbound Baseline AADT 2011 / 2012 (*Eastbound)	Southbound Baseline AADT 2011 / 2012 (*Westbound)	Total Baseline AADT 2011 / 2012	Combined Projected AADT 2016	Combined HGV 2016
1	A76 New Cumnock – B741 to Lime Rd	1,701	1,929	3,630	3,797	891
2	A76 Pathhead – New Cumnock between B741 and B7083(s)	2,478*	2,455*	4,932	5,159	-
3	A70 East Terelgin	3,307*	3,435*	6,743	7,127	968
4	A713 northwest of Dalmellington	2,586*	2,607*	5,193	5,432	333
5	A713 southeast of Dalmellington	764	777	1,541	1,612	175
6	B741 northeast of Dalmellington	437	425	862	902	67
7	B741 west of New Cumnock	993	946	1,939	2,028	120
8	Afton Rd south of B741	324	319	643	672	17

13.5 Assessment of Construction Impacts

13.5.1 During the 18 month construction phase, personnel will travel to and from the application site by private car, light vehicles or minibus. In addition to these vehicles, the following HGVs will require access to the application site:

- low-loaders and tipper lorries transporting excavators and removing spoil;
- low-loaders and flat-bed lorries to deliver rebar, equipment, plant and control building components;
- HGVs to move stone within the application site from proposed onsite borrow pits;
- HGVs delivering raw materials for onsite concrete batching for turbine foundations;
- extendable semi-low and platform trailers (i.e. the TDVs) with escort vehicle delivering turbine components;
- cranes delivered as mobile units and on low-loaders and
- HGVs to remove timber from the site.

- 13.5.2 The TDVs are classed as abnormal loads during delivery to the application site. Once the component has been delivered, the TDV will retract to the size of a standard articulated vehicle (approximately 16.5 m in length) and as such will no longer comprise an abnormal load or require the assistance of an escort vehicle on its return journey.
- 13.5.3 The main erection crane will be in the region of 900 tonnes lifting capacity. Whilst travelling to the application site on public roads, the crane will be de-rigged and its axle weights will be within that permissible by current legislation. The width of the crane will be approximately 3 m and the length of the crane will be approximately 18 m. One smaller assisting crane (of 500 tonnes capacity) will also be required. The two cranes will lift turbine tower sections and blades from the delivery vehicles and into their assembly position. The larger crane will be used to lift the tower sections, turbine nacelle and the hub and blade assembly into position. The assisting crane will help to align and position the components whilst being installed. Once each turbine is assembled and installed, the two cranes will be moved to the next turbine position.
- 13.5.4 The nacelle will be the heaviest single component; the overall weight of this TDV being in the region of 140 tonnes. The longest vehicles that will access the application site will be the blade TDVs at approximately 55.7 m in length, based upon a 52 m blade component.

Predicted Impacts

- 13.5.5 The traffic impact of the additional vehicles associated with the construction of the proposed development can be categorised as:
- additional traffic volumes associated with the construction activities for the proposed development travelling on the existing road network and
 - delays to non-development related journeys as a result of slow moving vehicles i.e. TDVs.
- 13.5.6 **Tables 13.6** and **13.7** provide a summary of the traffic generated throughout the course of the 18 month construction programme and **Tables 13.8** and **13.9** detail the assumed distribution of traffic throughout the road network and increases in traffic flows on the road network as a result of the construction activities. A detailed breakdown of the traffic generated throughout the course of the construction programme is contained within **Appendix 13.2 Volume IV**.
- 13.5.7 The timber clearance movements have been included to coincide with the first ten months of the construction programme. While the timber clearance may occur in advance of the construction of the windfarm the inclusion of the movements within the construction programme provides a robust assessment.
- 13.5.8 As outlined in **Table 13.6**, the total number of offsite vehicle movements generated during the construction of the proposed development is estimated to be **23,992** over the 18 month construction period. This figure includes **152** abnormal load movements, **8,915** HGV movements and **14,925** car / light vehicle movements (referred to here as Light Goods Vehicles (LGV)). The maximum increase of 105 vehicles per day occurs in month 8 of the programme.
- 13.5.9 It is important to note that with the construction programme being only 18 months long, the increase in traffic associated with the construction activities will be relatively short term. **Table 13.8** and **Table 13.9** show the total traffic percentage increase and the HGV percentage increase respectively. Paragraphs 13.10.9 to 13.10.19 discuss the impacts on key sections of the road network (based on strategic ATC locations) as a result of the increase in traffic associated with the construction of the proposed development.

Table 13.6 Summary of Predicted Construction Phase Traffic Generation

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Total
Total LGV Movements	733	653	653	653	773	773	773	1293	1093	1093	1040	1040	880	880	680	680	480	760	14925
Total Abnormal Load Movements	0	0	0	0	0	0	0	0	0	0	39	38	37	37	0	0	0	2	152
Total HGV Movements	701	608	545	164	292	287	292	800	801	792	729	688	544	544	461	461	38	166	8915
OVERALL TOTAL	1433	1261	1197	817	1064	1060	1064	2093	1893	1885	1808	1766	1460	1460	1141	1141	518	928	23992

All traffic movements shown in this table are two-way flows.

Table 13.7 Predicted Daily Vehicle Movements

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Total
Monthly Vehicle Trips	1433	1261	1197	817	1064	1060	1064	2093	1893	1885	1808	1766	1460	1460	1141	1141	518	928	23992
No. of Days*	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	
Average Total per Day	72	63	60	41	53	53	53	105	95	94	90	88	73	73	57	57	26	46	
Average HGV Total per Day	35	30	27	8	15	14	15	40	40	40	38	36	29	29	23	23	2	8	
Average LGV Total per Day	37	33	33	33	39	39	39	65	55	55	52	52	44	44	34	34	24	38	

* Proposed hours of construction from 07:00-19:00 Mon-Fri and 07:00-13:00 Sat. This assessment assesses a 5 day working week only in order to ensure that a robust assessment is undertaken. All traffic movements shown in this table are two-way flows.

Table 13.8 Percentage Daily Increase on Identified Links Due to All Vehicle Movements During Construction Phase

ATC Counter Location	% Split at each ATC	% Increase in Total Vehicles																	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
A76 New Cumnock-B741 to Lime Rd	100.0 %	1.9%	1.7%	1.6%	1.1%	1.4%	1.4%	1.4%	2.8%	2.5%	2.5%	2.4%	2.3%	1.9%	1.9%	1.5%	1.5%	0.7%	1.2%
A76 Pathhead-New Cumnock Between B741 and B7083(s)	100.0 %	1.4%	1.2%	1.1%	0.8%	1.0%	1.0%	1.0%	2.0%	1.8%	1.8%	1.7%	1.7%	1.4%	1.4%	1.1%	1.1%	0.5%	0.9%
A70 East Terelgin	100.0 %	1.0%	0.9%	0.8%	0.6%	0.7%	0.7%	0.7%	1.5%	1.3%	1.3%	1.3%	1.2%	1.0%	1.0%	0.8%	0.8%	0.4%	0.7%
A713 Southeast of Dalmellington	100.0 %	4.4%	3.9%	3.7%	2.5%	3.3%	3.3%	3.3%	6.5%	5.9%	5.8%	5.6%	5.5%	4.5%	4.5%	3.5%	3.5%	1.6%	2.9%
A713 Northwest of Dalmellington	100.0 %	1.3%	1.2%	1.1%	0.8%	1.0%	1.0%	1.0%	1.9%	1.7%	1.7%	1.7%	1.6%	1.3%	1.3%	1.1%	1.1%	0.5%	0.9%
B741 Northeast of Dalmellington	100.0 %	8.0%	7.0%	6.6%	4.5%	5.9%	5.9%	5.9%	11.6%	10.5%	10.5%	10.0%	9.8%	8.1%	8.1%	6.3%	6.3%	2.9%	5.1%
B741 Southwest of New Cumnock	100.0 %	3.5%	3.1%	3.0%	2.0%	2.6%	2.6%	2.6%	5.2%	4.7%	4.6%	4.5%	4.4%	3.6%	3.6%	2.8%	2.8%	1.3%	2.3%
Afton Rd South of New Cumnock	100.0 %	10.7%	9.4%	8.9%	6.1%	7.9%	7.9%	7.9%	15.6%	14.1%	14.0%	13.5%	13.1%	10.9%	10.9%	8.5%	8.5%	3.9%	6.9%

Table 13.9 Percentage Increase on Identified Links Due to HGV Movements During Construction Phase

ATC Counter Location		% Split at each ATC	% Increase in HGV Vehicle Movements																	
Month			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
A76 New Cumnock-B741 to Lime Rd	100.0 %	3.9%	3.4%	3.0%	0.9%	1.7%	1.6%	1.7%	4.5%	4.5%	4.5%	4.3%	4.0%	3.3%	3.3%	2.6%	2.6%	0.2%	0.9%	
A76 Pathhead-New Cumnock Between B741 and B7083(s)	100.0 %	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
A70 East Terelgin	100.0 %	3.6%	3.1%	2.8%	0.8%	1.5%	1.4%	1.5%	4.1%	4.1%	4.1%	3.9%	3.7%	3.0%	3.0%	2.4%	2.4%	0.2%	0.8%	
A713 Southeast of Dalmellington	100.0 %	20.0%	17.2%	15.4%	4.6%	8.6%	8.0%	8.6%	22.9%	22.9%	22.9%	21.7%	20.6%	16.6%	16.6%	13.2%	13.2%	1.1%	4.6%	
A713 Northwest of Dalmellington	100.0 %	10.5%	9.0%	8.1%	2.4%	4.5%	4.2%	4.5%	12.0%	12.0%	12.0%	11.4%	10.8%	8.7%	8.7%	6.9%	6.9%	0.6%	2.4%	
B741 Northeast of Dalmellington	100.0 %	52.0%	44.6%	40.1%	11.9%	22.3%	20.8%	22.3%	59.4%	59.4%	59.4%	56.4%	53.5%	43.1%	43.1%	34.2%	34.2%	3.0%	11.9 %	
B741 Southwest of New Cumnock	100.0 %	29.2%	25.0%	22.5%	6.7%	12.5%	11.7%	12.5%	33.4%	33.4%	33.4%	31.7%	30.0%	24.2%	24.2%	19.2%	19.2%	1.7%	6.7%	
Afton Rd South of New Cumnock	100.0 %	211.7 %	181.4 %	163.3 %	48.4%	90.7%	84.7%	90.7%	241.9 %	241.9 %	241.9 %	229.8 %	217.7 %	175.4 %	175.4 %	139.1 %	139.1 %	12.1%	48.4 %	

13.5.10 As detailed in **Table 13.8** above all the road sections within the study area are predicted to experience an increase of less than 16% as a result of construction traffic, based on the maximum increase of 105 vehicles per day. Therefore the increase in traffic at all locations is of negligible significance (less than 30%) in accordance with criteria set out in **Table 13.2**.

13.5.11 In addition when considering the increase in HGV movements, based on a maximum of 40 HGVs per day the following road sections are predicted to experience an increase greater than 30% and are therefore of significance, when considering the addition of HGV traffic onto the baseline volumes:

B741 Northeast of Dalmellington

13.5.12 This road may experience a worst case increase in HGV movements of 59.4% (40 HGVs per day) on a base flow of 67 HGVs per day. This change is of minor significance (between 30% and 60%) in accordance with the criteria set out in **Table 13.2**. The maximum potential worst case increase of 40 HGVs per day occurs only in months 8, 9 and 10 of the programme with daily movements reducing across all other months, as identified within **Table 13.7**. Whilst theoretically this increase will result in a minor effect, it is important to consider the increase in the context of the existing low levels of baseline traffic and the carrying capacity of the road. It is noted that this road is currently operating significantly below its capacity. **Table 13.3** provides typical capacities for a variety of road types and it is estimated that the capacity of a road such as this is a 43,200 two-way flow per day. During the peak month of the construction phase, the total vehicles per day on this road (including baseline traffic) will be 1,007 per day. As such, it is clear that the road is currently operating below its capacity and will continue to do so with the addition of the construction traffic flows.

B741 Southwest of New Cumnock

13.5.13 This road may experience a worst case increase in HGV movements of 33.4% (40 HGVs per day) on a base flow of 120 HGVs per day. This change is of minor significance (between 30% and 60%) in accordance with the criteria set out in **Table 13.2**. The maximum potential worst case increase of 40 HGVs per day occurs only in months 8, 9 and 10 of the programme with daily movements reducing across all other months, as identified within **Table 13.7**. Whilst theoretically this increase will result in a minor effect, it is important to consider the increase in the context of the existing low levels of baseline traffic and the carrying capacity of the road. It is noted that this road is currently operating significantly below its capacity. From **Table 13.3** it can be seen that the estimated capacity of a road such as this is a 43,200 two-way flow per day. During the peak month of the construction phase, the total vehicles per day on this road (including baseline traffic) will be 2,133 per day. As such, it is clear that the road is currently operating below its capacity and will continue to do so with the addition of the construction traffic flows.

Afton Road south of New Cumnock

13.5.14 Afton Road is predicted to experience a potential worst case increase in HGV movements of 241.9% (40 HGVs per day) on a base flow of 17 HGVs per day. This change is of major significance (over 90%) in accordance with the criteria set out in **Table 13.2**. The maximum potential worst case increase of 40 HGVs per day occurs only in months 8, 9 and 10 of the programme with daily movements reducing across all other months, as identified within **Table 13.7**. Whilst theoretically this increase will result in a major effect, it is important to consider the increase in the context of the existing low levels of baseline traffic and the carrying capacity of the road. It is noted that this road is currently operating significantly below its capacity. From **Table 13.3** it can be seen that the estimated capacity of a road such as this is a 6,720 two-way flow per day. During the peak month of the construction phase, the

total vehicles per day on this road (including baseline traffic) will be 777 per day. As such, it is clear that the road is currently operating below its capacity and will continue to do so with the addition of the construction traffic flows.

Summary of Construction Traffic Generation Impacts

- 13.5.15 In terms of total traffic generation, the construction of the proposed development will have a negligible impact upon all assessed road sections.
- 13.5.16 With regards to HGV movements, the percentage increases for the Afton Road section suggests a major impact on the road network in accordance with the IEMA criteria as detailed in **Table 13.2**. However, this high percentage is a result of the low levels of background HGV traffic at this location. Furthermore, it has been demonstrated that during the busiest months for HGVs, the total two-way HGV movements per day will be on average only 40. Therefore, despite the high percentage increases, the numerical increase in HGVs is low. Moreover, the effects of construction traffic will occur over a relatively short period and the existing road infrastructure is operating well below capacity, therefore reducing the overall impact. Consequently, no significant environmental effects are predicted to arise from construction traffic generated by the proposed development.

Assessment of Environmental Impacts

Accidents and Safety

- 13.5.17 The maximum daily number of HGV movements over the 18 month programme equates to approximately 40 two-way movements per day (4 two-way movements per hour) and these minimal flows are not considered to have a significant impact on accidents and safety along the delivery routes.

Driver Delay

- 13.5.18 Traffic delays as a result of construction traffic could occur along the chosen site access route(s). The IEMA Guidelines note that '*these delays are only likely to be significant when the traffic on the network surrounding the development is already at, or close to, the capacity of the system*'.
- 13.5.19 The road network surrounding the application site is currently operating comfortably within capacity, which is confirmed when comparing the baseline AADT flows in **Table 13.5** with the anticipated capacity outlined within **Table 13.3**. For example on Afton Road, where the proposed site access is located, it is estimated that the capacity of such a road equates to a 6,720 two-way flow per day. The maximum impact increase in traffic associated with the proposed development on this road is 105 vehicles per day in addition to a two way baseline flow of 672 per day. As such, it is clear that the road is currently operating below its capacity and will continue to do so with the addition of construction traffic flows.

Fear, Intimidation and Pedestrian Amenity / Delay

- 13.5.20 Traffic volume, composition and speeds, in combination with pedestrian footways and crossings, contribute to the level of general unpleasantness, fear, intimidation and delay experienced by pedestrians and other vulnerable road users.
- 13.5.21 The HGVs accessing the proposed development would reach a maximum of approximately 40 two-way movements per day (4 two-way movements per hour) and these minimal flows are not considered to have a significant effect on fear, intimidation and delay along the delivery routes. During the busiest month there are only predicted to be 39 abnormal load deliveries, with deliveries only occurring during 5 months of the programme and as such the infrequent deliveries, coupled with the use of an escort and programming out with busy periods, ensure that abnormal load deliveries will have a negligible effect on fear, intimidation and pedestrian amenity/delay.

Severance

- 13.5.22 The IEMA Guidelines note that '*Severance is the perceived division that can occur within a community when it becomes separated by a major traffic artery*'.
- 13.5.23 The HGVs accessing the application site will reach a maximum of 40 two-way movements per day (4 two-way movements per hour) and this is expected to have a negligible impact on severance given the low predicted volumes and the short term nature of the construction programme.

Mitigation

- 13.5.24 Temporary effects relating to an increase in general construction traffic will be minimised through the implementation of an appropriate locally focused Construction Traffic Management Plan (CTMP), which will seek to promote the safe and efficient transportation of components and materials to the development in order to minimise congestion and disruption. The CTMP will be prepared prior to construction which will apply to all public road sections, enhanced with locally specific measures as appropriate. The CTMP will include but not be limited to:
- a statement of which public roads are not to be used by construction traffic;
 - a statement of which local settlements and community receptors are to be avoided and at which times;
 - a statement of local event days, during which, construction deliveries will not be carried out;
 - a commitment to monitor and ensure that damage to walkways, driveways, accesses, bridges, walls, verges and private property does not occur;
 - a commitment to providing temporary signage at notified locations (e.g. to warn of turning construction traffic at the Development access); and
 - arrangements for on-going liaison with stakeholders including the local community (e.g. proposed communication strategy covering emergency services, the local authority and the local community).
- 13.5.25 Whilst significant effects on road infrastructure are not predicted, pre-construction, and post-construction road surveys will also be undertaken and any material change in infrastructure condition recorded. PWEL will ensure that any road sections, where there has been deterioration in road condition agreed as attributable to the development construction, will be restored to the standard as recorded in pre-construction surveys.

13.5.26 With regards to abnormal loads, the following mitigation measures are proposed:

- improvements to identified roads and / or junctions on the proposed TDV access route detailed within the ALRA Appendix 13.1 Volume IV;
- all TDV movements will be programmed to take place outside of peak flow hours, where practicable, in order to minimise disruption to general traffic flows on the network;
- a haulier escort or police escort will accompany all TDVs;
- it will be necessary to stop traffic travelling in the opposite direction in order to allow abnormal load vehicles to negotiate specific pinch points on the route, as detailed within the ALRA **Appendix 13.1 Volume IV**;
- appropriate warning signs will be used to warn other road users of the presence of TDVs and
- discussions with Transport Scotland and East Ayrshire Council will be necessary in order to determine traffic management measures for the TDV movements.

13.5.27 Continuous monitoring during construction is not necessary. It is proposed the CTMP will ensure that frequent inspections are carried out to ensure that agreed mitigation measures, as outlined above, are being undertaken.

Residual Impacts

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

- a CTMP will minimise, as far as practicable, traffic impacts during construction;
- the delivery routes proposed are mainly on trunk roads and key regional roads, which are established HGV routes;
- the maximum traffic increases as a result of construction related traffic will be temporary and
- the environmental effects identified previously will be managed through the mitigation measures outlined above, thus ensuring the impacts are not significant.

Cumulative Impacts

13.5.29 The following windfarm developments are considered within the cumulative assessment with regards to construction traffic impacts:

- Afton Windfarm - Consented (27 turbines);
- Ashmark Hill Windfarm – Proposed (7 turbines);
- High Cumnock Windfarm – Proposed (8 turbines) and
- Quantans Hill Windfarm – Proposed (19 turbines).

13.5.30 Given that the above sites are either consented or currently in the planning phase, there is the potential for overlap with the construction programme for the proposed development.

13.5.31 The construction programmes for the cumulative sites are of varying lengths, however for the purposes of this assessment it is assumed that all construction programmes will overlap and as such, the cumulative assessment has considered the worst case construction months of each programme occurring at the same time in order to robustly assess the cumulative effect.

13.5.32 On reviewing the local road network, all eight sections of road covered by the ATC counter locations are predicted to experience an increase in vehicle movements associated with one or more developments. Given the uncertainties associated with how vehicles will route to each site, a potential worst case assessment of traffic impact has been undertaken, where it has been assumed that 100% of construction traffic will pass each counter location. In reality, it is likely that the additional traffic at each counter location will be considerably less than the total number assessed, thus resulting in a lower overall impact. Notwithstanding this, construction traffic associated with both High Cumnock and Quantans Hill sites has not been applied to the Afton Road ATC, given that it is highly unlikely that any construction vehicles will route this way.

13.10 ATC Counters Experiencing a Cumulative Effect

No.	Route	Afton Two-way Daily Traffic	Ashmark Hill Two-way Daily Traffic	High Cumnock Two-way Daily Traffic	Quantans Hill Two-way Daily Traffic	Pencloe Two-way Daily Traffic	Total Two-way Cumulative Daily Traffic	Two-way Projected AADT 2016 Baseline	Percentage Increase
1	A76 New Cumnock – B741 to Lime Rd	136	120	96	53	105	510	3,797	13.4%
2	A76 Pathhead – New Cumnock between B741 and B7083(s)	136	120	96	53	105	510	5,159	9.8%
3	A70 East Terelgin	136	120	96	53	105	510	7,127	7.2%
4	A713 northwest of Dalmellington	136	120	96	53	105	510	5,432	9.4%
5	A713 southeast of Dalmellington	136	120	96	53	105	510	1,612	31.6%
6	B741 northeast of Dalmellington	136	120	96	53	105	510	902	56.6%
7	B741 west of New Cumnock	136	120	-	-	105	361	2,028	17.8%
8	Afton Rd south of B741	136	120	-	-	105	361	672	53.7%

Summary of Cumulative Assessment Impacts

13.5.33 It is demonstrated in **Table 13.10** that five of the eight sections of road, subject to the cumulative assessment, will experience a percentage increase of less than 30%, which is of negligible significance in terms of the criteria within **Table 13.2**.

13.5.34 The cumulative assessment has predicted a minor impact (between 30% and 60%) at counters 5, 6 and 8 on the road network, in terms of the criteria within **Table 13.2**, with percentage increases of 31.6%, 56.6% and 53.7% respectively.

13.5.35 It is noted that all roads which experience a minor impact, in terms of the cumulative assessment, are currently operating significantly below capacity. Taking Afton Road (counter 8) as an example, where the site access will be located, the capacity of a road such as this (identified within **Table 13.3**) is a 6,720 two-way flow per day. Assuming the peak month of construction occurs at the same time for Pencloe, Ashmark Hill and Afton windfarms, which is highly unlikely, the total vehicles per day on this road (including baseline traffic) will be 1,033. As such, it is clear that the road is currently operating below its capacity and will continue to do so with the addition of the worst case traffic flows associated with all three windfarms.

Furthermore, it is also important to note that a potential worst case assessment of traffic impact has been undertaken, where it has been assumed that 100% of construction traffic associated with cumulative sites will utilise the majority of the sections of road assessed given the uncertainties relating to the sourcing of materials. In reality, it is highly likely that the additional traffic at each counter location will be lower than the maximum number assessed due to the number of routes available, which will further reduce the overall impact.

13.6 Assessment of Operational Impacts

Predicted Impacts

13.6.1 The predicted levels of traffic associated with the operation and maintenance of the proposed development are unknown at this point. However, previous experience of other windfarms allows the following assumptions to be made:

- standard turbine servicing up to 10 times annually;
- unscheduled servicing up to 10 times annually;
- repairs to turbines up to 30 times annually;
- access track maintenance up to 4 visits annually;
- substation maintenance up to 1 visit annually and
- routine site inspections once a month.

13.6.2 In the unlikely event that all of the above events occur on the same day, vehicle movements will not be expected to exceed 10 movements per day. The impacts of this level of operational traffic falls substantially below the guidance thresholds and is consequently considered to be insignificant.

Mitigation

13.6.3 As previously identified, the traffic generated during operation will not have a significant impact on the existing road network. Suitable signage will be erected advising of the appropriate access to the proposed development.

Residual Impacts

13.6.4 There will be negligible residual impacts on the existing road network from the operation of the proposed development

Cumulative Impacts

13.6.5 The robust cumulative operational traffic would be approximately 50 movements per day which is considered to be insignificant.

13.7 Assessment of Decommissioning Impacts

Predicted Impacts

- 13.7.1 At this stage, it is not possible to forecast quantitatively the likely traffic effects during the decommissioning of the proposed development. This is due to the baseline data not being valid in 25 years' time.
- 13.7.2 Notwithstanding this, prior to decommissioning of the proposed development, a further traffic assessment will be undertaken and traffic management procedures agreed with EAC. The levels of traffic associated with the decommissioning will be comparatively lower than those during the construction phase since decommissioning will mainly comprise the removal of all above ground infrastructure (see **Chapter 4: Project Description**)

Mitigation

- 13.7.3 The existing baseline data is unlikely to be relevant during decommissioning, therefore, it is considered more effective to consider any mitigation measures closer to the time of decommissioning to ensure traffic impacts are minimised.

Residual Impacts

- 13.7.4 The decommissioning impacts should be similar to the construction impacts, but their intensity will be greatly reduced as the majority of the construction traffic is associated with concrete pouring for turbine foundations, which will mostly remain in place irrespective of decommissioning options. There will therefore be negligible residual impacts.

Cumulative Impacts

- 13.7.5 It is predicted that the decommissioning of windfarms would be programmed in order that they do not coincide. Therefore the decommissioning will not have a cumulative impact.

13.8 Summary and Conclusions

- 13.8.1 The additional traffic as a result of the anticipated construction programme will result in increases of traffic flows on the trunk roads and local roads leading to the application site. However, when considering actual volumes of traffic, the predicted increases in flow are generally of a negligible magnitude and will not have an effect on the practical operating capacity of these roads. The environmental effect is therefore considered not significant in terms of the EIA Regulations assuming the proposed mitigation measures are implemented.
- 13.8.2 The levels of traffic anticipated during the operational phase of the proposed development are not significant in terms of the EIA Regulations.
- 13.8.3 The principal impact of traffic is associated with the construction of the proposed development. These effects are of a temporary nature and are negligible and not significant in terms of the EIA Regulations.
- 13.8.4 When considering the proposed development within a cumulative assessment the effects are negligible and not significant.

13.9 References

- IEMA, 1993 Guidelines for the Environmental Assessment of Road Traffic, by the Institute of Environmental Management and Assessment, 1993
- IHT, 1994 Guidelines for Traffic Impact Assessment, The Institution of Highways and Transportation, September 1994
- Transport Scotland 2012, 'Transport Assessment Guidance' published by Transport Scotland, 2012
- Scottish Government 2010, Scottish Planning Policy
- DFT, 2012b, Volume 15 Economic Assessment of Road Schemes in Scotland; Section 1 The NESAs Manual, Department for Transport, amended 2012.

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14 Socio-Economics

14.1 Introduction

14.1.1 This chapter assesses the potential social and economic impacts of the proposed development, including those on public access and on recreation. It addresses the current recreational use of the application site and surrounding area, and also considers tourism activities in the area. **Chapter 7: Landscape and Visual Assessment** presents the assessment of the visual impact of the proposed development from key viewpoints including stopping points along recognised recreational walking or driving routes. As such the impact on visual amenity is not considered further in this chapter.

14.1.2 The following potential issues were considered through the assessment:

- Impacts on public access with regards to the open access nature of the application site;
- Impacts on the use of Public Rights of Way (PROW) including footpaths, bridleways, and 'other routes with public access (ORPA), both within the application site and in the vicinity;
- Capital spend arising from the project;
- Direct and indirect employment generation; and
- Indirect economic impacts on recreation and tourism.

14.2 Policy, Legislation and Guidance

National Guidance

Scottish Government Economic Strategy (2011)

14.2.1 The Government Economic Strategy highlights six strategic priorities that drive economic growth:

- A supportive business environment;
- Transition to a low carbon economy;
- Learning, skills and well-being;
- Infrastructure development and place;
- Effective government; and
- Equity.

14.2.2 The urgent need to meet emissions targets has resulted in the creation of a specific Strategic Priority focused on the low carbon economy. Energy (including renewables) is one of the seven growth sectors identified in the economic strategy.

Scottish Planning Policy (SPP) (2014)

14.2.3 The latest version of Scottish Planning Policy (SPP) was published on June 23, 2014 and it states that the overarching purpose of the Scottish Government is to increase sustainable economic growth. The SPP advises that the planning system should proactively support development that will contribute to sustainable economic growth and it also introduces a presumption in favour of development that contributes to sustainable development.

- 14.2.4 It also advised that when preparing development plans, local authorities should ensure that (paragraph 79):

“plans should set out a spatial strategy which:

- reflects the development pressures, environmental assets, and economic needs of the area, reflecting the overarching aim of supporting diversification and growth of the rural economy;*

- promotes economic activity and diversification, including, where appropriate, sustainable development linked to tourism and leisure, forestry, farm and croft diversification and aquaculture, nature conservation, and renewable energy developments, while ensuring that the distinctive character of the area, the service function of small towns and natural and cultural heritage are protected and enhanced”.*

- 14.2.5 SPP therefore directs that support should be given to the development of a diverse range of renewable energy technologies to ensure that the renewable energy potential of any given area is realised and optimised in a way that takes account of relevant environmental, social, economic and transport issues and maximises benefits.

Regional & Local Policy

- 14.2.6 Currently the following plans make up the development plan for East Ayrshire:

- Ayrshire Joint Structure Plan 2007;
- East Ayrshire Local Plan 2010 and
- East Ayrshire Opencast Coal Subject Plan 2003.

- 14.2.7 These will all be replaced by the East Ayrshire Local Development plan when it is adopted in 2015.

Ayrshire Joint Structure Plan 2007

- 14.2.8 The Structure Plan is the strategic land use planning document and covers East, North and South Ayrshire. The Ayrshire Joint Structure Plan acknowledges the substantial renewable energy resources that are ready to be exploited in the area. It suggests that renewable energy developments have the potential to “*act as an economic and sustainable driver of local economies for the future*” (paragraph 43). It is also noted that “*...windfarms can be important to the future economic regeneration of rural communities*” (paragraph 46).

- 14.2.9 An addendum has been added to the Ayrshire Joint Structure Plan (available at: <http://www.east-ayrshire.gov.uk/Resources/PDF/W/Windfarmguidance.pdf>) that states “*...the scale and cumulative impact of windfarms proposal within Ayrshire continues to raise significant concerns amongst communities*”.

East Ayrshire Local Plan (2010)

- 14.2.10 The Plan provides the base for future development throughout East Ayrshire through to 2017. Wind energy development is covered in Policy CS14. The proposed development is not within an Area of Search for windfarms, therefore the policy notes a need to take into consideration the communities, tourism and recreational interests.

- 14.2.11 Policy CS15 (*page 45 of Volume 2: Strategic and General Development Management Policies*) notes that commercial windfarm developments will have to contribute to a dedicated Renewable Energy Fund that will be used to finance sustainable community environmental projects, particularly those designed to help reduce carbon emissions and counteract global warming. *“For a period of 10 years from the commencement of construction work on the windfarm, all contributions will be directed exclusively to local projects within 10 kilometres of the boundary of the windfarm. Thereafter, 50% of the contributions received will be directed towards local projects with 50% being reserved for use in the wider East Ayrshire area. Contributions will be payable annually and be set at a standard rate of £2500 per megawatt of installed capacity per annum, index linked to 1 January 2008”.*
- 14.2.12 Through the preparation of the East Ayrshire Development Plan and the Council’s work in relation to *‘Transforming the Relationship with the Communities we serve’*, the Council is currently reviewing how the monies within the Renewable Energy Fund can most effectively be spent to benefit those local communities within East Ayrshire which are affected by wind farm developments.
- 14.2.13 The council is also reviewing the amount of community benefit collected in light of current guidance and examples committed for windfarms across Scotland.

East Ayrshire Local Development Plan (October 2012)

- 14.2.14 With regards to wind energy, the Local Development Plan looks at the key challenges facing East Ayrshire and the wider Ayrshire Area. It confirms that *“the policy framework should be based on the capacity of the area to accommodate further large scale windfarm development, taking into account all relevant constraints”.* The plan recognises the national policy that *“Development Plans should provide spatial frameworks for windfarms of over 20 MW generating capacity, identifying: (i) areas requiring significant protection; (ii) areas with potential constraints and: (iii) areas of search where appropriate proposals are likely to be supported”.*
- 14.2.15 The East Ayrshire Local Plan 2010 also introduced a requirement for commercial windfarm developers to contribute to a dedicated Renewable Energy Fund (REF). The financial contribution to the fund is intended to help recompense local communities for any disturbance experienced during the construction, operational and decommissioning phases of windfarm development. Through the Council’s work in relation to *‘Transforming the Relationship with the Communities we serve’*, the Council will review how the monies within the Renewable Energy Fund can most effectively be spent to benefit those local communities within East Ayrshire which are affected by windfarm developments.

Ayrshire Supplementary Planning Guidance (SPG) on Windfarm Development

- 14.2.16 The planning guidance acknowledges that the Ayrshire Councils are aware of the potential challenges associated with wind energy. Ayrshire is noted as having a significant wind energy resource and for offering an attractive location for windfarm development. The guidance is based on the principle that windfarms should be accommodated *“where the technology can operate efficiently and environmental and cumulative impacts can be satisfactorily addressed”.*
- 14.2.17 The guidance covers spatial framework and visual & landscape considerations. It is noted that *“Development which has a significantly adverse impact on tourism and recreational interests will not be supported”.* In terms of community impact the guidance notes *“Development will not generally be supported within 2 km of a town and village or within either 700 metres or a distance of 10 times the turbines rotor blade diameter (whichever is the greater) from an individual dwelling, work place or community facility unless the developer can demonstrate the impacts are acceptable”.*

Other Policy Consideration

East Ayrshire Tourism Strategy and Action Plan 2009 – 2015

- 14.2.18 The East Ayrshire Tourism Strategy and Action Plan describes how the area will contribute to the national growth target set by the Scottish Government of 50% growth in tourism revenue by 2015 (included within the Scottish Executive “*A Tourism Framework for Change*” (2006)). It highlights the importance of sustainable tourism development and calls for growth in green tourism. One of its key objectives is to strengthen the proportion of the areas as a green destination. The strategy notes the progress that has been made to establish path networks and promote outdoor access within East Ayrshire and it is important that access networks continue to develop and that there is introduction of more “*signage linking networks to other tourism attractions*” (p.19) with increases in adventure tourism also noted, with Glen Afton identified as a potential location.

East Ayrshire Outdoor Access Strategy (2001)

- 14.2.19 The strategy notes the need to encourage outdoor recreation within and around their communities with New Cumnock targeted as an area where this could be beneficial. It notes the need to link local community based routes and networks with more strategic, longer distance routes to help encourage accessibility. The following vision is provided:

“A series of well planned, co-ordinated and used path networks which will provide connections between communities, meet the social needs and health needs of communities, realise the area’s tourism potential, promote more sustainable transport choices and support economic and environmental regeneration”.

Dumfries and Galloway Structure Plan (1999)

- 14.2.20 The proposed development is located in proximity to the Dumfries and Galloway local authority border, therefore planning policy for the area has also been considered. The Structure Plan Strategy states that “*economic development which diversifies and strengthens the local economy in a sustainable manner*” (Strategy Statement 1, p.14) will be encouraged. Moreover, it encourages development which “*increases the supply of jobs particularly in areas of high unemployment and in rural areas*” (p.14). The Structure Plan also notes that the Council will take into account the cumulative impact of windfarm proposals (Policy S22, p.82).

14.3 Methodology

- 14.3.1 For the purposes of the socio-economic assessment an inner study area of 2 km (to reflect local policy) has been used, with an outer study area of 5 km to take account of potential visual impacts. Please See **Figures 14.1** and **14.2 Volume III**.
- 14.3.2 Potential impacts from the construction, operation and decommissioning of the proposed development are identified and their significance assessed with regard to the magnitude of the effect and sensitivity of the receptors.
- 14.3.3 Potential impacts and their magnitude upon receptors will be assessed as defined in **Table 14.1**. Magnitude can be either positive or negative. It takes into account the following factors:
- The spatial extent and number of people or firms affected (for example, individuals, neighbourhoods, local area, region, Scottish economy);
 - The duration of the impact (for example temporary or permanent, irreversible or permanent, short-term, medium-term or long-term) and
 - Thresholds – where an effect will create an unacceptable step change.

Table 14.1 Definition of Magnitude of Impact

	Extent	Duration	Scale
Large	Scotland wide	Permanent irreversible impact	A paradigm shift / step change
Medium	East Ayrshire region	Impact to occur for 5-10 years	Major difference perceptible
Small	Local Authority area	Impact to occur for 1-5 years	Moderate / minor difference perceptible
Negligible	Immediate location to site	Impact to occur less than 1 year	Negligible difference

14.3.4 When dealing with socio-economic factors associated with the proposed development, a range of people may be affected, and there is a degree of sensitivity associated with all groups. The sensitivity varies to take into account the different types of receptors who may respond differently to a particular impact, and the nature of the impact. **Table 14.2** provides a summary definition of sensitivity for the purposes of this assessment.

Table 14.2 Definition of Sensitivity of Receptors

Sensitivity	Definition
High	<p>The identified needs or concerns of a receptor (e.g. community or organisation) indicate that it will be highly sensitive to change as a result of an impact.</p> <p>The receptor is an economy* that is susceptible to total or substantial change as a result of the impact.</p> <p>The resource will be put under significant pressure and will be unable to absorb the change.</p> <p>There are no suitable, alternative and available resources accessible to the users impacted.</p>
Medium	<p>The receptor is comprised in part of vulnerable groups or communities. Therefore, the receptor is likely to be partially or moderately affected by an impact.</p> <p>The identified needs or concerns of a receptor (e.g. community or organisation) indicate that it will be moderately sensitive to change as a result of an impact.</p> <p>The resource is able to absorb a proportion of the change but the change will put some pressure on the resource.</p> <p>There is limited capacity in available, alternative resources and/or these are difficult to access.</p>
Low	<p>Minor or negligible effect on vulnerable groups or community.</p> <p>The receptor is an economy* that is susceptible to minor or negligible change as a result of the impact.</p> <p>The recognised needs or concerns of the receptor (e.g. community or firms) indicate that it will have a low sensitivity as a result of the impact.</p> <p>The resource is able to absorb the change.</p> <p>There is spare capacity at suitable, alternative resources which are easily accessible.</p>

* An economy refers to an economic system of interest, in this case the economic conditions of East Ayrshire.

14.3.5 The rating of significance is determined by whether it is categorised as neutral, minor, moderate or major. In accordance with the EIA Regulations 2011, effects assessed as being of “moderate” or “major” significance are considered to be significant effects. The significance is assessed as presented in **Table 14.3**.

Table 14.3 Significance Matrix

Magnitude of Impact	Sensitivity of Receptor		
	High	Medium	Low
Large	Major Significance	Moderate Significance	[1]
Medium	Moderate Significance	[1]	Minor Significance
Small	Moderate Significance	[2]	[2]
Negligible	[1]	[2]	Neutral Significance
[1] The choice between 'Moderate Significance', 'Minor Significance' and 'Neutral Significance' will depend on the specific impact and will be down to professional judgement and reasoning			
[2] The choice between 'Minor Significance' and 'Neutral Significance' will depend on the specific impact and will be down to professional judgement and reasoning.			

14.3.6 It should be recognised that the above provides a broad process for determining the likely significance of impacts. However, there are likely to be some exceptions in which something may be determined as a “minor” level of significance based on the above but is considered to be a significant issue for the community. Therefore, consideration is also given to the level of community acceptability or community concern about the impact when determining the level of significance. For example, disturbance to a public right of way because of the proposed development may be classed as minor, however, this may be a significant issue for local communities and the level of community acceptability or concern around this issue is therefore considered in the overall evaluation.

Data Sources

14.3.7 The assessment includes an extensive review of information sources, to establish existing conditions and to identify current tourism and recreation businesses and activities within the area (supported by a site visit). The assessment uses standard socio-economic and demographic data from available datasets, including the 2011 census (<http://www.sns.gov.uk>), NOMIS (the Office for National Statistics website) Scottish Public Health Observatory (<http://www.scotpho.org.uk>) and standard sources of tourist and visitor data found on Visit Scotland’s website.

Consultation

14.3.8 A response to the scoping report was received in January 2013 and outlines a number of points related to the socio economic assessment.

Economic Benefit

14.3.9 The scoping response highlights The Government Economic Strategy (2011) that establishes a new Strategic Priority – Transition to a Low Carbon Economy. The low carbon economic sector is seen as providing an excellent opportunity to secure investment and jobs. The scoping response also notes the “2020 Routemap for Renewable Energy in Scotland” that highlights the manufacturing potential of the renewables sector and opportunities for communities to “share in the rewards of our next energy revolution”. The concept of economic benefit as a material consideration is explicitly confirmed in the Scottish Planning Policy (SPP). The scoping report has requested that the application include relevant economic information connected with the project, including the potential number of jobs and economic activity associated with the procurement, construction, operation and decommissioning of the proposed development.

Access

- 14.3.10 The scoping response also notes that the applicant should set out the alternative access routes considered and the rationale and methods used to select the chosen access routes. There is a need to set out the intended use of access routes i.e. transportation of turbine components, delivery of construction materials, every day operational use etc. Applicants should specify which access routes are temporary and which are required for the operational duration of the development. Reference is also made to the impact of the proposed development on public footpaths and rights of way. If re-routing is required alternative routes should be highlighted for consideration (further guidance is suggested in the Scottish Outdoor Access Code). The ES needs to outline any provisions made regarding public access, having regard to the requirements of the Land Reform (Scotland) Act 2003 and the Scottish Outdoor Access Code at <http://www.outdooraccess-scotland.com>, clarifying the extent of any access restrictions proposed, if any, during construction or operation and indicating any new facilities for access to be provided on or off- site.
- 14.3.11 RSPB Scotland also responded to state that they are a partner in the Coalfield Environment Initiative (CEI) which is a partnership between local authority, conservation bodies and industry, working together to enhance, conserve and promote the environment in East Ayrshire. East Ayrshire CEI has carried out a range of public access and habitat enhancements in the area, and these have been undertaken to benefit both local communities and visitors to the area. Opportunities within the application site to complement and add value to this work should be considered, for example by development access routes that link to the New Cumnock Access Network.
- 14.3.12 There are general access rights over any property under the terms of the Land Reform (Scotland) Act 2003. There are also Core Paths Plans, prepared by local authorities as part of their duties under this Act. ScotWays responded to the scoping request to state that the National Catalogue of Rights of Way shows rights of way SCD100 and SCD120 are within the application site (with several proposed turbine locations in close proximity to SCD100). ScotWays refer to the Welsh Assembly Government Technical Advice Note (TAN 8) on Renewable Energy that advises wind turbines to be set back a minimum distance of the height of the blade tip from any public highway (or right of way). Therefore, ScotWays have requested confirmation of the minimum separation distance used and requests that consideration is given to how public access rights will be managed alongside the site's access requirements. It should be noted however that the two PRoWs identified by Scotways within the application site are not accessible at present due to the maturing forestry plantations.

Local Consultation

- 14.3.13 In addition to scoping consultation a number of organisations were contacted directly for their thoughts regarding the proposed development. Those contacted were focused on businesses within the 2 km zone that may use or require the application site for their business purposes. Those contacted were:
- Ashmark Farm Bed and Breakfast (Afton Road, Cumnock, Ayrshire, KA18 4PR);
 - Afton Waters Bed and Breakfast and Art experience (New Cumnock, KA18 4PR);
 - Glen Afton Caravan Park (New Cumnock, KA18 4PR); and
 - Coalfield Environment Initiative (CEI) who have provided upgrade works to the path associated with Glen Afton reservoir (see: <http://www.ea-cei.org.uk/pathnetwork/index.html>)

- 14.3.14 The organisations listed were contacted on the 7th October 2013 by email and one response was received. This response was from Afton Waters Bed and Breakfast and raised concerns that they have over the impact from windfarms upon tourism in the local area and more widely across Scotland. Assessment of the impacts upon tourism is provided in **Section 14.5**.

14.4 Baseline Conditions

- 14.4.1 The application site is located in East Ayrshire; the closest part of the application site boundary is approximately 2.5 km north of New Cumnock and 11 km east of Dalmellington (no towns or villages are within 2 km of the proposed development). The site is located entirely within the administrative boundary of East Ayrshire Council (the boundary with Dumfries and Galloway Council is immediately south of the application site). The nearest postcode is KA18 4PR (properties along Afton Road, north east of the application site) and it is located within data zone S01001276 (referred to in this chapter as the New Cumnock data zone) designated under the Scottish National Statistics website with demographic data associated with the area provided in **Appendix 14.1 Volume IV**.
- 14.4.2 The closest receptors are identified in **Chapter 4: Project Description (Table 4.1)**. The closest is Pencloe Farm which is located directly north of the site and Lynn View, located 1.3 km northwest of the closest proposed turbine and 1.06 km from the application site boundary.
- 14.4.3 A map of local stakeholders is included in **Figure 14.1 Volume III**, a boundary of 5 km and 2 km has been used to highlight socio-economic aspects. There is a recently (during 2012) improved right of way marked on **Figure 14.2 Volume III**, the improvements to the path have been undertaken by The East Ayrshire CEI.
- 14.4.4 The majority of the application site comprises a commercial conifer plantation managed and operated by Forestry Commission Scotland (FCS) and therefore subject to open access. A conifer plantation in private ownership is located to the east of the application site. The forest includes a biking trail and a number of watercourses, and the Southern Upland Way passes some distance to the east of the area (with the potential for viewpoints across the forest area). **Figure 14.2 Volume III** includes details on rights of way associated with the application site.
- 14.4.5 There are distinctive types of community surrounding the area. There are pastoral communities to the eastern side of the area, including Thornhill and Carron Bridge (approximately 20 km from the application site). There is a more isolated moorland community around Carsphairn to the south (approximately 10 km from the application site) and former coal mining towns to the north including New Cumnock (approximately 2.5 km from the application site) and Sanquhar (approximately 15 km from the application site).

Socio Economic Profile

- 14.4.6 The socio economic profile examines the key indicators and measures of socio economic activity in the study area. It sets a context for the assessment and highlights key economic issues.

Population

- 14.4.7 The estimated population of Scotland in 2011 was 5,254,800 with 17.4% of the population classed as children (under 16), 62.8% as working age and 20% as pensionable age. Within East Ayrshire Local Authority area the population in 2011 was 120,200 with similar levels of children (17.5%), working age (61.6%) and pensionable age (21%). There is a slightly lower percentage of working age population in East Ayrshire compared to the Scottish average and slightly higher percentage of pensionable age. Within the New Cumnock data zone the population in 2011 was 626 with 16.3% children, 64.7% working age and 19% pensionable age.

Tourism (source: The Visitor Economy of Ayrshire: The Present Profile and Future Opportunities, 2011)

- 14.4.8 In 2009, the Visitor Economy in Ayrshire & Arran generated £342M or about 3% of the Scottish total. There is a strong seasonal pattern to local visitor expenditure, with June, July and August accounting for 41% of the total. Around half of the income from the area's Visitor Economy was accounted for by businesses in South Ayrshire. Since 2006, the local income generated by visitors has grown by 8%, but visitor numbers have dropped by an equivalent percentage. Most of the reported growth has been in North and East Ayrshire. The Visitor Economy is identified as a major employer accounting for 5% of all jobs in East Ayrshire (greater in South and North Ayrshire). Visit Scotland notes a number of tourist attractions within a wider search from the application site, examples include:

1. Ayrshire and Arran:

- New Cumnock Golf Course;
- Burns House Museum, Mauchline;
- Knockshinnoch Lagoons;
- The Doon Valley Museum – The museum depicts the social and industrial history of the area, with particular reference to its coal mines and ironworks;
- Doon Valley Crafters;
- Cumnock Factory Outlet; and
- Baird Institute Museum and Art Gallery – Houses collections and artefacts relating to the history of Cumnock and the Doon Valley.

2. Dumfries and Galloway:

- Sanquhar Golf Club;
- Sanquhar F.U.N. Pool;
- Lowther Hills Circular;
- A'The Airts and
- Sanquhar Tolbooth Museum.

Education, Skills and Training

- 14.4.9 Qualification levels in East Ayrshire highlight below average (Scotland) NVQ levels and a higher percentage of individuals (18%) with no qualifications compared to Scotland's average (10.7%). Most people in East Ayrshire are at NVQ1 stage (fewer than 5 GCSEs at grades A-C).

- 14.4.10 There is a slightly higher number of manufacturing employees within East Ayrshire (9.4%) when compared to Scotland's average (8.7%). There are also slightly higher than average involved with construction work (6.3% in East Ayrshire compared to 5.9% in Scotland). There are slightly higher levels of people employed within public administration, education and health within East Ayrshire (34.1%) compared to the Scottish average (30%). Tourism related employees in East Ayrshire are 7.2%, less than the Scottish average of 8.9%.

Economic activity of population

- 14.4.11 Numbers of employment in East Ayrshire are similar to Scotland's average figures. A significant proportion of the population are within the employment group of "professional occupation". Average weekly pay is £489.50 (which is similar to national average (£498.30)).

Crime and Environment (source: <http://www.scotpho.org.uk> for East Ayrshire)

- 14.4.12 The crime rate in East Ayrshire is not significantly different to Scotland. The proportion of the population hospitalised after an assault is higher than average. In East Ayrshire, 46% of adults rate their neighbourhood "a very good place to live" (compared to Scotland average of 52%).

Health

- 14.4.13 Male and female life expectancies are significantly lower than the Scotland average. All-cause mortality (all ages) is also significantly worse than the Scotland average. Mortality rates from coronary heart disease, cancer and cerebrovascular disease (under-75s) are not significantly different to Scotland.

14.5 Assessment of Construction Impacts

Employment

- 14.5.1 A detailed construction workforce schedule, i.e. worker numbers throughout the construction programme and likely shift patterns, would not be known until the contract for building the proposed development has been granted, however, an estimated number of construction workers to be onsite at any one time would be 40 (based on project experience of a similar nature). This is in line with benchmarking data presented by Renewable UK (2012). This would occur over about an 18 month construction period (with a maximum of 90 workers onsite during peak construction periods). Peak workforce would occur during the installation of the turbines.
- 14.5.2 Based on a rate of 10 person years of employment being one full-time equivalent (FTE), English Partnerships (2003) it can be predicted the construction phase will generate in the order of 6 to 7 FTE jobs (20 month construction period with an average of 39 workers equates to 780 months of employment, equivalent to 65 years of employment equates to 6 to 7 FTE jobs). The community baseline (**Appendix 14.1 Volume IV**) highlighted greater than average numbers of construction workers within East Ayrshire; it is therefore expected that the construction programme will be able to utilise local employees (in addition to more specialist skills required). It is likely that employment will have minor or negligible effect amongst a labour force. The local labour resource is expected to be able to absorb the change that the proposed development will bring, resulting in a ranking of low sensitivity. The magnitude of the effect is likely to be small, with any noticeable difference in employment observed local to the data area and occurring between 1 to 5 years. The effect of direct employment is likely to be positive, minor significance (therefore, not classed as significant under EIA Regulations).

- 14.5.3 There is also the potential for indirect employment to occur due to the proposed development as local businesses may benefit from the presence of the construction workforce. Indirect employment levels can be calculated by applying a local level multiplier of 1.1 (English Partnerships, 2003). This is based on research that indicates that for every 100 FTE jobs associated directly with a project, there are likely to be 10 FTE indirect jobs (i.e. 10%). It is, therefore, unlikely that any significant indirect employment, in terms of FTE jobs, will result during the construction period.

Business Revenue

- 14.5.4 An estimate of £1.045 million per MW installed capacity has been based on windfarm experience and review of financial requirement £72.4m (based on 21 turbines at 3.3MW each = 69.3MW capacity) for the proposed development (the capital cost estimate (and breakdown provided in **Table 14.4**). A proportion of this work will be performed by Scottish firms and so expenditure will generate local and regional economic activity. This estimate includes design and development costs, civil engineering works, electrical infrastructure (including grid connection), manufacture of turbines, assembly of the towers, turbines and commissioning. **Table 14.4** provides an estimated breakdown of these costs by total spend and proportion of total spend.

Table 14.4 Breakdown of Capital Spend

Component	£ million	% of total
Manufacture and installation	47.06	65
Civil engineering and turbine foundations	9.41	13
Electrical infrastructure	7.24	10
Design and development	3.62	5
Other costs	5.07	7
TOTAL	72.4	100

- 14.5.5 Published information on installed costs for UK windfarms can be found in a report prepared on behalf of the RenewableUK and Department of Energy and Climate Change (2012) that indicates: “On average, 45% of the construction costs are spent in the UK including 7% in the local area and 29% in the region or nation.”
- 14.5.6 In this case this would result in a typical project spend of the order of £5.06m in the local area and £20.99m within the region / Scotland. The types of local businesses that might benefit from this could include fencing contractors, local civil engineering contractors, timber and aggregate suppliers.
- 14.5.7 The direct expenditure arising from the proposed development during construction can be seen as offering a beneficial opportunity for Scotland. This issue is therefore ranked as having large magnitude and medium sensitivity leading to a positive, moderate significance.

Tourism (including Access)

- 14.5.8 Potential tourism and recreation impacts arising during the construction phase relate to:
- Disruption to the normal use of resources within the application site or in its vicinity; and
 - A reduction in the enjoyment gained from using these tourism and recreation resources potentially resulting in reluctance by individuals to visit the feature.
 - This could arise from, for example, a negative perception of construction activities as a feature in the landscape, or from construction noise and traffic.
- 14.5.9 The application site is currently used for commercial forestry. Parts of the application site will be clear felled for the proposed development and then replanted using the Windfarm Restock Plan (**Appendix 4.1 Volume IV**).
- 14.5.10 Following a discussion with the Access Officer at East Ayrshire Council, it is proposed that the PRoW SCD100 (which is not currently accessible due to forestry), be temporarily diverted during the construction phase and reinstated during operation. Health and safety of users during the operational phase will be considered with respect to proximity of the turbines and the route diverted if necessary. Any required diversion will be agreed with East Ayrshire Council and ScotWays.
- 14.5.11 The closest recreational activity to the application site is the Afton Dam Route, a walk around the Afton Reservoir. During construction there is unlikely to be significant impacts upon users of the route, as there will be limited visibility of the construction activities (see **Figure 7.3.2 Volume III**) and with the distance to the application site, noise levels will be minimal (**Section 12.6, Chapter 12: Noise and Vibration**).
- 14.5.12 There are a number of recreational amenities (parks and sports facilities) located in New Cumnock over 2.5 km north of the application site (**Figure 14.1 Volume III**). Some of these are located along the A76 (the proposed access route for the development), however, the construction phase is temporary (18 months), and to minimise disruption a Traffic Management Plan will be agreed with East Ayrshire Council to be implemented during this period. The potential for impacts upon the local road network is assessed in more depth in **Chapter 13: Traffic and Transportation**. The additional traffic as a result of the anticipated construction programme will result in increases of traffic flows on the following key regional and local roads leading to the application site;
- A76;
 - A70;
 - A713;
 - B741; and
 - Afton Road.
- 14.5.13 When considering actual volumes of traffic, the predicted increase in flows are not considered to have an effect on the operating capacity of the roads or with respect to noise. Therefore, the predicted significance of any potential impact will be negligible and temporary as this will only last for the duration of the construction period.

- 14.5.14 While the PRoW which crosses the application site is currently inaccessible, without mitigation, construction activities may directly result in unacceptable health and safety impacts on those exercising their right to responsible access onsite, presenting a major potential adverse impact. Mitigation as described below is therefore proposed. The development will not impact upon any rights of way or core paths outwith the boundary of the application site.
- 14.5.15 The potential impact on use and enjoyment of offsite tourism and recreational activities during the construction phase will be of small magnitude and low sensitivity, therefore resulting in minor significance.

Mitigation

- 14.5.16 The mitigation required for the construction phase with respect to the right to access has been developed to protect the health and safety of recreational users. Health and safety is of paramount importance to PWEL and whilst it will allow public access as far as possible to the application site, during construction, access will need to be closely controlled in areas of construction activity.
- 14.5.17 The borrow pits, construction compounds, control building and substation compound and turbine foundations when being actively worked will be fenced, as will any open excavations where required. Likewise when turbines are being erected access to these areas will be restricted and controlled. All plant, equipment and welfare units will be shuttered up, locked and parked within the construction compounds when not in use.
- 14.5.18 Where access requires to be restricted at any time, clear signage /information boards following the Scottish Outdoor Access Code (SNH, undated) branding guidelines (as requested by SNH) will be used, for example at entry points to the application site to inform visitors of the construction activities so that active construction areas can be avoided. Signage will show the location of the construction activities and the access tracks and will be agreed with EAC. An Outdoor Access Management Plan will be produced and agreed with EAC.
- 14.5.19 All construction staff will be required to undertake an induction to alert them to the potential for recreational users and to the environmental, health and safety measures that need to be taken. All delivery drivers and plant operators will be briefed during tool box talks (i.e. an onsite presentation to the workforce) as to the crossing (and also initial temporary use and redirection) of the PRoW SCD100 that is onsite. The approaches along the PRoW to the stretch within the application site will be signed to warn users of the approaching hazard.
- 14.5.20 All operatives and delivery drivers will be informed to advise site management of any deterioration of crossing point safety. All drivers will be requested to keep within an onsite speed limit of 15mph and to reduce this speed further when passing recreational users.
- 14.5.21 A Health and Safety risk assessment will be undertaken. If this identifies that additional mitigation is required to ensure the safety of the public, then further measures will be considered, which may include the use of banksmen, for example when plant is operating during the construction of new tracks or site access. The role of the banksmen would be to ensure that anyone exercising their right to access or to use the right of way is able to do so in safety away from any active or dangerous works.

- 14.5.22 Proposed mitigation measures to address adverse impacts during the construction phase also include the continued engagement with the community to listen to, and respond to, their concerns as the proposed development progresses. An ongoing communication strategy will be implemented to ensure that the local community and interested stakeholders are engaged with respect to any issues of concern and provided information regarding the proposed mitigation. The construction programme and details will also be communicated to the local community in order to reduce any inconvenience or disturbance.

Residual Impacts

- 14.5.23 With the proposed mitigation measures in place, the major potential impacts with respect to health and safety of open access during the construction and decommissioning phases will be minimised and the residual effect is anticipated to be temporary, adverse and of minor significance. Following mitigation, there are no significant adverse residual effects expected to occur with respect to general rights of access to the application site. In addition, residual impacts with respect to tourism and recreational amenities in the area are anticipated to be negligible.

14.6 Assessment of Operational Impacts

Employment

- 14.6.1 Windfarms typically result in only a few opportunities for long-term employment, as projects of the size of the proposed windfarm development are largely unmanned. It is anticipated that the demand for qualified expertise will be required during the operational phase of the development, and it is possible that this could generate opportunities locally; this however, cannot be confirmed at this stage. Due to the nature of wind farms it is likely that major maintenance events will occur from time to time when additional staff and contractors will be required for short periods. The windfarm owner/operator will aim to maximise the use of local resources where reasonable practicable. Based on the socio-economic criteria outlined in **Tables 14.1 to 14.3**, this impact is considered to be of minor beneficial significance. The main economic benefit to the local community is not through long-term employment, but instead through the community fund (see paragraph 14.6.15). There is not likely to be any indirect employment associated with the operational phase of the proposed windfarm development.
- 14.6.2 It is not expected that the operation of the proposed windfarm development within forestry land will significantly alter the employment within that sector. Further details on the Forestry Design Plan are provided within **Appendix 4.1 Volume IV**.

Business Revenue

- 14.6.3 An accurate figure for operational maintenance expenditure for the proposed development is not currently available. However, a representative figure has been assessed to be 2% of turbine capital costs (IPA Consulting, 2003). Applying this factor to the proposed Pencloe Windfarm produces an annual operational maintenance expenditure of £2.01m (£50.16m over the 25 year operational life). Opportunities would exist for local firms to provide some of the goods and services required, but the percentage of expenditure is likely to be relatively small and result in negligible magnitude and low sensitivity resulting in negligible effect that is not significant.

Supply Chain

- 14.6.4 Onshore wind brings substantial new economic benefits and job opportunities to the country as a whole and at a local level. The BiGGAR economics report shows that in 2011 onshore wind supported around 8,600 jobs and was worth £548 million to the UK economy. A similar study published in March 2012 by Scottish Renewables, the renewables industry group, '*Delivery the Ambition: employment in renewable energy in Scotland*' showed that the renewable energy industry supports more than 11,000 jobs in Scotland through direct employment and effects on the supply chain. Onshore wind developments are a large part of this, with the report stating:

"The bulk of these jobs are currently involved in projects that are principally driven by onshore wind generation."

- 14.6.5 Whilst the proposed development is relatively small in the context of these numbers, it will nonetheless contribute to investment and opportunities for the local supply chain. Supplies of maintenance produces, such as oil and paint, will be needed during the operation of the project, although not in significant amounts and only on an infrequent basis. During maintenance work, it is likely that plant hire will be required and it is expected that this will be sourced locally. Based on the socio-economic assessment criteria, the impact on the wider supply chain is expected to be negligible, albeit beneficial.

Tourism (including Access)

- 14.6.6 Potential tourism and recreation impacts include any disruption to the normal access or use of tourism and recreational amenities and also the potential impacts arising from an adverse perception of the wind turbines as a feature on the landscape, resulting in a reduction in enjoyment of an amenity or reluctance by individuals to visit the feature or area.
- 14.6.7 A number of research studies have been undertaken regarding the impact of windfarm development on tourism. The most recent was completed by the University of Edinburgh (Cara Aitchison) and submitted to the Renewables Enquiry Scottish Government in April 2012. This submission was intended to address concerns relating to tourism raised in written and oral evidence submitted by a range of organisations and individuals to the Scottish Government's current Renewables Inquiry (2012). This report also draws on the findings of the two largest studies of the tourism impact of wind farms conducted to date (University of the West of England, 2004; Glasgow Caledonian University, 2008).
- 14.6.8 The research findings revealed a clear consensus that there has been no measurable economic impact, either positively or negatively, of wind farms on tourism. Similarly, there is consensus among researchers of studies that have sought to predict the more specific potential economic impact of wind farms on tourism. Here again, there is no evidence to support the assertion that wind farms are likely to have a negative economic impact on tourism.
- 14.6.9 Interestingly the report concludes that "*the opposition to wind farms on tourism grounds is informed more by fear than fact. The research conducted by GCU stated that 'Importantly, respondents that had seen a wind farm were less hostile than those who had not'* (Glasgow Caledonian University, 2008: 3). *Starling's and Glasgow Caledonian University's findings therefore lend support to Young's (2003) research; namely, that opposition to wind farms tends to fall after construction*".
- 14.6.10 The Moffat Centre, 2008 report also highlights the positive opinions associated with wind farms and tourism activities. Highlights from this study in Scotland (where a significant proportion of work on tourism and wind farm compatibility has been completed) are shown in **Table 14.5**.

Table 14.5 Summary of Tourist Perception of Wind Farms

The Economic Impacts of Wind Farms on Scottish Tourism, Glasgow Caledonian University, Moffat Centre, and Cogentsi, 2008
<ul style="list-style-type: none"> • Three-quarters of tourists felt wind farms had a beneficial or neutral impact on the landscape • Overseas visitors seem to be more accepting about wind farms than domestic tourists • Importantly, respondents that had seen a wind farm were less hostile than those who had not • The vast majority (93-99%) of tourists that had seen a wind farm in the local area suggested that the experience would not have any effect on their decision to return to that area, or to Scotland as a whole • If the renewables target is met via substantial wind farm development, Scottish tourism revenues in 2015 are forecast to be 0.18% lower than they would have been if there were no wind farms in Scotland • The overall conclusion of this research was that the Scottish Government should be able to meet commitments to generate at least 50% of Scotland's electricity from renewable sources by 2020 with minimal impact on the tourism industry's ambition to grow revenues by over £2 billion in real terms over the period 2005-2015.

14.6.11 While the operation of the proposed development will not impact on access to any tourism or recreational amenities or cause disruption, potential impacts upon the enjoyment of these has been considered. These are linked to landscape and visual impact (**Chapter 7: Landscape and Visual**), noise (**Chapter 12: Noise and Vibration**) and traffic and transport (**Chapter 13: Traffic and Transportation**). A summary of the risk of impacts on the enjoyment of tourism and recreation amenities as a result of the proposed development's operation with respect to noise and traffic is as follows:

- The operational noise assessment has demonstrated that the ETSU-R-97 criterion limits (including daytime amenity) can be satisfied at all properties across all wind speeds. The operational noise levels are acceptable in terms of the guidance recommended by planning policy for the assessment of wind farm noise and, therefore, are considered not significant in EIA terms. Being at a significantly greater distance than the residential properties considered, it is considered that there would be no impact in terms of noise on the identified tourism and recreation facilities identified above;
- Vehicle movements during the operational phase are not expected to exceed 10 movements per day at peak times. No impact is, therefore, anticipated with respect to tourism and recreation amenities due to operational traffic levels being insignificant.

14.6.12 A review of the Zone of Theoretical Visibility mapping (as shown in **Figures 7.2.1 to 7.2.8 Volume III**) indicates that there will be some limited local visibility from the northern edge of New Cumnock where a number of recreational facilities are located and also along limited sections of the Afton Burn Way (reservoir walk) where the proposed development may be partially seen in typically filtered views through the mature belts of riverside trees. These views are likely to be transitory, long distance views and will be generally experienced as people move through the landscape. In socio economic terms, although the wind turbines may be seen, it is reasonable to conclude that there will be no major adverse impact on the use and enjoyment of amenities, and thereby no resulting reluctance by individuals to visit these facilities or the area. As a result the socio-economic impact is considered to be negligible. Further assessment upon the visual impact of the proposed windfarm development is provided in Section 7.9 (paragraph 7.9.229 for impact upon Afton Reservoir).

- 14.6.13 The PRow SCD100 within the application site will be reinstated prior to the operational phase with due consideration to distances to turbines. This will be an improvement on the current situation as the PRow is currently inaccessible. During operation of the proposed development, no major disruption to the general right to access on the Right of Way on the application site is expected, as, on a day to day basis, minimal maintenance is required. Major maintenance is likely to occur only occasionally. Any temporary disruption will be over a small area (localised to the maintenance area) and over a much shorter period (days rather than months) than during construction. This disruption is considered to result in a potential impact of negligible significance.
- 14.6.14 There will be no new boundary features or access controls that would prevent the general right of access to the application site, other than the possible fencing of borrow pits for health and safety reasons. The presence of the access tracks will result in increased access options onto the higher ground of the plateau, for walkers, cyclists and horse riders. This is considered to be a minor beneficial significance, but is not considered to represent a significant impact of the proposals.

Mitigation

- 14.6.15 The proposal, if consented, will contribute the agreed sum of money per MW (retail price index linked) of installed capacity to an annual community trust fund, in accordance with EAC's community benefits policy which is currently being updated.
- 14.6.16 Engagement with the local community will also continue to keep the public and stakeholders informed as to activities relating to the operational phase. Opportunities for mitigation/enhancement to the PRow will be considered through consultation with the Coalfield Environment Initiative and the New Cumnock Access Network.

Residual Impacts

- 14.6.17 There are a range of beneficial residual effects associated directly with the proposed development, although these are considered, due to the size of the project, to be negligible in magnitude, when the project is considered in isolation. However, when combined with other wind farm development in the region and across the UK, it will contribute to the economic stimulus they are reported to provide. It has been reported that wind farms approved during the last 12 months alone will create hundreds of jobs and contribute millions of pounds to local economies across Scotland. As noted in paragraph 14.6.4 and according to DECC (BiGGAR 2012), the onshore wind industry supported more than 8,600 jobs and was worth £548 million to the UK economy in 2011; of which around 1,100 jobs and £84 million investment occur at the local authority level in which onshore wind turbines are located. This represents approximately £700,000 for every MW of onshore wind installed in the UK, with over £100,000 staying within the host local authority area.

14.7 Assessment of Decommissioning Impacts

- 14.7.1 At the end of the operational life of the proposed development the turbines will be removed and the ground reinstated. It is not possible at this stage to assess in detail the socio-economic impacts of this phase (because there has been relatively little experience of this project phase for windfarms). However, it can be predicted the decommissioning process will be positive insofar as there will be some limited employment opportunities. Business revenue and impact on tourism and recreation are assessed as negligible, because there is not expected to be any impact from them but it is not possible to state categorically at this time because of the likelihood that communities will change and evolve by the time decommissioning occurs; however it is unlikely that any significant effects will result.

Mitigation

- 14.7.2 Consultations with local residents and stakeholders will be undertaken prior to the decommissioning phase beginning in order to inform them of the proposed schedule and activities to be undertaken during this phase. This will provide information on the expected impacts of this phase, and allow consultees to feedback their concerns and queries. Health and safety will again be of paramount importance and a range of measures will be employed in a similar manner to those described above for the construction phase and in accordance with a risk assessment which will be prepared prior to the start of this phase.

Residual Impacts

- 14.7.3 The residual socio-economic effect is anticipated to be temporary and of neutral significance.

14.8 Cumulative Impacts

- 14.8.1 With no significant adverse socio-economic effects predicted as a direct result of the proposed development, it is predicted that there will be no significant adverse cumulative effects in the local area. The proposed development will contribute to the local economy and when considered with other wind farm projects which may occur in the area, additional benefits on employment, indirect employment and supply chain economic activity will accrue. These are anticipated to be beneficial and permanent but minor in magnitude and significance.
- 14.8.2 However, it is possible that over the lifetime of the proposed development, the local supply chain could develop in response to the cumulative opportunities that these projects bring. Recent work by DECC (BiGGAR 2012) has shown that wind farms do have a very real beneficial effect on the local economies in which they are located (see paragraph 14.6.17).

14.9 Summary and Conclusions

- 14.9.1 Overall, the proposed development is expected to give rise to negligible socio-economic effects in the local area and across East Ayrshire.
- 14.9.2 While there are a number of tourism and recreational attractions in the vicinity (i.e. within 20 km), there are none within the application site itself, other than the currently inaccessible PRoW. Following mitigation, there are no significant residual effects anticipated to any of these recreational features.
- 14.9.3 In terms of construction costs it is estimated the proposed development would generate a project spend of the order of £5.06m in the local area and £20.99m within the region / Scotland. The types of local businesses that might benefit from this could include fencing contractors, local civil engineering contractors, timber and aggregate suppliers.
- 14.9.4 Benefits on a small-scale will relate to economic investment through employee spending in the local economy and supply chain development.

14.10 References

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15 Telecommunications, Aviation and Defence

15.1 Introduction

- 15.1.1 This chapter considers the potential impacts that the proposed Pencloe Windfarm may have on telecommunications, aviation and defence assets.
- 15.1.2 Wind turbines, as with any large structure, have the potential to interfere with electromagnetic signals. This can affect television reception, radio communication networks, radar and other systems associated with aviation and national defence. Wind turbines can also pose an obstacle hazard to low flying aircraft.

15.2 Policy, Legislation and Guidance

Town and Country Planning (Safeguarded Aerodromes, Technical Sites and Military Explosive Storage Areas) (Scotland) Direction 2003

- 15.2.1 Certain aerodromes, radar stations and aeronautical radio communication and navigation facilities are statutorily safeguarded under the provisions of the Town and Country Planning (Safeguarded Aerodromes, Technical Sites and Military Explosive Storage Areas) (Scotland) Direction 2003.

Scottish Planning Policy

- 15.2.2 Scottish Planning Policy (2014) (SPP) states that the consideration of proposals for energy infrastructure developments is likely to include impacts on aviation and defence interests, telecommunications and broadcasting installations, particularly ensuring that transmission links are not compromised.

Scottish Government Online Planning Advice

- 15.2.3 Scottish Government advice regarding onshore wind turbines advises that planning authorities should ensure that developers have consulted relevant aviation interests.
- 15.2.4 The online planning guidance on onshore wind turbines also advises that applicants should consult the Radiocommunications Agency (now part of Ofcom) to identify any radio installations in the neighbourhood of a windfarm site and should make direct contact with the operators of any such facilities.
- 15.2.5 Further guidance on the potential impacts of wind turbines on aviation is provided in the following documents:
- Wind Energy, Defence & Civil Aviation Interests Working Group, Wind Energy And Aviation Interests – Interim Guidelines, ETSU W/14/00626/REP, 2002;
 - Civil Aviation Authority, Safety Regulation Group, CAP 764: CAA Policy and Guidelines on Wind Turbines, June 2013;
 - Civil Aviation Authority, Safety Regulation Group, CAP 670: Air Traffic Services Safety Requirements, Third Issue, Amendment 1/2013, 13 June 2013, Part B, Section 4;
 - Scottish Executive Development Department, Planning Circular 2/2003: Safeguarding of Aerodromes, Technical Sites and Military Explosive Storage Areas: The Town and Country Planning (Safeguarded Aerodromes, Technical Sites and Military Explosive Storage Areas) (Scotland) Direction 2003;
 - National Air Traffic Services (NATS) safeguarding maps (<http://www.nats.co.uk/services/information/wind-farms/self-assessment-maps/>) and
 - Scottish Government, South-West Scotland Regional Aviation Solution Group, Final Report, February 2010.

Planning Advice Note (PAN) 62: Radio Telecommunications

- 15.2.6 PAN 62 states: Large and prominent structures such as tall buildings and windfarms can cause disruption to radio telecommunications services by obstructing or reflecting the signals. The Radiocommunications Agency may be able to suggest engineering solutions to overcome the problem, such as installing repeaters. Planning authorities can grant planning permission for such prominent structures subject to a condition that before development commences the developer will propose measures by which the quality of reception affected by the proposal will be maintained.

Ayrshire Joint Structure Plan

- 15.2.7 Paragraph 45 of the Ayrshire Joint Structure Plan states that two areas of search for large-scale windfarms have been identified in order, inter alia, to “safeguard the operational needs of Glasgow and Glasgow Prestwick Airports”. The application site is not in either of these areas. Proposals outwith these areas are judged against the criteria in Policy ECON7, which include impacts on aviation and defence interests and broadcasting installations.

Windfarm Guidance Addendum to Ayrshire Joint Structure Plan

- 15.2.8 Paragraph 20 of the October 2009 Structure Plan Addendum ‘Guidance on the Location of Windfarms in Ayrshire’ states that windfarms will not be permitted in locations where the cumulative impact will adversely affect aviation safety and operations and requires that aviation interests are consulted and agree to any proposed mitigations.
- 15.2.9 On telecommunications and television reception, the guidance requires that “developers should consult with and demonstrate that network owners and Ofcom are satisfied that no adverse impact will occur or alternatively that a technical solution is available and will be provided as part of the scheme. Development which has an adverse impact on broadcasting and receiving installations will not be supported.”

East Ayrshire Local Plan

- 15.2.10 The East Ayrshire Local Plan contains no additional policies or guidance relating to wind energy developments or their potential impacts on aviation or telecommunications.

15.3 Methodology

Consultation

- 15.3.1 The following aviation and telecommunications issues were identified during consultation, including the EIA scoping process.

Table 15.1: Issues identified during consultation

Consultee	Response/Issue	Where/How this is addressed
Ofcom	Search Radius 2000 m at Centre UK NGR NS6029206260 identified one link operated by British Telecom (BT)	BT has been consulted. The potential impact of the development on this link has been assessed in this chapter.
Joint Radio Company (JRC)	JRC does not foresee any potential problems based on known interference scenarios and the data provided.	This response is noted and has contributed to the assessment presented in this chapter.
Atkins	The above application has now been examined in relation to UHF Radio Scanning Telemetry communications used by our Client in that region and we are happy to inform you that we have no objection to your proposal.	This response is noted and has contributed to the assessment presented in this chapter.
BT Network Radio Protection	Our link passes through your windfarm. BT requires a minimum separation of 100 m from blade tip to link path.	The potential impact of the development on this link has been assessed in this chapter.
BBC	You would be likely to affect 0 homes for whom there is no alternative off-air service. In addition, you may affect up to 4 homes for whom there may be an alternative off-air service.	This chapter has assessed whether any domestic properties are located in areas where TV reception may be affected.
Glasgow Prestwick Airport (GPA)	GPA lodged a holding objection regarding impacts on radar and also their Instrument Landing System.	The potential impact of the development on Glasgow Prestwick Airport has been assessed in this chapter.
Defence Infrastructure Organisation	A turbine development at the height and location that you propose may have an impact on low flying operations. It is possible that the Ministry of Defence (MoD) will request that the turbines are fitted with visible or infrared aviation safety lighting.	The potential impact of the development on military low flying has been assessed in this chapter. The turbine layout has been revised to reduce this impact.
NATS En Route Ltd (NERL)	NERL would not have an objection to a development as described	This response is noted and has contributed to the assessment presented in this chapter.

Baseline Characterisation

Study Area

15.3.2 Study areas with the following radii were used in determining the aviation and telecommunications baseline:

- 125 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;
- 50 km for the Eskdalemuir seismic monitoring station;
- 30 km for licensed and Government aerodromes;
- 10 km for unlicensed aerodromes, airstrips and gliding sites;

- 40 km for television transmitters and
- 2000 m for microwave and scanning telemetry radio links.

Desk Study

15.3.3 The description of baseline conditions for aviation and telecommunications 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 application site, referencing the UK Aeronautical Information Publication, the UK Military Aeronautical Information Publication, aeronautical charts and published pilot's guides and
- Consultation with identified aviation and telecommunications consultees.

Method of Assessment

15.3.4 The potential impacts of the proposed Pencloe Windfarm on aviation 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 the Eskdalemuir seismic monitoring station or aeronautical radio navigation or communication equipment.

15.3.5 The potential impacts of the proposed Pencloe Windfarm on telecommunications have been assessed by considering whether any of the turbines would be within industry and operator recommended separation distances from microwave or scanning telemetry radio links.

15.3.6 The potential impacts of the proposed Pencloe Windfarm on television reception have been assessed by determining whether any domestic properties are located in zones where the BBC and Ofcom advise reception could be affected.

Significance Criteria

Air Traffic Control and Air Defence Radar

15.3.7 The significance of an impact on 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 application site; 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.

15.3.8 Potential obstacle hazard impacts of the turbines has been determined by assessing the proximity of the proposed Pencloe Windfarm to airfields and airstrips, including whether any obstacle limitation surfaces 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.

- 15.3.9 The significance of potential effects on aviation and radar receptors is defined using the following criteria:
- No impact on this receptor;
 - **Low** – Receptor able to continue operations using standard management measures;
 - **Medium** – Receptor able to continue operations with some restrictions or with additional operational mitigation measures in place and
 - **High** - Receptor unable to continue operations unless technical mitigation is in place.

Telecommunications

15.3.10 Potential impacts on telecommunications have been assessed by determining the proximity of any fixed telecommunications links to the proposed turbines and comparing those to industry and operator recommended separation distances.

15.3.11 The significance of potential effects on telecommunications is defined using the following criteria:

- No impact on this receptor;
- **Low** – Impacts not expected to reduce radio link performance below operator required criteria;
- **Medium** – Impacts expected to reduce radio link performance below operator required criteria but capable of mitigation by upgrades to transmitter/receiver or antenna systems and
- **High** - Impacts expected to reduce radio link performance below operator required criteria and not capable of mitigation by upgrades to transmitter/receiver or antenna systems. Link re-routing or replacement required.

Television Reception

15.3.12 Potential impacts on television reception have been assessed by determining the number of domestic properties where TV reception may be impaired.

15.3.13 The significance of potential effects on television reception is defined using the following criteria:

- No impact on this receptor;
- **Low** – Impacts expected to be capable of mitigation by antenna or receiver adjustment;
- **Medium** – Impacts expected to be capable of mitigation by switching to alternative transmitter station and
- **High** - Impacts requiring provision of alternative source of television signal such as satellite or cable.

15.4 Baseline Conditions

Current Baseline

Aviation

- 15.4.1 The seven most north-westerly turbines (Turbines 12, 13, 14, 17, 18, 19 and 20 – see **Figure 15.3 Volume III**) in the proposed Pencloe Windfarm are located in uncontrolled airspace between ground level and 4,000 feet (1,219 m) above sea level. Between 4,000 and 5,500 feet (1,676 m) above sea level is the Class D controlled airspace of the Prestwick Control Area, under the authority of air traffic control at Prestwick Airport. Between 5,500 feet and Flight Level 195 (approximately 19,500 feet) is the Class D controlled airspace of the Scottish Terminal Control Area (TMA) under the control of the NATS En Route Ltd (NERL) Scottish Area Control Centre at Prestwick. Above FL195 is Class C controlled airspace, also under the control of the Scottish Area Control Centre.
- 15.4.2 The remainder of the turbines are located in uncontrolled airspace between ground level and 5,500 feet above sea level. Between 5,500 feet and Flight Level 195 (approximately 19,500 feet) is the Class D controlled airspace of the Scottish TMA and above that, Class C controlled airspace also under the control of the Scottish Area Control Centre.
- 15.4.3 The airspace between ground level and 4,000 feet above sea level over the application site (5,500 feet in the south-eastern parts of the site) may be used by any civil or military aircraft without clearance from or radio contact with any air traffic control agency. The users of this airspace include military aircraft, predominantly between ground level and 2000 feet above ground level and occasional light civil aircraft.
- 15.4.4 The controlled airspace above the application site up to Flight Level 245 (FL245 – approximately 24,500 feet above sea level) is used mainly by aircraft inbound to Prestwick from the south and some southbound air traffic on airway N615. This airspace above FL245 over the site is mainly used by transatlantic traffic.
- 15.4.5 Air traffic in the controlled airspace above the application site and under the control of Prestwick Airport is controlled using the primary surveillance radar located at Prestwick Airport. Aircraft under the control of the Scottish Area Control Centre are controlled using a multiple radar network which mainly uses data from the radars at Lowther Hill near Wanlockhead (27 km east of the site) and Great Dun Fell in Cumbria (132 km south east of the application site).
- 15.4.6 Other air traffic control primary surveillance radars within 125 km of the application site are located at Glasgow Airport, Cumbernauld, Kincardine, Edinburgh Airport, RAF Spadeadam (Deadwater Fell), RAF Spadeadam (Berry Hill) and QinetiQ West Freugh. None of these radars will have line of sight to the proposed Pencloe wind turbines.
- 15.4.7 There are no Meteorological Office radars within 30 km of the application site.
- 15.4.8 There are no secondary surveillance radars within 20 km of the application site. The only aeronautical radio navigation aid within 20 km of the site is the New Galloway Non-Directional Beacon (NDB), 17 km south of the application site. It is due to be withdrawn from service by 2018.
- 15.4.9 The application site is not within the 50 km consultation zone around the Eskdalemuir seismic monitoring station.
- 15.4.10 The only licensed or Government aerodrome within 30 km of the application site is Prestwick Airport (30 km to the north west).

- 15.4.11 The airspace between ground level and 2,000 feet above ground level over the application site is part of the UK Military Low Flying System. This is part of Low Flying Area 16, within which the minimum height for fixed wing military aircraft is 250 feet. The area is also part of Low Flying Area 20 (Tactical) – also known as the Borders Tactical Training Area – where fixed wing aircraft may be authorised to fly at heights down to 100 feet separation from the terrain and obstacles. Turbines 1, 2, 12, 13, 14 and 19 of the Pencloe Windfarm are located in an area classified by the MoD as a “*high priority military low flying area likely to raise considerable and significant concerns*”. The remaining fifteen turbines are in an area classified by the MoD as a “*low priority military low flying area less likely to raise concerns*.”
- 15.4.12 There are no unlicensed aerodromes or airstrips, gliding, hang gliding, parachuting or microlight sites within 10 km of the proposed Pencloe Windfarm.

Telecommunications

- 15.4.13 Ofcom has advised that there is one fixed microwave telecommunications link, operated by BT, passing within 2000 m of the centre of the application site. BT has advised that the link passes through the application site.
- 15.4.14 Atkins has advised that there are no water industry UHF radio scanning telemetry links with the potential to be affected by the proposed Pencloe Windfarm.
- 15.4.15 The Joint Radio Company (JRC) has advised that there are no UK fuel and power industry UHF radio scanning telemetry links with the potential to be affected by the proposed Pencloe Windfarm.

Television Reception

- 15.4.16 Television signals in the area are received from the Darvel and Black Hill (Channel 5) transmitters.

Future Baseline

Aviation

- 15.4.17 The New Galloway NDB will be withdrawn by 2018. There are no other known planned changes to the aviation baseline.

Telecommunications

- 15.4.18 There are no known planned changes to the telecommunications or television baseline.

15.5 Assessment of Construction and Decommissioning Impacts

Predicted Impacts

Aviation

- 15.5.1 During the construction and decommissioning phases, the turbine blades will be stationary. Consequently no effects would occur on any air traffic control primary surveillance radars.
- 15.5.2 Wind turbines located at a distance of 17 km from the New Galloway NDB will have no impact on the facility.
- 15.5.3 The proposed development is located beyond all obstacle limitation surfaces and Instrument Flight Procedure obstacle assessment surfaces for Prestwick Airport and will therefore have no effect on these.

- 15.5.4 The highest turbine blade tips in the proposed development will be those of Turbine 6, at 2116 feet above sea level. This would require the Prestwick Airport Air Traffic Control Surveillance Minimum Altitude (ATCSMA) – the lowest altitude to which Prestwick controllers can instruct aircraft to descend while in receipt of a radar service – to be 3200 feet above sea level in the area over and within three nautical miles (5.56 km) of the application site. The current ATCSMA over most of that area is currently 3900 feet above sea level. However a 3 nm radius around the proposed turbines extends into an area where the ATCSMA is currently 2900 feet above sea level. The proposed development would require the ATCSMA in this area to be raised to 3200 feet. The operational impact of this on ATC operations at Prestwick Airport depends on the extent to which aircraft are currently vectored through this area at altitudes between 2900 and 3200 feet. The instrument approach procedures for runway 30 currently require aircraft to be flying no lower than 3500 feet through this area. Most aircraft receiving radar vectors in this area are being kept within the boundaries of controlled airspace. Normal controlling practice is to vector aircraft no lower than 500 feet above the base of controlled airspace. Since the lowest part of controlled airspace in the potentially affected area has a base of 3000 feet above sea level, the current normal minimum vectoring altitude is 3500 feet. It is therefore unlikely that any flight path profiles will require alteration as a result of the change to the ATCSMA. It is concluded that the raising of the ATCSMA from 2900 feet to 3200 feet in an area to the north west of the application site will have a low impact on ATC operations at Prestwick Airport.
- 15.5.5 The proposed development is within the designated operational coverage of the Instrument Landing System (ILS) for runway 30 at Prestwick Airport. Large physical structures have the potential to degrade the performance of ILS. However there are no known cases of wind turbines causing unacceptable degradation of performance on ILS. PWEL is in discussion with Prestwick Airport on the nature of studies required to assess the impact of the proposed development on the Prestwick runway 30 ILS.
- 15.5.6 Military aircraft flying at the normal minimum separation from the terrain and obstacles of 250 feet are not regarded by the MoD as being exposed to unacceptable hazards from vertical obstructions, due to the plotting of all obstacles greater than 300 feet high on low flying charts and the pilot's ability to see and avoid obstacles. Aircraft with clearance to fly in Low Flying Area 20(T) at heights down to 100 feet have less room to manoeuvre and may therefore be more affected by wind turbines. The division between the "*high priority military low flying area*" and "*low priority military low flying area*" across the application site reflects the fact that crews of low flying military aircraft use the terrain to maximise their evasion of detection. This means that they will generally elect to fly along valleys and avoid flying over high terrain and prominent ridges. The "*high priority*" area is a corridor used by these aircraft between the New Cumnock and Loch Doon areas. However, any such aircraft flying over the northern parts of the Pencloe Windfarm would also have to fly over higher terrain up to 1867 feet above sea level to the west of the proposed application site. Crews seeking to maximise terrain screening would be unlikely to adopt such a routing and would fly further north, over lower terrain, away from the windfarm.
- 15.5.7 The proposed Pencloe Windfarm is not located in a narrow valley which might restrict the ability of low flying aircraft to avoid the turbines; there are no airspace constraints above the application site which would constrain vertical avoidance and there are no other significant vertical obstructions within 5 km that might constrain horizontal avoidance. The impact on low flying military aircraft is therefore assessed as low.

Telecommunications

- 15.5.8 A BT-operated microwave radio link runs through the application site. It passes approximately 26 m from the proposed location of the tower of Turbine 21 and more than 100 m from the blade tips of all other turbines in the proposed development. BT requires a minimum separation of 100 m between any turbine blade tips and the centre of its microwave links. The erection of the tower of Turbine 21 is likely to have an unacceptable impact on this link. The magnitude of the impact is assessed as high. The link functions as a supervisory control and data acquisition (SCADA) control link for the operational Windy Standard Windfarm.

Television Reception

- 15.5.9 There are no domestic properties located in the areas where there is potential for television reception to be affected by the windfarm. Therefore, no impact is predicted on television reception.

Mitigation

Aviation

- 15.5.10 Prior to the commencement of construction, details of the turbine locations and heights and the construction start date would be provided to the MoD to enable the application site to be marked on aeronautical charts.
- 15.5.11 To improve visibility of the turbines to military pilots flying at low level at night, MoD-approved infra-red lighting would be fitted to the turbines.

Telecommunications and Television Reception

- 15.5.12 Prior to the construction of the proposed development, mitigation measures to maintain the performance of the BT microwave link from Windy Standard Windfarm to Mauchline will be implemented. PWEL is in discussion with BT and the owners of the Windy Standard Windfarm on the nature of the mitigation.

Residual impacts

- 15.5.13 There would be no residual impacts on telecommunications or television reception. During the construction phase, low flying military aircraft will be required to avoid the turbines horizontally or vertically.

Cumulative impacts

- 15.5.14 The cumulative developments to be assessed in combination with the proposed Pencloe Windfarm are listed in **Chapter 2: EIA Process**. There will be no cumulative impacts on air traffic control radar during the construction phase since wind turbine effects on radar are caused by the rotating turbine blades. Cumulative impacts on low flying aircraft would be likely to occur with the operational Hare Hill and Windy Standard windfarms, the consented development at Afton and the proposed developments at Ashmark Hill and South Kyle. The MoD has not objected to the Afton, Ashmark Hill or South Kyle on low flying grounds. It is concluded that the Pencloe Windfarm will have a low cumulative impact on military low flying. There would be no cumulative impacts on telecommunications or television reception during the construction phase.

15.6 Assessment of Operational Impacts

Predicted impacts

Aviation

- 15.6.1 The radar line of sight to the turbines from the NERL radars at Great Dun Fell and Lowther Hill and the Prestwick Airport primary surveillance radar has been assessed using GlobalMapper software. The results of the analysis are shown in **Figures 15.1, 15.2 and 135.3 Volume III** respectively.
- 15.6.2 **Figure 13.1 Volume III** shows that one of the proposed turbines (Turbine 6) will be at the margins of the line of sight from the Great Dun Fell radar at 125 m above ground level. All remaining turbines will be beyond the line of sight. Due to the distance from the radar (130 km) this marginal line of sight is unlikely to translate into unwanted returns appearing on the radar display. It is concluded that there will be no impact on the Great Dun Fell radar. NERL has confirmed that it has no objection to the proposed development.
- 15.6.3 **Figure 13.2 Volume III** shows that the Lowther Hill radar will have theoretical line of sight to some of the northern parts of the application site at 125 m above ground level. The blade tips of Turbines 1, 13 and 14 are calculated to be within line of sight. There will be no line of sight to other turbines in the development due to intervening terrain. Taking into account the processing capacity of the Lowther Hill radar, none of the proposed turbines are anticipated to be detectable by the radar. NERL has confirmed that it has no objection to the proposed development.
- 15.6.4 **Figure 13.3 Volume III** shows that the Prestwick Airport radar will have line of sight to all of the Pencloe turbines at the blade tip height of 125 m above ground level. The rotating turbine blades would be likely to appear intermittently as unwanted radar returns. Aircraft overflying the application site while receiving air traffic radar services from controllers at Prestwick Airport include airliners and other Instrument Flight Rules (IFR) traffic arriving at and departing from Prestwick, remaining inside controlled airspace and other aircraft, including transiting traffic, flying below the base of controlled airspace. The Pencloe area has been identified by Prestwick Airport as a zone where unwanted radar returns from wind turbines have an unacceptable impact on air traffic management.
- 15.6.5 Cumulative impacts on the Prestwick Airport radar could occur with the existing windfarms at Hare Hill and Windy Standard, the consented developments at Afton and Hare Hill Extension and with proposed developments at Ashmark Hill and South Kyle. The cumulative effects of these windfarms with Pencloe could increase controller workload, increase the risk of loss of radar identity of aircraft due to the presence of clutter and increase the frequency and duration with which radar data labels are obscured. However, these cumulative impacts will be reduced as a result of radar mitigation schemes applied to all proposed schemes in the area.
- 15.6.6 The impact of the operational phase of the proposed development on the Prestwick Airport ATCSMA will be the same as during the construction and decommissioning phases, set out in paragraph 15.5.4.
- 15.6.7 The impact of the operational phase of the proposed development on the Prestwick Airport runway 30 ILS will be the same as during the construction and decommissioning phases, set out in paragraph 15.5.5.
- 15.6.8 The obstacle hazard effects on low flying military aircraft would be similar to those in the construction and decommissioning phases. The magnitude of this impact is assessed as low.

Telecommunications and Television Reception

- 15.6.9 The impacts on telecommunications and television reception would be the same as those during the construction and decommissioning phases.

Mitigation

Aviation

- 15.6.10 The turbine layout of the proposed development has been designed to ensure that it does not have an unacceptable impact on air traffic control radars operated by NATS En Route.
- 15.6.11 Prior to the construction of the proposed development, mitigation measures to maintain the performance of the Glasgow Prestwick International Airport primary surveillance radar will be implemented. PWEL is in discussion with Prestwick Airport on the nature of the mitigation. Prestwick Airport is currently considering a blanking and in-fill solution using one of two candidate technologies for the in-fill radar – the Aveillant Holographic Radar and the C-Speed Lightwave radar. The selected radar mitigation scheme will be secured by a suspensive planning condition.
- 15.6.12 No additional mitigation for the effects on military low flying, over and above that provided by design and prior to the construction stage, will be required during the operational phase.

Residual Impact

- 15.6.13 There would be no residual impacts on telecommunications or television reception. Residual impacts on low flying military aircraft would be the same as during the construction phase.

Cumulative impacts

- 15.6.14 The cumulative developments to be assessed in combination with the proposed Pencloe Windfarm are listed in **Chapter 2: EIA Process**. Cumulative impacts on the Prestwick Airport radar would be unlikely to occur because the effects of the proposed Pencloe Windfarm on these radars will be fully mitigated.
- 15.6.15 Cumulative impacts on low flying aircraft would be unlikely to occur because the other existing and consented windfarms are either inside the area defined by the MoD as “low priority” (Windy Standard, Whiteside Hill), or are, like the Pencloe development, located on top of ridges and high ground away from the valleys where the bulk of low flying takes place (Hare Hill, Sanquhar).
- 15.6.16 There would be no cumulative impacts on telecommunications or television reception.

15.7 Summary and Conclusions

15.7.1 The potential impacts of the proposed Pencloe Windfarm on aviation and telecommunications are summarised in **Table 15.2**.

Table 15.2: Summary of Potential Impacts of the proposed Pencloe Windfarm, Mitigation and Residual Impacts

Likely Significant Impact	Mitigation Proposed	Means of Implementation	Outcome/Residual Impact
Construction			
Degraded performance of BT microwave link	Re-routing of link	Agreement with BT and owners of Windy Standard Windfarm	No significant impact
Obstacle hazard to low flying military aircraft	Information provided to MoD	Pencloe Windfarm turbines marked on low flying charts	No significant impact
Obstacle hazard to low flying military aircraft at night	Infra-red lighting installed on turbines	Infra-red lighting	No significant impact
Operational			
Unwanted radar returns on Prestwick Airport radar	'Blanking plus infill'	Contractual arrangement between developer and Prestwick Airport	No significant impact
Obstacle hazard to low flying military aircraft	Information provided to MoD	Pencloe Windfarm turbines marked on low flying charts	No significant impact
Obstacle hazard to low flying military aircraft at night	Infra-red lighting installed on turbines	Infra-red lighting	No significant impact

16 Climate Change

16.1 Introduction

- 16.1.1 One of the principal justifications for developing onshore windfarms is to reduce net greenhouse gas (GHG) emissions by displacing grid electricity generated from conventional fossil fuel sources. However, no form of electricity generation is completely GHG free; there will be emissions as a result of manufacture of wind turbines and construction materials, as well as emissions from construction activities and transport.
- 16.1.2 In addition to the lifecycle emissions from the turbines and associated windfarm infrastructure, where the windfarm is located on carbon rich soils such as peat, there are potential impacts resulting from direct action of excavating peat for construction and also the indirect changes to hydrology that can both result in losses of soil carbon. The footprint of the infrastructure will also decrease the area covered by carbon-fixing vegetation. Conversely, restoration activities undertaken post-construction or post-decommissioning could have a positive effect on carbon uptake through the restoration of bog and forestry habitat.
- 16.1.3 In the context of this report, GHG emissions are emissions of any of the basket of six GHG defined under the Kyoto Treaty, including carbon dioxide (CO₂), methane and nitrous oxide. All GHG emissions can be measured in tonnes of CO₂ equivalents (tCO₂e) which is a quantity that describes, for a given mixture and amount of GHG, the amount of CO₂ that would have the same global warming potential (GWP), when measured over a 100 year timescale. These units therefore enable the comparison of different greenhouse gases emitted or saved, at different project stages. The most common GHG is carbon dioxide and therefore this report uses the terminology used the Scottish Environment Protection Agency (SEPA) in their Carbon Calculator (Scottish Government (2011) and refers to 'carbon emissions'.

Aim of this Chapter

- 16.1.4 The aim of this chapter is to address carbon balance issues raised by both the Scottish Government Energy Consents and Deployment Unit and SEPA in their scoping responses for the proposed development.
- 16.1.5 The Scottish Government requested that:

'The applicant must produce a statement of expected carbon savings over the lifetime of the windfarm. The statement should include an assessment of the carbon emissions associated with track preparation, foundations, steel, and transport; any carbon losses from tree felling (and offsetting from tree planting); and any carbon losses from loss or degradation of peaty soils. Reference can be made to the technical note "Calculating Potential Carbon Losses and Savings from Windfarms on Scottish Peatlands" (Scottish Government 2011). The spreadsheet tool it refers to should be used for proposed developments on peat but can also be used for sites that will be drained, are located on carbon rich soils or require a significant amount of deforestation.

It is important to ensure that the carbon balance of renewable energy projects is not adversely affected by management of peat resource. There need to be measures in place to ensure that the proposed development does not lead to significant drying or oxidation of peat through, for example, proposed development of access tracks and other infrastructure, drainage channels, or "landscaping" of excavated peat. The basis for these measures should be set out within the ES, on which a detailed peat management scheme, required through planning condition, can subsequently be designed to ensure that the carbon balance benefits of the scheme are maximised.

Applicants are required to submit full details of the potential carbon losses and savings of the windfarm, and demonstrate how the scheme has been designed to minimise the payback figure.'

- 16.1.6 SEPA noted that the EIA needed to address, amongst other issues, the carbon release impacts of the proposed development.
- ‘Scottish Planning Policy (SPP) recognizes “the disturbance of some soils, particularly peat, may lead to the release of stored carbon, contribution to carbon emissions” (Paragraph 133). In line with SPP and government guidance, we recommend that the ES or planning submission contains a section systematically assessing carbon balance. This assessment should quantify the gains over the life of the project against the release of carbon dioxide during construction. It should include all elements of the proposal, including borrow pits, construction of roads/tracks and other infrastructure and loss of peat bog. Please refer to the Scottish Government guidance ‘Calculating carbon savings from windfarms on Scottish peat lands – A New Approach, which provides a revised methodology for estimating the impacts of this type of proposed development on carbon dynamics of peat lands.’*
- 16.1.7 Both scoping responses refer to the Government guidance document ‘Calculating carbon savings from windfarms on Scottish peat lands – A New Approach’ (Nayak et al 2008) which provides a methodology for estimating the impacts of this type of development on the carbon dynamics of peatlands.
- 16.1.8 Originally published in 2008, the Carbon Calculator has been refined on the basis of feedback and further research. The current version of the calculator (v2.9) contains the facility to partition a site for forestry and constructed elements and also to add additional peat excavation volumes. The protected version for use in planning applications (v2.9.0) has been used to calculate the carbon payback period for the proposed development. The payback period is the length of time required for a project to save the estimated carbon invested in its construction, operation and decommissioning through the generation of renewable electricity and assumed displacement of fossil fuel generated-electricity in the grid (Scottish Government 2014).
- 16.1.9 The Government’s methodology uses site specific parameters to model the impacts of installation and operation of the proposed development on peat soils, taking into account the wider potential impacts on peatland hydrology and decomposition of organic matter, as well as the lifecycle costs of the turbines. Carbon savings are calculated for a range of grid displacement factors.
- 16.1.10 The layout of the proposed development has been designed, as far as possible, to minimise the impact on peatland habitats and hence the carbon balance benefits of the proposed development from the generation of renewable energy will be maximised.
- 16.1.11 The structure of this chapter is as follows:
- Section 16.2 describes the legislation, policy and guidance relevant to the carbon balance of the construction, operation and decommissioning of renewable energy projects;
 - Section 16.3 describes the methodologies used in this assessment with regards to the carbon balance and the calculation of the estimated payback period of the proposed development;
 - Section 16.4 explains the sources and assumptions behind the data inputs to the carbon model;
 - Section 16.5 details and discusses the results from the model and includes a sensitivity analysis of certain key parameters; and
 - Section 16.6 summarises the findings of the model and provides an overall conclusion on the estimated carbon emissions of the proposed development and its expected payback period.

16.2 Legislation, Policy and Guidance

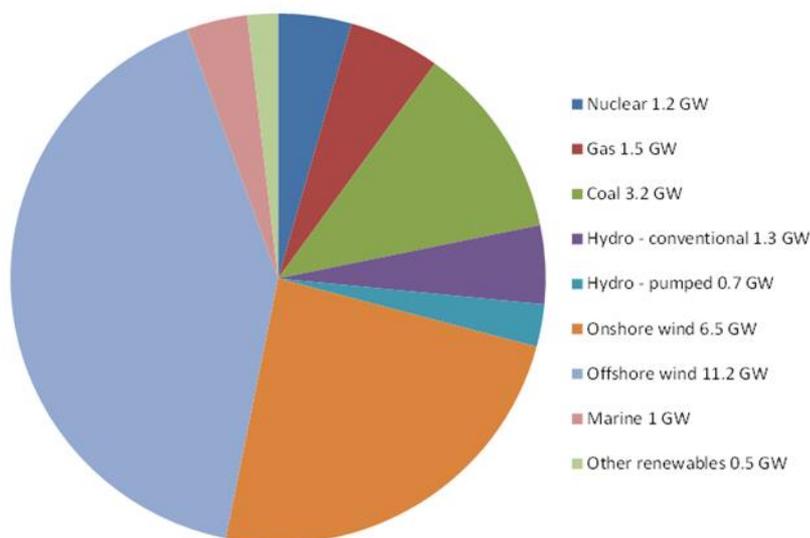
Legislation

- 16.2.1 One of the key drivers for the Scottish Government's renewable energy targets is the Climate Change (Scotland) Act, 2009. The Act creates the statutory framework for GHG emissions reductions in Scotland by setting both an interim 42 % reduction target for 2020, and an 80 % reduction target for 2050. Decarbonisation of grid electricity through increasing the percentage of electricity generated by renewables is one of the key ways to deliver these carbon reduction targets. The Climate Change (Scotland) Act also recognises the importance of carbon stores in peat and soils by incorporating a duty to produce a land use strategy.
- 16.2.2 As part of the UK, Scotland is also subject to the EU Directive 2009/28/EC which commits the EU to generate 20 % of all energy consumed from renewable sources by 2020. This has been translated to individual targets for Member States, depending on their starting points and potential capacity. The UK has a commitment to source 15 % of all energy from renewable resources; this has been translated into a target of 30 % of electricity from renewables by 2020 (National Renewable Energy Action Plan for the United Kingdom, UK Government, undated).

Policy

- 16.2.3 Current Scottish Government policy is to generate the equivalent of 100 % of Scotland's gross annual electricity consumption and the equivalent of 11 % of Scotland's heat demand from renewable sources and also to have 500 MW of community and locally-owned renewable energy, all by 2020 (Scottish Government, 2011a). **Diagram 16.1** shows the potential electricity grid mix scenario required to achieve this target and indicates that onshore wind is a large and critical component of this. Current installed capacity for onshore wind in Scotland was around 4.5 GW in Q3 of 2014 (DECC, 2014a) and therefore to meet the targets, installed capacity needs to increase by around 30% in the next five years.

Diagram 16.1: Evolution of the Electricity Generation Mix in Scotland by 2020 onwards (Scottish Government, 2010)



- 16.2.4 It should also be noted that the construction of new energy infrastructure has potential environmental impacts. Scotland's land use strategy (Scottish Government, 2011b) highlights the need to balance maximising renewable energy generation through onshore windfarms whilst minimising the environmental impacts on landscape, cultural heritage and environmental carbon stores.
- 16.2.5 Further detail on international, European and national policy and targets relating to both reducing GHG emissions and increasing the generation of renewable electricity can be found in Section 5.13 of the **Planning Statement** which forms a supporting document to the Section 36 Consent application for the proposed development.

Guidance

- 16.2.6 One of the key potential impacts identified for onshore windfarms in Scotland is for proposed sites on areas of peat, where stored carbon can be released through the extraction and drainage of these soils. Research and guidance commissioned by the Scottish Government utilises a life cycle methodology approach to estimating the wider emissions and savings of carbon associated with windfarms and for calculating how long the proposed development will take to 'pay back' the carbon emitted during its construction. Since June 2011, Scottish Ministers have required all new Section 36 applications received since June 2011 to include an assessment of carbon losses using the Scottish Government's published method for assessing carbon losses and savings if the site contains areas of deep peat (over 0.5 m in depth) (Scottish Government, 2011c). This methodology and approach is consistent with the Climate Change Mitigation & EIA Principles of the Institute of Environmental Management and Assessment (IEMA, 2010). The principles state that the assessment should aim to consider whole life effects including, but not limited to:
- embodied energy in the manufacture of materials used for the proposed development;
 - emissions related to construction - from materials delivery to onsite machinery;
 - operational emissions related to the functioning of the proposed development- including appropriate offsite emissions; and
 - decommissioning, where relevant.
- 16.2.7 When evaluating significance, all new carbon emissions contribute to a significant negative environmental effect; however, some projects will replace existing developments that have higher carbon profiles. The significance of a project's emissions should therefore be based on its net carbon impact, which may be positive or negative.

16.3 Methodology

- 16.3.1 In determining whether an application to build and operate a windfarm should be consented, the assessment of potential carbon losses and savings is a material consideration for Scottish Ministers. It is one important consideration among many, and currently there are no official guidelines about what constitutes an acceptable or unacceptable payback period.
- 16.3.2 Carbon emissions and savings are both ultimately part of a global 'pool' and therefore this assessment is not restricted solely to those emissions or savings that occur within the boundary of the application site. Land-based emissions from peat and habitat losses are based on the site footprint but other activities, for example, emissions resulting from the extraction and production of steel are likely to occur in other parts of the world but are still attributable to this project.

- 16.3.3 The temporal scope for the assessment is set as the same period as the anticipated lifespan for the windfarm i.e. 25 years but, unless it is specified that the site will be restored with respect to hydrology and habitat upon decommissioning, the losses through the indirect effects on peat will continue on until the Carbon Calculator estimates that there is no more oxidisable peat within the vicinity of the infrastructure.
- 16.3.4 This climate change assessment has covered the following potential sources, and savings, of carbon emissions from the three project stages:
- Construction*
- Carbon emissions resulting from the extraction and manufacture of materials required to construct the proposed development. These will be assessed on a 'cradle to gate' boundary (cradle-to-gate is an assessment of a partial product life cycle from resource extraction (cradle) to the factory gate and excludes transport, use and disposal).
 - Carbon emissions resulting from the transport of materials and labour from the assumed point of production to the application site.
 - Carbon emissions resulting from onsite use of plant and equipment.
 - Carbon emissions resulting from the direct excavation of peat onsite for building tracks, hardstanding, turbine foundations and other infrastructure.
- Operation*
- Carbon emissions resulting from operation of the proposed development, in particular transport of staff to site.
 - Carbon emissions from the indirect impact of drainage on peat surrounding the development infrastructure.
 - Carbon savings resulting from the displacement of grid electricity generated by fossil fuels.
 - Carbon emissions resulting from the loss of active carbon-absorbing habitat.
 - Carbon uptake resulting from the restoration of carbon-absorbing habitat.
- Decommissioning*
- Carbon emissions resulting from the transport of labour to the application site and the transport of waste materials offsite.
 - Carbon emissions resulting from onsite use of plant and equipment.
- 16.3.5 The scope of this assessment excludes transport of materials, in particular turbines, from overseas; the transport assessment is based on the point of entry into the UK.
- 16.3.6 The assessment has used the following methodologies to estimate the overall impact of the proposed development on climate change:
- Baseline emissions have been calculated using site-based data and publically available energy datasets;
 - The Scottish Government's Carbon Calculator 'Calculating carbon savings from windfarms on Scottish peat lands - A New Approach'. Spreadsheet version 2.9.0 (Scottish Government, 2014); and
 - An additional spreadsheet to capture emissions not covered within the Carbon Calculator (additional construction materials, transport of materials, labour and plant to and from site, onsite plant use during construction and decommissioning). This spreadsheet uses UK Government conversion factors for company reporting where required (DECC, 2013a).
- 16.3.7 Where possible, site specific input parameters are used, but where these are not available or the quantities of carbon emissions are negligible, estimates have been used.

Baseline

- 16.3.8 It is not easy to set a baseline for climate change impacts because of the size of the global pool – each individual project has a very small overall impact on this pool but there are many small projects and climate change mitigation relies on reducing the impacts of all of these.
- 16.3.9 The key climate change impacts of constructing a windfarm on peatland are the potential release of stored carbon from peat soils and the contribution of renewable units of electricity into the overall electricity grid, thereby reducing overall carbon intensity. Therefore, the baseline is two-fold: firstly, the current percentage of renewable electricity generation in Scotland will be used as the baseline to determine the significance of the proposed development in reaching Scotland’s renewable generation targets. Secondly, an estimate of the current quantity of stored carbon in the soils within the application site will be used to help determine the significance of the estimated carbon losses from the application site.
- 16.3.10 The Scottish Government’s 2020 Routemap for Renewable Energy in Scotland, published in 2011 (Scottish Government, 2011a), established a target for the equivalent of 100 % of Scotland’s gross electricity demand to be supplied from renewable sources by 2020. After exceeding the interim target to meet 31 % of electricity demand from renewables by 2011, the interim target was updated to 50 % by 2015 (Scottish Government, 2012). The latest dataset available for gross electricity consumption and renewable generation in Scotland is shown in **Table 16.1**.

Table 16.1 Contribution of renewables to gross electricity consumption in Scotland (DECC, 2014a)

	2010	2011	2012
Gross electricity consumption (GWh)	39,669	37,871	36,602
Renewables generation (GWh)	9,591	13,728	14,612
Renewables as a % of gross electricity consumption	24.2%	36.2%	39.9%

- 16.3.11 **Table 16.2** shows how the total stored carbon onsite has been estimated. The carbon content and dry soil bulk density have been estimated from data collected on site (see **Table 16.6** and also paragraphs 16.3.16 to 16.3.18) and the average peat depth has been calculated from all peat depth data within the site boundary. Peat volume and potential carbon emissions have been rounded up to the nearest thousand cubic metres/tonnes.

Table 16.2 Estimated soil carbon stores within the application site

Parameter	Expected	Minimum	Maximum
Size of application site (ha)	871	828	915
Average peat depth across application site (m)	0.55	0.51	0.58
Carbon content of dry peat (% by weight)	40.7%	34.9%	46.5%
Dry bulk density of peat (g cm ⁻³)	0.12	0.09	0.15
Estimated volume of peat on site (m ³)	4,758,000	4,238,000	5,307,000
Estimated amount of oxidisable carbon in soils onsite (tC)	232,000	133,000	370,000
Estimated equivalent emissions of carbon dioxide (tCO ₂ e)	853,000	489,000	1,359,000

The Scottish Government Carbon Calculator for windfarms on peatland

- 16.3.12 The Scottish Government methodology, titled 'Calculating potential carbon losses and savings from windfarms on Scottish peat lands: A New Approach' (Nayak et al, 2008. 2), was designed in response to concerns on the reliability of methods used to calculate reductions in greenhouse gas emissions arising from large scale windfarm proposed developments on peat land. The calculator looks at the benefit of displacing conventionally generated electricity in the grid compared to the predicted direct and indirect emissions of carbon from construction, operation and decommissioning and provides an estimate of the carbon payback time for the proposed development.
- 16.3.13 This method built further on the Technical Guidance note produced by SNH in 2003 (SNH, 2003) for calculating carbon 'payback' times for windfarms. This method did not take account of the wider impacts on the hydrology and stability of peat lands. The current methodology provides a straightforward way to model the impacts of installation and operation of windfarms on peat soils, taking into account the wider potential impacts on peat land hydrology and decomposition of organic matter.
- 16.3.14 The most recent version of the excel spreadsheet titled 'Calculating carbon savings from windfarms on Scottish peat lands - spreadsheet version 2.9.0' (April 2014) (Scottish Government, 2014) which is provided on the Scottish Government website, along with the latest methodology report, was used to estimate the carbon payback period for the proposed windfarm.
- 16.3.15 The spreadsheet tool contains several worksheets, all connected to the input data sheet. Specific methodologies used to estimate key input parameters are discussed below, while all the sources and assumptions behind the complete set of input parameters are detailed in **Table 16.6**.

Estimating bulk density

- 16.3.16 The samples taken to provide a site-specific estimate of dry soil bulk density, which is one of the key parameters within the Carbon Calculator for estimating total soil carbon losses, returned values much higher than the expected range for peat. Since there are a number of aspects of this test which can produce erroneous results, another method of estimating dry soil bulk density was used.
- 16.3.17 Within the literature on peat, a number of studies document the relationship between bulk density and Von Post scale of humification. In particular, work by Päiväinen in 1973 documented linear relationships for different types of peat (Kolka *et al*, 2011). The relationship for Sphagnum-based peat is described as $Y = 0.045 + 0.011X$, where X is the Von Post score for humification.
- 16.3.18 Cores were taken at 171 locations. Where peat was present, Von Post scores for both humification (H score) and saturation (B score) were recorded in the acrotelm (if present; a large number of cores did not actually contain an obvious acrotelmic layer) and at metre intervals in the catotelm. The wide coverage of Von Post data across the site meant that it was possible to use this equation to estimate the overall bulk density at the site. The methodology used was:
- 1) Average Von Post scores for acrotelm measurements (mean = 4.03, count 49);
 - 2) Average Von Post scores for catotelm measurements (mean = 7.75, count 150);
 - 3) Calculate bulk density estimates for the acrotelm and catotelm based on these two measurements and the equation above;
 - 4) Calculate a weighed overall bulk density estimate, using the measured proportions of acrotelm and catotelm in the overall peat column; and
 - 5) Calculate a range using the 95 % confidence interval for both the proportions of acrotelmic peat and catotemic peat and the Von Post scores.

Estimating average drainage distance from drainage features

- 16.3.19 As agreed previously with SEPA, a number of different site measurements were taken to characterise the peat body within the application site; these included measurements of peat humification using the Von Post score at different depths within the peat column. As described above, these measurements were used to estimate the dry soil bulk density, using relationships described within the literature and weighted for the known proportions of acrotelmic and catotelmic peat at the application site.
- 16.3.20 The bulk density estimates have been used to estimate the hydraulic conductivity of the peat, according to the relationship curve described within Peatbogs and Carbon (Lyndsey, 2010). Hydraulic conductivity describes the ease with which a fluid can move through pore spaces and fractures in soils. The equation for bulk densities over 0.13 g / cm^3 is given as $y = 7683.3e^{(-74.981x)}$ where x is the dry soil bulk density in g/cm^3 and y is the hydraulic conductivity in metres per day (m/day).
- 16.3.21 The value of hydraulic conductivity given by this equation is then used to estimate the average drainage distance, using the equation given in Nayak *et al* (2008). This equation is given as $y = 11.958x - 9.361$, where x is the log value of hydraulic conductivity measured in millimetres per day (mm/day).
- 16.3.22 The values calculated for the application site are shown in **Table 16.3**. The initial minimum and maximum values are estimated from the calculated 95 % confidence intervals of the Von Post scores. However, because this provides such a small range of estimates, a value of +/-25 % is used in the Carbon Calculator for the minimum and maximum in order to accommodate greater uncertainty.

Table 16.3 Calculated values of key input parameters

Calculated values	Expected	Minimum	Maximum
Average Von Post score for the overall peat column	7.10	6.90	7.31
Bulk density (g / cm^3)	0.123	0.121	0.125
Hydraulic conductivity (m / day)	0.73	0.62	0.85
Average extent of drainage distance (m)	12.9	12.1	13.7

Additional calculations

- 16.3.23 In addition to the carbon emissions resulting from the manufacture of the turbines, there are other emissions resulting from construction and decommissioning activities that are not yet available in the Scottish Government Carbon Calculator.
- 16.3.24 The lifecycle carbon emissions from the turbines themselves and the concrete used in the foundations have already been included in the Carbon Calculator; however, additional construction materials are required for construction of the windfarm, including steel reinforcement, aggregate and cabling.
- 16.3.25 In addition there will be emissions resulting from transport of harvested timber offsite prior to construction, transport of materials, plant and labour to site during construction and decommissioning, use of plant / equipment onsite during forestry felling and construction and decommissioning and transport of staff to site during operation. For completeness, these emissions have been estimated using the input parameters described in Tables 16.4 and 16.5 and included in the final overall assessment of carbon losses.

Table 16.4 Additional calculations for construction materials

Material	Quantity	Data sources
Steel	4,200 tonnes	Embodied carbon content from ICE v2.0 for Bar & rod - UK (EU) Average recycled content (University of Bath, 2011).
Cable – 33 kv	18.0 km	Length taken from Appendix 14.2 Volume IV . Embodied carbon factor from Ecoinvent System Process for Transmission network, electricity, high voltage (Ecoinvent, 2003).
Aggregate	Sourced onsite	Aggregate will be required for tracks and compounds, but the majority of this will be sourced from onsite borrow pits; the emissions associated with extraction are included in the assessment of plant and equipment.
Sand	5,178 m ³	Embodied carbon content from ICE v2.0 for sand (University of Bath, 2011).
Geotextile	190,280 m ²	Embodied carbon and mass per m ² from Cook (2009) (Cook, 2009). Quantity estimated from transport assessment.

Table 16.5: Additional calculations for transport and plant and equipment

Transport	Project phase	Data sources
Transport of materials to site	Construction (including forestry felling)	Appendix 14.2 Volume IV summarises the number of deliveries anticipated for the proposed development. The emissions resulting from the delivery of materials have been estimated using industry standards of distance and vehicle emissions (DECC, 2013a).
	Decommissioning	An assumption has been made that decommissioning would be similar to construction but as cabling, foundations, concrete and tracks would remain <i>in situ</i> , the vehicle movements associated with these items would not be required. Timber transport has been removed. Fuel deliveries have been pro-rated for the expected shorter length of the decommissioning period.
Plant and equipment	Construction (including forestry felling)	Number of fuel deliveries from transport movement calculations. Assumption that deliveries would average 10,000 litres of diesel.
	Decommissioning	Pro-rated for shorter decommissioning period.
Transport of labour to site	Construction	Total of Light Vehicle Movements taken from Appendix 14.2 Volume IV . Emissions are estimated on an average travel distance of 25 km (single trip) and average vehicle emissions.
	Operation	Chapter 4 states that the predicted levels of traffic associated with the operation and maintenance of the Proposed development are unknown at this point. However, previous experience allows the following assumptions can be made: <ul style="list-style-type: none"> • standard turbine servicing approximately 10 times annually; • unscheduled servicing approximately 10 times annually; • repairs to turbines approximately 30 times annually; • access track maintenance approximately 4 visits

Transport	Project phase	Data sources
		<p>annually;</p> <ul style="list-style-type: none"> substation maintenance approximately 1 visit annually; and routine site inspections once a fortnight. <p>Emissions are based on an estimated travel distance of 25 km and average emissions for a dual purpose 4x4 vehicle.</p>
	Decommissioning	Based on transport of operational staff but pro-rated for a shorter 12 month decommissioning period.

16.4 Data Inputs, Sources and Key Assumptions

Introduction

- 16.4.1 A variety of data sources were used to establish the parameters entered into the input sheets of the Carbon Calculator for the project. Where possible, inputs have been based on data collected onsite, although there were some cases where literature values were used instead. Where interpretation of the site conditions was required to develop a reasonable input range, discussions were held with the lead ecologist and hydrologist for the EIA for the proposed development. Information was also taken from the Peat Depth Survey Data included in the Peat Slide Hazard Risk Assessment (Appendix 10.1 Volume IV).
- 16.4.2 The sources of the data and the key assumptions made are listed in **Table 16.6**. Where applicable, a range is given, with the minimum, maximum and expected value entered into the three columns of the model to generate the expected payback period and a range of possible payback periods. Where permitted by the type and distribution of the raw data, the range has been calculated as +/- two standard errors from the calculated average to give an estimate of the 95% confidence interval. However, where this is not possible, calculation of the range is based on the likely percentage error in estimation of the parameter e.g. 10% or 50%.

Table 16.6 Data sources and key assumptions

Parameter	Expected	Minimum	Maximum	Data source	Key assumptions
Wind farm characteristics					
Dimensions					
No. of turbines	21	21	21	Chapter 4: Project Description	None
Life time of wind farm (years)	25	25	25	Chapter 4: Project Description	Standard planning consent
Performance					
Turbine capacity (MW)	3.3	3.3	3.3	Chapter 4: Project Description states that the maximum expected rated capacity is 3.3 MW.	Assumed no variation.
Capacity factor – using direct input of capacity factor (percentage efficiency)	27.9	26.5	29.4	The capacity factor has been estimated from the most recent available time series data 2000 to 2013, published by DECC Department of Energy and Climate Change in September 2014 (DECC, 2014b). The expected factor used is an average of the available time series (2000 to 2013). Mean: 27.9 Count: 14 Standard error: 0.007	A 95% Confidence Interval has been calculated as the mean +/- 2 standard errors to estimate the likely minimum and maximum values.
Backup					
Extra capacity required for backup (%)	5	5	5	Suggested carbon calculator protocol parameter for scenario where wind energy generates more than 20% of national electricity.	SEPA has indicated that, for this parameter, the electricity generation capacity of Scotland, rather than the UK should be considered. The current statistics on renewable generation estimate that around 30% of the total electricity consumption in Scotland was generated by wind (DECC, 2014b). Therefore, this parameter have been set at 5% for all three scenarios.
Additional emissions due to reduced thermal efficiency of the reserve generation (%)	10	10	10	Suggested carbon calculator protocol parameter for scenario where extra capacity for backup is required.	Extra emissions due to reduced thermal efficiency of the reserve power generation are estimated at ≈ 10% within the carbon calculator.

Carbon dioxide emissions from turbine life - (e.g. manufacture, construction, decommissioning)	Calculate with installed capacity option selected			The methodology allows for emissions to be calculated according to turbine capacity, using a relationship for turbines over 1 MW capacity developed from available literature.	The exact make and type of turbine to be used has not yet been specified, therefore the more accurate option of estimating the lifecycle emissions directly from manufacturer's information is not available.
Characteristics of peat land before wind farm development					
Type of peat land	Acid Bog	Acid Bog	Acid Bog	An 'acid bog' is fed primarily by rainwater and often inhabited by sphagnum moss, thus making it acidic. This is a more appropriate type than the alternative of 'Fen'.	
Average air temperature at site (°C)	8.50	8.39	8.61	Based on 103 year (1910 – 2013) average temperature data for region Scotland West available from the Met Office (undated)	It is assumed that the West Scotland region provides a reasonable estimate of the annual temperature for the application site
Average depth of peat onsite (m)	0.55	0.51	0.58	The average depth of peat across the application site has been estimated by calculating the mean of all the peat depth probes taken within the red line boundary. Mean: 0.55 Count: 722 Standard Error: 0.02	A 95% Confidence Interval has been calculated as the mean +/- 2 standard errors to estimate the likely minimum and maximum values.
C Content of dry peat (% by weight)	40.7	34.9	46.5	10 samples were taken from the application site and measured by an independent laboratory. The carbon content results are within the lower end of the SEPA literature value ranges for basin peat, which are between 32.61% and 59.12% (NSIS, 2007-2009) Mean: 40.7 Count: 10 Standard Error: 2.89	Carbon (C) content of dry peat was measured by standard analytical procedures. A 95% Confidence Interval has been calculated as the mean +/- 2 standard errors to estimate the likely minimum and maximum values.

Average extent of drainage around drainage features onsite (m)	12.9	9.7	16.3	The average extent of drainage around drainage features at the application site has been estimated using the Von Post scores for approximately 171 cores across the application site and measurements of the average acrotelm/catotelm boundary depth. The methodology uses relationships between these characteristics and other parameters such as bulk density, hydraulic conductivity and estimated drainage distance to come up with a site-based average for this parameter. This methodology is described in depth in paragraphs 16.3.19 to 16.3.22	Although the calculated range of values based on the upper and lower estimates of bulk density is very small, to reflect the uncertainty in this parameter, a range of +/- 25% has been used to calculate the likely minimum and maximum.
Average water table depth at site (m)	0.05	0.0	0.09	Based on Jacobs' Hydrologist's site observations and information from Von Post B Scores. The Hydrologist's observations were of ponding water in forest areas. Parts of the application site are quite steep and water is channelled into small forest drains which feed into larger tributaries to the main watercourses which run through the valleys of the application site. There is quite a lot of surface water on this site. These observations are reflected in the high average B score for the acrotelm (3.84); this implies that in many locations the acrotelm was fairly saturated and therefore the water table was likely to lie close to the surface.	The minimum value has been set at zero to reflect the possibility that the water table could be at the surface – this is unlikely to be the average depth across a whole year. The maximum depth has been set as the acrotelm/catotelm boundary (0.09 m) and the expected depth is the mid-point between these two depths.

Dry soil bulk density (g/cm ³)	0.12	0.09	0.15	The bulk density literature value data are unpublished data from the National Soil Inventory of Scotland (2007-2009) for amorphous, well decomposed peat; for blanket peat, the range is 0.072 to 0.293, with an average of 0.132 g/cm ³ (SIFSS). 10 dry bulk density samples were taken on site for comparison but the values returned from this analysis were slightly above the upper end of this range (0.33 g/cm ³). An alternative method of estimating bulk density, using the known relationship between the Von Post scale of humification was used to estimate bulk density values much closer to those of peat. The methodology for this calculation is detailed in paragraphs 16.3.16 to 16.3.18.	Although the calculated range of values of bulk density based on the Von Post data was very small, to reflect the uncertainty in this parameter, a range of +/- 25% has been used to calculate the likely minimum and maximum. A sensitivity analysis has been done to demonstrate the impact of using the higher bulk density values as measured in the laboratory. This is described in paragraphs 16.5.9 to 16.5.12.
Characteristics of bog plants					
Time required for regeneration of bog plants after restoration (years)	10	5	15	Suggested literature values from Carbon Calculator protocol.	A range of +/- 50% has been used to calculate the likely minimum and maximum.
Carbon accumulation due to C fixation by bog plants in un-drained peats (t C ha ⁻¹ yr ⁻¹)	0.25	0.12	0.31	Suggested literature values from Carbon Calculator protocol. The overall result is not very sensitive to this input, so the default value can be used if measurements are not available. The range suggested in the methodology from the literature for apparent C accumulation rate in peatland is 0.12 to 0.31 t C ha ⁻¹ yr ⁻¹ The SNH guidance uses a value of 0.25 t C ha ⁻¹ yr ⁻¹ (SNH, 2011)	Suggested range of 0.12 to 0.31 t C ha ⁻¹ yr ⁻¹ .
Forestry Plantation Characteristics					
Method used to calculate CO ₂ loss from forest felling	Simple data				
Area of forestry plantation to be felled (ha)	19.9	18.9	20.9	Chapter 4: Project Description states in total felling for the proposed development requires the removal of 19.93 ha of woodland.	A range of +/- 5% has been used to calculate the likely minimum and maximum.

Average rate of carbon sequestration in timber (tC ha ⁻¹ y ⁻¹)	3.6	3.24	3.96	This is based on an assumed yield class of 16 m ³ ; this value is suggested within the Carbon Calculator for plantation carbon sequestration.	A range of +/- 10% has been used to calculate the likely minimum and maximum.
Counterfactual emission factors					
Coal-fired plant emission factor (t CO ₂ MWh ⁻¹)	0.907	0.816	0.998	The coal emission factor is the most recent available figure for the year 2013 (DECC, 2014c).	A range of +/- 10% has been used to calculate the likely minimum and maximum.
Grid-mix emission factor (t CO ₂ MWh ⁻¹)	0.454	0.409	0.499	The grid-mix emission factor is the most recent available figure, which is for the year 2013, for all fuels (DECC, 2014c).	A range of +/- 10% has been used to calculate the likely minimum and maximum.
Fossil fuel- mix emission factor (t CO ₂ MWh ⁻¹)	0.701	0.631	0.771	The fossil-fuel emission factor is the most recent available figure, which is for the year 2013, for all fossil fuels DECC, 2014c).	A range of +/- 10% has been used to calculate the likely minimum and maximum.
Borrow Pits					
Number of borrow pits	4	4	4	Chapter 4: Project Description states four borrow pits (circa 0.30ha, 0.32ha, 0.32ha and 0.36ha in area)	
Average length of pits (m)	57	54	60	The area of the four borrow pits have been totalled (12,992 m ²) and then divided by 4. The square root of the average area was used to estimate the length and width = 57 m x 57 m.	It has been assumed for calculation purposes that the borrow pits are square. A range of +/- 5% has been used to calculate the likely minimum and maximum.
Average width of pits (m)	57	54	60		
Average depth of peat removed from pit (m)	0.31	0.11	0.52	The average peat depth has been calculated as an average of all the peat probes at each borrow pit location (infrastructure + a buffer of 50 m). The estimated peat volume has been calculated as the area of each borrow pit multiplied by the peat depth. The overall average peat depth has then been calculated as the sum of the volumes divided by the sum of the areas.	A 95% confidence interval has been calculated as the mean +/- 2 standard errors of peat depth for each borrow pit. The minimum and maximum depth were then used to calculate the overall average peat depths as the sum of the volumes divided by the sum of the areas for both the minimum and maximum values.
Foundations and hard-standing area associated with each turbine					
Average length of turbine foundations (m)	22	20	24	Chapter 4: Project Description states that wind turbines will be supported on concrete foundations,	The depth of the excavation will depend on the need to reach suitable substrate but will

Average width of turbine foundations	22	20	24	measuring approximately 20 m by 20 m and 3.5 m in depth, dependent on ground conditions, with a 5 m diameter central pedestal where it meets the turbine tower.	typically be 3.5 m. The sides will be 'battered' back to ensure that they remain stable during construction the excavation for each foundation could extend to 24 m across. The expected excavation has been set at 22m, with the minimum as 20m and the maximum as 24m.
Average depth of peat removed from turbine foundations	0.52	0.39	0.65	The average peat depth has been calculated as an average of the average of all the peat probes at each turbine/hardstanding location, with a 50 m buffer. By taking an average of the average, overweighting locations with more probes will not occur. Mean = 0.52 m Count = 21 SE = 0.07	A 95% Confidence Interval has been calculated as the mean +/- 2 standard errors to estimate the likely minimum and maximum values.
Average length of hardstanding (m)	34.6	34.6	38.1	Chapter 4: Project Description states that hardstanding areas will be required adjacent to each turbine base to accommodate cranes and their outriggers. These will be of similar construction to the tracks (see below), but covering a triangular area adjacent to the turbine foundation, approximately 55 m x 41 m x 68.6 m (along track edge) and covering an area of 1128 m ² . Two additional 'tail crane' hardstandings (12 m x 3 m) may also be required, depending on the local topography and the type of crane ultimately used for construction. Therefore the total area has been estimated at 1200m ² and the dimensions have been taken as the square root of this area.	Although the hardstandings are designed as mainly triangular, for the purposes of the Carbon Calculator, they have been assumed to be a square of similar area. These dimensions are assumed to be the expected and minimum values, with a possible 10% increase for the maximum range.
Average width of hardstanding (m)	34.6	34.6	38.1		
Average depth of peat removed from hardstanding	0.52	0.39	0.65	The average peat depth has been calculated as an average of the average of all the peat probes at each turbine/hardstanding location, with a 50 m buffer. By taking an average of the average, overweighting locations with more probes will not occur. Mean = 0.52 m Count = 21 SE = 0.07	A 95% CI has been calculated as mean +/- 2 SE to estimate the likely minimum and maximum values.

Access tracks					
Total length of access track (m)	17,261	16,397	18,124	All access tracks for the proposed development have been measured using GIS.	A range of +/- 5% has been used to calculate the likely minimum and maximum.
Existing track length (m)	0	0	0	There is 4,417m of existing access track but this will require upgrading so it has been included within the excavated track length.	
Length of access track that is floating road (m)	0	0	0	No floating roads will be used.	
Length of access track that is excavated road (m)	15,912	15,117	16,708	This includes the existing track length as it is assumed that this might need to be upgraded. The length is measured in GIS.	A range of +/-5% has been used to calculate the likely maximum.
Excavated road width (m)	7.5	6.75	8.25	Chapter 4: Project Description states that the finished road running width will be 5 m. However, a width of 7.5 m has been used to allow for cable trenches and drainage.	A range of +/- 10% has been used to calculate the likely minimum and maximum.
Excavated road depth (m)	0.39	0.32	0.46	The average peat depth has been calculated from the average of all the peat probes in a 25 m buffer around the excavated and upgraded access track length. Count = 131 Mean = 0.39 SE = 0.04	A 95% Confidence Interval has been calculated as the mean +/- 2 standard errors to estimate the likely minimum and maximum values.
Length of access track that is rock filled road (m)	1,348	1,281	1,416	The length of the rockfilled track is measured in GIS.	A range of +/- 5% has been used to calculate the likely minimum and maximum.
Rock filled road width (m)	7.5	6.75	8.25	Chapter 4: Project Description states that the finished road running width will be 5 m. However, a width of 7.5 m has been used to allow for cable trenches and drainage.	A range of +/- 10% has been used to calculate the likely minimum and maximum.

Rock filled road depth (m)	0.8	0.35	1.25	Rockfill type track construction may be utilised in areas of deep peat (generally more than 1.0 m depth) where there are steep slopes perpendicular to the track. The average peat depth has been calculated from the average of all the peat probes in a 25 m buffer around the rock-filled access track length. Count = 10 Mean = 0.8 SE = 0.22	A 95% Confidence Interval has been calculated as the mean +/- 2 standard errors to estimate the likely minimum and maximum values.
Length of rock filled road that is drained (m)	1,348	1,281	1,416	The need for drainage will be established onsite during construction by observation. Tracks will be designed with a slight camber to encourage runoff to adjacent trackside drains. Trackside drains will be provided to control runoff from construction areas especially during heavy rainfall events. For the purposes of this assessment, it is assumed that all the rock-filled track is drained.	A range of +/-5% has been used to calculate the likely maximum.
Average depth of drains associated with rock filled roads (m)	0.8	0.35	1.25	Trackside drainage will comprise infiltration trenches with check dams which will be unlined to allow the standing water to infiltrate back into the ground. Therefore, the drains will need to be as deep as the peat layer alongside this track type. The average peat depth has been calculated from the average of all the peat probes in a 25 m buffer around the rock-filled access track length. Count = 10 Mean = 0.8 SE = 0.22	A 95% Confidence Interval has been calculated as the mean +/- 2 standard errors to estimate the likely minimum and maximum values.
Cable trenches					
Length of any cable trench on peat that does not follow access tracks and is lined with a permeable membrane (e.g. sand) (m)	0	0	0	Chapter 4: Project Description states that the construction of the cable route will minimise disturbance to drainage by taking the route alongside the access track and around the turbines adjacent to new tracks.	Assumed that all the cable trenches will follow access tracks.
Depth of cable trench (m)	0	0	0	Parameter not required as all cable trenches assumed to follow access tracks.	
Additional peat excavated (not accounted for above)					

Volume of additional peat excavated (m3)	8,524	8,098	8,950	The average peat depth has been calculated as an average of all the peat probes at each infrastructure type (infrastructure + a buffer of 50 m). The estimated peat volume has been calculated as the area of each infrastructure type multiplied by the depth. These have been added together to get an overall volume of additional peat excavated.	A range of +/- 5% has been used to calculate the likely minimum and maximum.
Area of additional peat excavated (m3)	11,875	11,281	12,469	The additional area excavated has been measured using GIS and includes: <ul style="list-style-type: none"> • Passing place (x5) • Sub-station (x1) • Construction compound (x2) • Anemometry mast (x3) 	A range of +/- 5% has been used to calculate the likely minimum and maximum.
Peat Slide Hazard					
Weblink: Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments	Low	Low	Low	The Peatslide Hazard and Risk Assessment Interpretive Report (September 2014, Appendix 10.1b Volume IV) indicates an overall score of 149 for the proposed turbine envelope area which places it in the low category of peat slide risk. In certain locations the score exceeds 200 and very locally, 300, which corresponds to a moderate risk level although such areas appear localised and the majority of the turbine envelope is considered to have a low risk of peat slide susceptibility.	Assumption is that that construction methodology and mitigation measures will be implemented during construction under geotechnical supervision.
Improvement of Carbon sequestration at site by blocking drains, restoration of habitat etc					
Improvement of felled plantation land				The Outline Habitat Management Plan (Appendix 8.5 Volume IV) states that the greatest potential for creating compensatory habitat at the application site involves restoration of moorland habitat, notably heath and blanket bog, in drained and afforested areas of shallow (<50 cm) or deeper peats.	

Area of felled plantation to be improved (ha)	23.6	22.4	24.8	The Outline Habitat Management Plan (Appendix 8.5 Volume IV) states that, overall, the area available for moorland restoration in clear-felled forestry within turbine buffers comprises 23.6 ha. This figure excludes the footprint of the wind farm development. It also excludes any buffers or parts of the buffers which already comprise open moorland; these amount to a total of c.12 ha of habitat (mainly moorland vegetation), which will be retained. Of the 18 turbine buffers for which habitat restoration is proposed, nine will be suitable for blanket bog restoration, whereas nine will be suitable for wet heath or both wet heath and blanket bog restoration.	A range of +/- 5% has been used to calculate the likely minimum and maximum area.
Water table depth in felled area before improvement (m)	0.4	0.36	0.44	It is assumed that the water table depth in the felled forestry areas will be sub-optimal for blanket bog and wet heath restoration. The felling of the forestry is likely to lower the water table on average, in particular in the exposed ridges. The OHMP (Appendix 8.5 Volume IV) explains that previous experience had demonstrated that the ridge and furrow patterns may remain after forestry removal and that ridges may remain above even a water table raised by drain blocking.	A range of +/- 10% has been used to calculate the likely minimum and maximum depth.
Water table depth in felled area after improvement (m)	0.1	0.09	0.11	The management objectives within the OHMP (Appendix 8.5 Volume IV) include: <ul style="list-style-type: none"> Management Objective A1: Mean depth to water table will be <100 mm between the drought months of April – July within 10 years after felling 	A range of +/- 10% has been used to calculate the likely minimum and maximum depth.
Time required for hydrology and habitat of felled plantation to return to its previous state on improvement (years)	10	7.5	12.5	The management objectives within the OHMP (Appendix 8.5 Volume IV) have restoration objectives for turbine buffers on deep (>50 cm) peat relating to achieving suitable conditions for bog restoration in the short-term (0 – 10 years). Therefore 10 years has been assumed to be a reasonable time for the restoration on felled plantation.	A range of +/- 25% has been used to calculate the likely minimum and maximum time.

Period of time when effectiveness of the improvement in felled plantation can be guaranteed (years)	25	25	25	The guidance within the Carbon Calculator states that unless there is strong supporting evidence that improvement in the felled forestry can be guaranteed beyond the lifetime of the windfarm, this parameter should be set as the lifetime of the windfarm.	Standard planning consent – no variation.
Restoration of peat removed from borrow pits				It is currently anticipated that the floor of the pits will be built up with surplus topsoil/ peat excavated during the construction of the windfarm. The side slopes of the borrow pits will be graded to a safe angle to prevent collapse and to provide a landform shape that integrates the feature, as far as practicable, with the adjacent landscape. The topsoil/peat will be replaced and prepared to create suitable ground conditions for seeding or re-turfing. Any seeding would be carried out in accordance with techniques and seed mixes approved by East Ayrshire Council. Detailed methodologies regarding removal of topsoil and reinstatement methods and approaches would also be agreed with the Council.	
Area of borrow pits to be restored (ha)	1.30	1.17	1.43	Total anticipated area of borrow pits	A range of +5% has been used to calculate the likely minimum and maximum.
Water table depth in borrow pit before restoration (m)	0.05	0.00	0.09	The water table depth in the borrow pits before excavation is assumed to be the same as the whole site average in the absence of specific information about these locations.	The minimum value has been set at zero to reflect the possibility that the water table could be at the surface – this is unlikely to be the average depth across a whole year. The maximum depth has been set as the acrotelm/catotelm boundary (0.09 m) and the expected depth is the mid-point between these two depths.
Water table depth in borrow pit after restoration (m)	0.10	0.09	0.11	The management objectives within the OHMP (September 2014) include: <ul style="list-style-type: none"> Management Objective A1: Mean depth to water table will be <100 mm between the drought months of April – July within 10 years It is assumed that this is a reasonable management objective for borrow-pit restoration.	A range of +/- 10% has been used to calculate the likely minimum and maximum depth.

Time required for hydrology and habitat of borrow pit to return to its previous restoration (years)	10	7.5	12.5	The management objectives within the OHMP (September 2014) have restoration objectives for turbine buffers on deep (>50 cm) peat relating to achieving suitable conditions for bog restoration in the short-term (0 – 10 years). Therefore 10 years has been assumed also to be a reasonable time for the restoration of borrow pits.	A range of +/- 25% has been used to calculate the likely minimum and maximum time.
Period of time when effectiveness of the restoration of peat removed from borrow pits can be guaranteed (years)	25	25	25	The guidance within the Carbon Calculator states that unless there is strong supporting evidence that improvement in the borrow pit can be guaranteed beyond the lifetime of the windfarm, this parameter should be set as the lifetime of the windfarm.	Standard planning consent – no variation.
Removal of drainage from foundations and hardstanding					
Water table depth around foundations and hardstanding before restoration (m)	0.52	0.39	0.65	Chapter 4: Project Description states that the turbine foundations will be covered and reinstated as appropriate, leaving only a narrow area of concrete at the base of each turbine tower and a stoned access path around the base. The turbine foundation area will be allowed to re-vegetate and will permit the natural infiltration of surface water. Foundations and hardstanding will be drained prior to construction. The estimated water table depth after draining but before restoration is estimated as the average peat depth at the foundation/hardstanding area.	A 95% Confidence Interval has been calculated as the mean +/- 2 standard errors to estimate the likely minimum and maximum values of the peat depth at the foundation/hardstanding area.
Water table depth around foundations and hardstanding after restoration (m)	0.10	0.09	0.11	The management objectives within the OHMP (September 2014) include: <ul style="list-style-type: none"> Management Objective A1: Mean depth to water table will be <100 mm between the drought months of April – July within 10 years It is assumed that this is a reasonable management objective for restoration of foundations and hardstanding.	A range of +/- 10% has been used to calculate the likely minimum and maximum depth.

Time to completion of backfilling, removal of any surface drains, and full restoration of the hydrology (years)	10	7.5	12.5	The management objectives within the OHMP (September 2014) have restoration objectives for turbine buffers on deep (>50 cm) peat relating to achieving suitable conditions for bog restoration in the short-term (0 – 10 years). Therefore 10 years has been assumed also to be a reasonable time for the restoration of foundations and hardstanding.	A range of +/- 25% has been used to calculate the likely minimum and maximum time.
Restoration of Application Site after decommissioning					
Will hydrology of the site be restored on decommissioning?	No	No	No	This section asks very specific questions about restoration of the site after decommissioning. All answers have been assumed to be 'No' as a worst case scenario as this information is not available at this stage. Chapter 4: Project Description states that at the end of the operational life, either planning permission will be sought to repower the development or the development will be decommissioned. It is assumed for the purposes of the EIA that the Proposed Development will be decommissioned at the end of its operational life. It is likely that some of the described activities will take place post-decommissioning through a programme of habitat restoration, in accordance with an agreed decommissioning plan, but since this is not yet defined, the responses to these questions have been set as 'no'.	Changing the responses to yes does not affect the expected payback of the wind farm.
Will you attempt to block any gullies that have formed due to the windfarm?	No	No	No		
Will you attempt to block all artificial ditches and facilitate rewetting?	No	No	No		
Will habitat of the site be restored on decommissioning?	No	No	No		
Will you control grazing on degraded areas?	No	No	No		
Will you manage areas to favour reintroduction of species	No	No	No		
Choice of methodology for calculating emission factors	Site specific			The parameters collected from the Application Site enable the use of the site specific methodology rather than the more generic IPCC default calculation	
Construction Input Data					
Volume of Concrete Used (m ³)	30,030	27,027	33,033	Chapter 4: Project Description estimates that each foundation will require approximately 1,430 m ³ of concrete and up to 200 tonnes of steel reinforcing. The steel reinforcement has been included in Table 16.4 .	A range of +/- 10% has been used to calculate the likely minimum and maximum.

16.5 Results of Carbon Calculator

16.5.1 The full excel spreadsheet model calculates the estimated carbon emission losses, gains and savings from the various aspects of the application site and the proposed development, and also calculates a payback period based on the three counterfactual (grid) emissions factors; coal fired plant, grid-mix and fossil fuel mix.

Results from the model

16.5.2 **Tables 16.7 to 16.10** show the results of the model using the parameter inputs described in **Tables 16.4 to 16.6**. The results are broken down into CO₂ losses due to the construction of the windfarm (Table 7), CO₂ gains from site restoration activities (**Table 16.8**) and CO₂ savings from the displacement of grid electricity (**Table 16.9**). Table 10 shows the estimated carbon payback period of the proposed development based on the average grid factor. The carbon payback period is calculated as the sum of the total losses and gains (gains are expressed as negative numbers and therefore reduce the total losses), divided by the yearly carbon savings from grid electricity displacement, which gives an estimate of the number of years of windfarm operation required to 'payback' the total carbon losses. There is also a calculated carbon intensity metric, which is independent of the grid factor.

Table 16.7 Estimated CO₂ losses due to the construction, operation and decommissioning of the proposed Pencloe Windfarm

Category of carbon losses	Equivalent carbon dioxide emissions (tCO ₂ e)		
	Expected	Minimum	Maximum
Losses due to turbine lifecycle - manufacture, construction, decommissioning	60,127	59,608	60,647
Losses due to provision of backup power to the grid	53,194	47,875	58,514
Losses due to reduced carbon fixing potential	2,231	694	4,049
Losses from soil organic matter	20,581	9,416	30,020
Losses due to Dissolved Organic Carbon & Particulate Organic Carbon leaching	23	4	66
Losses due to felling forestry	6,577	5,624	7,597
Sub-total of losses from the Carbon Calculator	142,735	123,220	160,892
Additional losses from construction materials not already included, i.e. plant and equipment use and transport	17,092	15,383	18,801
Total CO₂ losses due to the Pencloe Windfarm	159,826	138,603	179,693

16.5.3 **Table 16.7** shows that the action of constructing the proposed development is likely to produce around 160,000 tonnes of CO₂e emissions in total. These are mainly resulting from the turbine and concrete lifecycle (38%) and provision for backup power to the grid (33%). Onsite losses of carbon through extraction and drainage of soils (soil organic matter losses) contribute 13% and additional losses from other construction materials (e.g. steel, cabling and geotextile), plant and equipment use and transport of material and labour to site make up another 11%. Losses of carbon fixing potential (both felling forestry and loss of bog plant area) only contribute around 6% in total. Therefore, the majority of emissions for this windfarm are from activities beyond the application site boundary e.g. manufacture of turbines and potential requirement for backup power within the grid.

16.5.4 **Table 16.8** shows the estimated CO₂ gains over the lifetime of the proposed development from improvements through restoration. Restoration of felled forestry

areas within turbine buffers is estimated to contribute gains of around 4,000 tCO₂e, while removal of drainage around the turbines and hardstanding area contributes around 1,600 tCO₂e. The restoration of peat in borrow pits is not estimated to produce any gains because the change in water table is insignificant. However, in reality, these areas should help reduce the oxidation of extracted peat through restoration so the actual gains could be far greater than estimated by the Carbon Calculator methodology.

Table 16.8 Estimated CO₂ gains due to the proposed Pencloe windfarm

Category of carbon gains	Equivalent Carbon dioxide emissions (tCO ₂ e)		
	Expected	Minimum	Maximum
Gains due to improvement of felled forestry	-3,967	-2,739	-5390
Gains due to restoration of peat from borrow pits	0	0	0
Gains due to removal of drainage from foundations & hardstanding	-1,665	-711	-2,756
Total CO₂ gains due to the Pencloe windfarm	-5,632	-3,450	-8,146

16.5.5 **Table 16.9** shows the estimated yearly CO₂ savings, based on the three different grid emission factors. The highest estimated savings are for replacement of coal-fired electricity generation but even at the current UK grid-mix which includes nuclear and renewables, the proposed development is estimated to produce savings of nearly 77,000 tonnes of CO₂ per year by avoiding emissions resulting for electricity generation from other sources.

Table 16.9 Estimated yearly CO₂ savings from the proposed Pencloe Windfarm

Electricity grid emission factors	Annual carbon dioxide saving (tCO ₂ yr ⁻¹)		
	Expected	Minimum	Maximum
Coal-fired electricity generation (0.907 tCO ₂ MWh ⁻¹)	153,620	131,321	178,067
Grid-mix of electricity generation (0.454 tCO₂ MWh⁻¹)	76,895	65,733	89,132
Fossil fuel-mix of electricity generation (0.701 tCO ₂ MWh ⁻¹)	118,730	101,495	137,624

16.5.6 **Table 16.10** shows the estimated payback period, if the electricity generated by the windfarm is assumed to displace electricity generated by the grid at the current UK grid-mix which includes nuclear and renewables. This payback period is estimated at 2.0 years, with a minimum of 1.5 and a maximum of 2.7 years. The other carbon metric is the ratio of carbon emissions to power generation (also known as the carbon intensity). This is calculated at 0.036, which is significantly lower than the current grid-mix of 0.454 tCO₂e/MWh.

Table 16.10 Carbon balance metrics for Pencloe Windfarm

Carbon metrics	Metric		
	Expected	Minimum	Maximum
Estimated carbon payback based on the grid-mix of electricity generation (years)	2.0	1.5	2.7
Ratio of carbon emissions to power generation (tCO ₂ e/MWh)	0.036	0.032	0.039

Comparison with the baseline

16.5.7 The soil carbon losses from the application site are estimated at 21,000 tonnes of CO₂e. However, as shown in **Table 16.11**, this represents only around 2.4% of the total stored carbon onsite and includes anticipated excavated and drained peat losses. In reality this percentage is likely to be lower because the method used by the Carbon Calculator tool is likely to overestimate the losses from drained peat and also assumes that all excavated peat will be oxidised, whereas good management and re-use at site is likely to prevent at least a proportion of this oxidation.

Table 16.11 Estimated soil carbon stores within the Application site

Parameter	Expected	Minimum	Maximum
Estimated volume of peat onsite (m ³)	4,758,000	4,238,000	5,307,000
Estimated amount of oxidisable carbon in soils onsite (tC)	232,000	133,000	370,000
Estimated equivalent emissions of carbon dioxide (tCO ₂ e)	853,000	489,000	1,359,000
Total expected losses of stored carbon onsite (tCO ₂ e)	20,604	9,420	30,086
Estimated % of stored carbon lost due to construction of the Proposed development	2.42%	1.93%	2.21%

16.5.8 The proposed windfarm is estimated to generate around 169 GWh of renewable electricity per year, contributing around 0.43 % of the 2020 renewable target (based on 2012 gross electricity consumption of 39,602 GWh per year) (Ref 27).

Sensitivity Analysis

16.5.9 The sensitivity analysis shows the impact of varying key parameters on the overall estimated payback period based on the current UK grid-mix, whilst holding all other parameters constant, as shown in **Table 16.12**. Within the model there are a number of parameters known to have a much greater impact on overall estimated payback period; for some of these parameters there is also a degree of uncertainty over the inputs due to data collection restraints.

Table 16.12 Sensitivity analysis of key parameters under the grid mix counterfactual emission factor

Key parameter	Carbon payback period in years		
	Expected	Minimum	Maximum
Current estimated carbon payback based on the grid-mix of electricity generation (years)	2.0	1.5	2.7
Impact on payback of increasing the average water table depth to 0.4 m (+/-50%)	2.0	1.4	3.1
Impact of doubling the dry soil bulk density from 0.12 to 0.24 g/cm ³ (+/-25%)	2.3	1.6	3.2
Impact of increasing the average drainage distance from 12.9 m to 30 m (+/-25%)	2.1	1.5	2.8

16.5.10 **Table 16.12** shows that increasing the water table depth has no impact on the expected payback period, although the payback range increases slightly as the uncertainty increases.

16.5.11 Dry soil bulk density has a larger impact on expected payback, with a doubling of the value increasing the payback by 0.3 years. However, it should be noted that if the dry soil bulk density was higher, the calculated drainage distance would be much

lower, which would have the opposite effect on the payback, therefore the actual net effect of this parameter would be lower.

- 16.5.12 **Table 16.12** also shows that, while the average drainage distance around drainage features onsite is an important parameter in terms of the area of peat potentially affected by the proposed development, increasing this parameter from 12.9 m to 30 m only increases the expected payback period by 0.1 years because of the relative shallowness of the peat.
- 16.5.13 Overall there is relatively little sensitivity to the overall outcome from changing these individual parameters, which increases the confidence in the estimated payback period of 2.0 years with a range of 1.5 to 2.7

Cumulative effects of renewable energy projects on the long-term grid carbon factor

- 16.5.14 The most significant cumulative effect of the proposed development is on the long-term grid electricity carbon factor. As the supply of renewable energy generation increases, the overall national grid carbon factor is predicted to decrease, and this is a key strategy of the Scottish Government to reduce the overall emissions and meet the Climate Change (Scotland) Act targets. The cumulative effect of these projects would be to reduce the projected emissions savings of an individual project as each unit of grid electricity would be worth less carbon. This effect will be higher as renewable energy develops further into the future; however at the same time the exact generation composition of the grid and therefore the carbon emissions per unit of electricity is less predictable.
- 16.5.15 Although there is a great deal of uncertainty surrounding the future grid factor, the Intergovernmental Analysts Group at the Department for Energy and Climate Change have produced projections based on the UK achieving renewable energy targets and successfully implementing the UK Energy Policy. These predict an average grid factor (for generation) over the expected lifetime of the windfarm of approximately 0.124 tCO₂e/MWh (IAG, 2013). The effect of applying this average grid factor to the proposed development would be to reduce the overall savings and therefore increase the payback period from 2.0 years to 7.3 years. However, it should be noted that this does not change the estimated carbon intensity of the proposed development, which is still significantly lower than this projected future average grid factor.

Mitigation Measures

- 16.5.16 Although the results from the climate change assessment show that the impact of the Proposed Development on climate change mitigation is positive after an estimated 2.0 years of operation, there are ways to reduce this payback period further.

Design Phase

- 16.5.17 The project has been designed to avoid, where practicable, identified environmental constraints, including areas of deeper peat, particularly sensitive habitats, locations occupied by protected species, watercourses and cultural heritage features. Where avoidance has not been possible, mitigation measures have been proposed to prevent significant effects. More details about the design principles can be found in **Chapter 2: Site Selection, Design and Alternatives** and **Chapter 4: Project Description**.

Construction

- 16.5.18 The following activities will contribute to lower carbon emissions during the construction phase

- Implement a Site Waste Management Plan (SWMP) (Outline SWMP provided in **Appendix 15.1 Volume IV**) to reduce materials wastage;
- Implement a vehicle idling policy to ensure that, where practicable plant and equipment are turned off when not in use as part of the CEMP;
- Implement a Peat Management Plan (see **Appendix 10.5 Volume IV**) to minimise disturbance to peat where possible and to manage the extracted peat to maximise possibility of restoration in or ex situ; and
- Maximise restoration of extracted peat on site, particularly in restored borrow pit areas, maintaining the acrotelm layer in its proper position.

16.6 Discussion and Conclusions

- 16.6.1 The results of the Carbon Calculator for the proposed development show that the proposed development is estimated to produce annual carbon savings in the region of nearly 77,000 tonnes of CO₂ per year through the displacement of grid electricity (based on an average grid emission factor of 0.454 kg CO₂/kWh).
- 16.6.2 The assessment of the carbon losses and gains has estimated an overall net loss of around 154,200 tonnes of CO₂e, mainly due to the embodied losses from the manufacture of the turbines and the provision of backup power to the grid. Losses of carbon from soil organic matter, forestry and bog vegetation only contribute around 18% of the total. Within these net losses, additional materials, plant and equipment and transport of materials and labour contribute 17,000 tonnes of CO₂ emissions. Small carbon gains are anticipated from the restoration of areas of felled forestry.
- 16.6.3 The estimated payback period of the windfarm, using the Scottish Government methodology and additional calculations, is therefore 2.0 years, with a range of 1.5 to 2.7 years.
- 16.6.4 The windfarm has been specifically designed to reduce site based losses, both minimising the impact on the peatland habitat and reducing the volume of excavated peat removed by avoiding peat or by locating infrastructure preferentially, where practicable, on shallow peat deposits.
- 16.6.5 There are no current guidelines about what payback periods constitute a significant impact but 2.0 years is around 8% of the anticipated lifespan of the windfarm. Compared to fossil fuel electricity generation projects, which also produce embodied emissions during the construction phase and significant emissions during operation due to combustion of fossil fuels, this project has a very low carbon footprint and after an estimated 2.0 years, the electricity generated will be carbon neutral.
- 16.6.6 The carbon intensity of the electricity that would be produced by Pencloe Windfarm is estimated at 0.036 tCO₂ / MWh. This is well below both the current grid carbon intensity and therefore the proposed development will contribute towards decarbonisation of the national grid and is evaluated to make a significant positive contribution to climate change mitigation.

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17 Summary of Mitigation Measures

17.1 Introduction

- 17.1.1 This chapter summarises the proposed mitigation measures (including those for the prevention of pollution) which the Applicant is committing to during the construction, operation and decommissioning phases of the proposed development. Each of these phases will be carried out in accordance with the commitments (with respect to mitigation measures, management measures and/or monitoring requirements) made in this ES, plus any additional legislative and contractual requirements or updated good practice guidance in place at the time. This chapter also provides an overview of how these mitigation measures will be implemented and managed to ensure that the environmental impact of the proposed development is minimised where practicable.
- 17.1.2 This chapter draws on the mitigation measures required to minimise the significant impacts identified through the EIA process, as described in each of the technical chapters of this ES, i.e. **Chapters 6 to 16**. A summary of the measures proposed is provided in **Table 17.1**.
- 17.1.3 The strategy adopted by the Applicant for mitigation is based on good practice and a hierarchical approach as follows:
- Avoidance – making changes to a project’s design (or potential location) to prevent adverse effects on an environmental feature. This is considered to be the most acceptable form of mitigation;
 - Reduction – where avoidance is not possible, adverse effects may be reduced through the use of environmental controls as part of the project design;
 - Compensation or offset – where it is not possible to reduce the severity of predicted effect, measures may be proposed to compensate or offset the effects; and
 - Enhancement – it is sometimes possible within a development footprint to identify enhancement measures to create positive outcomes.
- 17.1.4 The EIA process works most effectively where it forms an integral part of the project design. In doing so, there is an opportunity to influence the decision-making such that negative environmental effects can be avoided or minimised, and opportunities for environmental gain or enhancement can be fully exploited.
- 17.1.5 The Pencloe Windfarm EIA team have worked closely with the design team to achieve an iterative design process where one team responds to the emerging work of the other. This process is described in **Chapter 2: Site Selection, Design and Alternatives**. Where possible, avoidance and reduction measures have been incorporated into the design of the proposed Development, in an attempt to prevent or minimise potential environmental effects which may arise from the development.
- 17.1.6 The selection of a suitable site and the design of turbine layout within that site to minimise landscape impacts is the keystone to providing an acceptable proposal. This process is described in **Chapter 2: Site Selection, Design and Alternatives**. The avoidance of a range of onsite and offsite features with associated buffers was also considered, as far as possible, during the design of the site layout as outlined in Section 2.4 of **Chapter 2: Site Selection, Design and Alternatives**. Factors considered included housing, watercourses, telecommunications links, ecological and cultural heritage features and design of the turbine layout has enabled the avoidance of a number of direct impacts upon them. Mitigation measures have also been proposed for the construction, operation and decommissioning phases of the proposed development to avoid, reduce, minimise or offset impacts which could not be avoided through the design process.

- 17.1.7 To facilitate the implementation of these measures, Environmental Management Plans (EMPs) will be prepared for the construction, operation and decommissioning phases. The EMPs will describe the environmental risks and potential impacts of site activities and outline how the proposed mitigation measures and procedures will be implemented to manage these. The EMPs will be prepared in advance of the start of each phase. It is anticipated that these will be presented to East Ayrshire Council for approval, in consultation with SNH and SEPA post-consent but prior to development commencing. An outline Construction EMP (CEMP) is provided in **Appendix 10.7 Volume IV**.
- 17.1.8 Although the majority of the pollution prevention / mitigation measures identified throughout the ES relate to the construction phase, a number rely on effective implementation and ongoing maintenance and monitoring once the proposed development is operational. The precise management structures for controlling these activities and ensuring that impacts are minimised will be agreed as part of the operational EMP and the Applicant will ensure that appropriate procedures and responsibilities are in place.
- 17.1.9 During the decommissioning phase, it is expected a similar procedure to that described for the construction phase will be followed. All contractors associated with the proposed development will be expected to conduct their activities in accordance with best practice and legislative requirements that are relevant at the time and in such a way that the effects on the environment during decommissioning are limited, where practicable. Furthermore, the Decommissioning EMP will outline specific procedures to restore the application site, as far as is practicable and desirable.

17.2 Schedule of Mitigation

- 17.2.1 The mitigation and enhancement measures included in the technical chapters (**Chapters 6 to 16**) of this ES, as summarised in **Table 17.1**, will form, where relevant, a 'Schedule of Mitigation' as part of the CEMP for the proposed development. Further details and context are provided in the technical chapters. The Schedule will be updated regularly as the proposed development proceeds and the results of any consultations and post-determination investigations become available.

Table 17.1 Draft Scheme of Mitigation

Topic Area	Proposed Mitigation
<p>Landscape and Visual Assessment</p>	<p>General</p> <p>Landscape and visual effects of the proposed development has been one of several technical aspects considered as part of the evolution of the design, which is described in detail in Chapter 2: Site Selection, Design and Alternatives.</p> <p>The principal means of mitigation with regard to wind energy development is the consideration of the siting, design and layout of the turbines and ancillary infrastructure, in relation to landscape and visual receptors as part of the design optimisation process described above.</p> <p>In summary, the optimised 21 turbine layout has been through a sequence of design review with careful analysis of computer generated wireframes, with the objective of minimised significant effects on landscape and visual receptors.</p> <p>In addition to this, standard/embedded mitigation measures have been incorporated such as the adoption of three bladed horizontal axis turbines with tubular steel towers and the selection of a mid-grey paint finish which will reduce the distance over which the turbines will be visible particularly in dull and overcast conditions, however the exact colour of the wind turbines will be agreed with East Ayrshire Council prior to the construction commencing.</p>
<p>Non-Avian Ecology</p>	<p><i>Construction</i></p> <p>Prior to construction commencing a CEMP, an outline of which is included as Appendix 10.7 Volume IV, will be produced and agreed with East Ayrshire Council in consultation with SNH and SEPA. This will contain full details of measures to minimise the impact on ecologically sensitive features within the application site boundary. A summary of ecology-related aspects to be included in the CEMP is provided below.</p> <p>An Ecological Clerk of Works (ECoW) will be employed during tree felling, unless where this is done as part of the normal forestry operations, and during construction. A detailed specification for the role of ECoW will form part of the CEMP.</p> <p>In addition to the species-specific mitigation outlined below, a watching brief will be in place in the unlikely event that any evidence of protected species within works areas is recorded, e.g. evidence of badgers, pine marten, wildcat or red squirrel. If resting places of such species are identified within a 50 m distance from works areas, mitigation measures will be developed as appropriate. This will be detailed in the CEMP.</p> <p><i>Mitigation and enhancement measures to reduce construction impacts on habitats</i></p> <p>The ECoW will brief site workers on the ecologically sensitive receptors present. Site workers will be instructed not to move</p>

Topic Area	Proposed Mitigation
	<p>beyond 10 m of infrastructure areas and measures to prevent inadvertent damage to habitats of value will be agreed, e.g. use of orange mesh tape fencing or brightly coloured tape to delineate the extent of the working areas. Site staff will be briefed on the use of this tape and the need to work inside the marked areas.</p> <p>As detailed in the GWDTE Assessment in Appendix 10.2 Volume IV, cross track drains will be installed upgradient of M6 mire at risk from dewatering in order to maintain hydraulic continuity to down gradient areas. Drainage will be passed through settlement tanks, systems to maintain water quality and then discharged down gradient to infiltrate back into the ground, thereby maintaining the overall volume of groundwater. In addition, there will be minimisation of any period of dewatering during the construction of Turbine 5 and the adjacent crane hardstanding.</p> <p>Peat turfs and excess excavated peat will be reinstated along road edges and around the edges of the crane hardstandings and laydown areas. Reinstatement will occur in these areas according to best practice; details of which will be presented within the CEMP.</p> <p>As detailed in Chapter 10: Hydrology, Hydrogeology and Geology and the Outline Peat Management Plan (Appendix 10.5 Volume IV), if any short-term storage of excavated peat is needed, excavated turfs will be stored adjacent to the construction area from which they have been excavated from to ensure that they remain moist and viable for reinstatement. Temporary stockpiles may be sprayed with water if necessary during particularly dry periods of weather to prevent drying out. They may also be stored adjacent to the remaining forestry cover to provide shade to prevent the peat from drying out and eroding.</p> <p>In order to compensate for the loss of wet heath, bog and flush habitat and disturbance of heath and bog during construction, a Habitat Management Plan (HMP) will be produced to detail the restoration of hydrological conditions suitable for blanket mire and heath habitat within the 80 m turbine buffers. These areas currently primarily comprise plantation woodland with some smaller areas of moorland as well. The area of cleared forestry which will be available for restoration amounts to a total of 23.6 ha. The plantation will be clear felled and drains and/or plough furrows will be blocked. The aim of these activities is to raise water levels to improve the condition of peatland vegetation within existing areas of open moorland and facilitate the establishment of blanket bog or heath in existing areas of plantation. In addition, it is proposed to widen river corridors within 28.8 ha of plantation forestry and it is further proposed to establish broadleaved woodland communities, modelled on the NVC types W4 <i>Betula pubescens</i> – <i>Molinia caerulea</i> woodland, W11 <i>Quercus petraea</i> – <i>Betula pubescens</i> – <i>Oxalis acetosella</i> woodland and W17 <i>Quercus petraea</i> – <i>Betula pubescens</i> – <i>Dicranum majus</i> woodland, within 181.5 ha of</p>

Topic Area	Proposed Mitigation
	<p>plantation. The HMP will also detail the subsequent management and monitoring of the habitat management areas. For further detail on the proposals, please refer to the Outline HMP included as Appendix 8.5 Volume IV.</p> <p><i>Mitigation to reduce construction impacts on fish</i></p> <p>As detailed in Chapter 10: Hydrology, Hydrogeology and Geology, a range of mitigation measures will be employed to minimise potential adverse impacts on watercourses. They include the following:</p> <ul style="list-style-type: none"> ▪ Sediment and drainage control through the separation and treatment of sediment laden water to prevent contaminated runoff from entering down gradient surface watercourses; ▪ Watercourse crossings will be constructed as pre-cast circular or semi-circular piped culverts with the size based on calculation of peak flow from the upstream catchment. The actual design of culverts will be done at the detailed design stage, in accordance with SEPA and CIRIA good practice guidance. Prior to construction the designs will be agreed with SEPA; ▪ Water quality will be tested prior to works commencing in order to ascertain the baseline conditions. Further testing will then be completed during and after the construction of watercourse crossings. Water quality will be tested upstream and downstream of any construction works so that the impact of the works can be determined. Any programme of water testing will be included within the CEMP; ▪ The storage of oils and other potentially polluting substances will be within the construction compounds or other designated areas away from the main operational areas over 50 m from OS mapped watercourses. Storage will be within impervious storage bunds with 110 % capacity, so that any spillages or leaks are contained; and ▪ If groundwater is encountered when excavating peat for construction of the turbine foundations, dewatering will be used to lower groundwater levels and ensure that wet working and direct contact of cement with the groundwater does not occur. Any water will be pumped to a settling lagoon to allow suspended sediment to settle. <p><i>Mitigation to reduce construction impacts on reptiles</i></p> <p>All construction work areas within potentially suitable open habitats for reptiles will initially be cut to a height of c.10 cm during the active season for reptiles (April to October) under the guidance of the ECoW (using e.g. a brush cutter or tractor mounted flail), before works in the relevant areas are due to take place, in order to reduce</p>

Topic Area	Proposed Mitigation
	<p>the height of vegetation and make it less attractive for reptile habitation. Immediately following this, working areas will be surveyed by the ECoW and any potential refugia or hibernacula will be moved out of working areas by hand. Working areas will then be kept unsuitable for reptiles through regular cutting until construction commences.</p> <p><i>Mitigation to reduce construction impacts on bats</i></p> <p>The bat buffers of 80 m will be maintained regardless of any other constraints identified when key-holing turbines.</p> <p><i>Mitigation to reduce construction impacts on otters</i></p> <p>Pre-construction checks for otter will be carried out on all watercourses within 250 m of works areas. If holts or resting places are identified within this distance, mitigation measures will be developed as appropriate. These will be detailed within the CEMP and are likely to include timing works to avoid impacts on holts during the breeding season, potentially using motion sensitive camera to investigate if any holt is a natal holt and appropriate mitigation will be taken to ensure that natal holts are given adequate protection. An ECoW-defined protection zone around resting places will also be enforced to ensure that no inadvertent damage occurs. If considered necessary, a license to undertake such works will be obtained from SNH.</p> <p>In addition, any open excavations will be covered at night to prevent otters from falling in. Alternatively a plank will be inserted into the excavation to allow any animals to climb out.</p> <p><i>Mitigation to reduce construction impacts on water voles</i></p> <p>Pre-construction checks for water vole will be carried out on all watercourses on which new or upgraded crossings are being proposed. The survey will cover a length of at least 50 m upstream and downstream of the location of the proposed crossing and works areas. If active burrows are confirmed within a 5 m distance from works areas, mitigation measures will be developed as appropriate. These will be detailed in the CEMP and are likely to include micro-siting or, if this is not possible, displacement of water voles through habitat manipulation, such as strimming. If considered necessary, a license to undertake such works will be obtained from SNH.</p> <p><i>Operation</i></p> <p>During operation of the windfarm, habitat management will proceed in accordance with the HMP. No other mitigation or compensation measures are necessary during windfarm operation.</p> <p><i>Decommissioning</i></p> <p>The need for decommissioning mitigation will be determined nearer the time of decommissioning of the development, following updated surveys and assessment.</p>

Topic Area	Proposed Mitigation
<p>Ornithology</p>	<p><i>Construction</i></p> <p>In mitigation for impacts on curlew, the route of the majority of the new access track diversion lies around 40 m from the Pencloe Farm buildings and mature broadleaved trees. This represents less optimal nest site or brood rearing locations for curlew. It is advised to schedule track construction and upgrade around Pencloe Farm outside of the summer nesting period to mitigate the impacts on breeding curlew. On a precautionary basis (i) optimal nest habitat can be created by grazing control offset from the immediate zone around the access track, (ii) dissuasion techniques employed prior to nest selection along the track route and (iii) predator control enhanced to reduce nest failure. The residual level of impact will be low to negligible on a locally important resource and not significant.</p> <p>On a precautionary basis to cover inter-year variability for other waders nests, pre-construction surveys are advised to confirm the locations of their core nest areas and then advice taken from the site EcoW.</p> <p>To ensure compliance with the Wildlife & Countryside Act 1981 for forest clearance, the preference is scheduling outside of the nesting season. Where these enabling works coincide with the bird nesting season pre-felling checks will be used to comply with the legal safeguards for birds. Pre-felling checks for common crossbill nests are also a legal requirement and would be needed in mid-winter to match its nesting season. Temporary 'no-go' areas to protect ground or tree nesting birds within the construction site will be demarcated. Buffer distances will be applied as appropriate to individual species and locality.</p> <p><i>Operation</i></p> <p>There are no aspects of operation in terms of land take, disturbance/displacement or the estimated collision risk that require mitigation to offset predicted impacts on birds with high nature conservation value.</p> <p><i>Decommissioning</i></p> <p>A similar set of measures may be required as outlined above for the construction phase, prior to decommissioning in order to inform appropriate mitigation in the future. At the time of this assessment any predictions will be probable or uncertain.</p>
<p>Hydrology, Hydrogeology and Geology</p>	<p><i>Construction</i></p> <p><i>Standard practice measures</i></p> <p>Standard practice measures will be implemented during construction across the application site. Some of the key standard practice guidelines are referred to in Section 10.2 Policy, Legislation and Guidance. These have been taken into account when assessing the potential impact and the likelihood of significant environmental impacts. These standard practice measures are detailed in Appendix 10.8 Volume IV.</p>

Topic Area	Proposed Mitigation
	<p><i>Sediment and drainage control</i></p> <p>Sediment and drainage control measures will be implemented during all construction activities that are likely to generate sediment laden water including:</p> <ul style="list-style-type: none"> ▪ Tree-felling; ▪ Borrow pit construction and use and ▪ Earthworks associated with the construction of tracks, turbine foundations, watercourse crossings and compounds. <p>Routine working and emergency procedures for the control of sediment and dust will incorporate the advice within the SEPA's PPG Notes, the CIRIA guidance and the DEFRA Guidelines for Handling Soils (MAFF, 2000). Standard practice measures (Appendix 10.4 Volume IV) including development and implementation of a sediment and drainage management plan (SDMP) and a CEMP (outline included in Appendix 10.7 Volume IV) will help to ensure that the water environment is protected from sediment laden runoff.</p> <p>In addition to these standard practice measures, specific sediment and drainage control measures to be applied in key construction areas / activities (described in Appendix 10.8 Volume IV). The philosophy for sediment and drainage control will be to separate and treat sediment laden water to prevent contaminated runoff from entering down gradient surface watercourses.</p> <p>In particular:</p> <ul style="list-style-type: none"> ▪ There will be a permit to pump and a permit to dig system put into operation; ▪ There will be no direct discharges of water from works areas to existing drainage channels or surface watercourses within or downstream of the application site; ▪ Drainage from larger works areas such as the construction of turbine foundations, borrow pits and construction compounds will be directed to settlement lagoons; ▪ Drainage from other areas will be discharged to infiltration trenches, settlement swales or to ground for filtration through vegetation; ▪ Detailed drainage design will ensure that overland flows paths are routed around compounds and buildings. Further details on the control of runoff in these areas will be included in the CEMP (Appendix 10.7 Volume IV); and ▪ During excavation and storage of any excavated material, measures set out in the PMP (Outline PMP included as Appendix 10.5 Volume IV) will be adhered to. <p>To enable potential surface water pathways to downstream</p>

Topic Area	Proposed Mitigation
	<p>watercourses to be identified, a survey of major drainage channels and unmapped watercourses will be undertaken for all areas within 250 m of any proposed infrastructure, prior to construction commencing. It will be particularly important for drainage channels / watercourses which are hydraulically connected to mapped watercourses within the main sub-catchments within the application site to be identified. This will enable measures to be implemented around identified at risk areas.</p> <p>The effectiveness of sediment and drainage control measures will be monitored through water quality monitoring of watercourses at key locations downstream of activities identified as likely to generate sediment laden runoff. The monitoring will allow the identification of any pollution incidences to occur, which will highlight whether any additional mitigation measures are required at certain locations.</p> <p><i>Measures to prevent pollution from concrete</i></p> <p>The concrete will most likely be batched onsite within one of the construction compounds. It is not known at this stage which construction compound the concrete will be batched within; however, all construction compounds are at least 50 m from the nearest watercourse. The Southern Construction Compound is the closest compound to a watercourse; it is 80 m north east of an unnamed tributary to the Water of Deugh. Concrete batching will occur on an impermeable surface within the construction compound. Any drainage or water used for washing associated with concrete batching will be collected and directed to a sump for treatment prior to discharge. Any discharge will be in accordance with SEPA discharge licensing conditions.</p> <p>Temporary bunds will be placed downslope of pouring operations to contain spillages and an Incident and Emergency Response Plan (detailed in the CEMP) will be developed for use by contractors and implemented in the event of a concrete spill.</p> <p>Prior to pouring of concrete foundations, the degree of weathering or fracturing of bedrock will be assessed. It may be necessary to form a barrier within the excavation to ensure liquid concrete does not come into contact with underlying groundwater. Either a geotextile liner or a sand layer would restrict the flow of concrete into the surrounding groundwater.</p> <p><i>Measures to prevent pollution from fuels, oils and other chemical substances</i></p> <p>To reduce the likelihood of spills or leakages of oils, fuels or other potentially polluting substances that could cause significant impacts to down gradient watercourses and / or groundwater the following measures will be undertaken:</p> <ul style="list-style-type: none"> ▪ Oil, fuel and other substances will be stored in a storage area within the construction compounds or other designated areas

Topic Area	Proposed Mitigation
	<p>away from the main operational areas over 50 m from OS mapped watercourses. Potentially polluting substances will be stored within impervious storage bunds with 110% capacity, to ensure complete spill / leak retention. Further temporary bunds will be placed around the borrow pit areas to contain any spillages or contaminated surface water runoff.</p> <ul style="list-style-type: none"> ▪ Construction machinery will be routinely checked to ensure they are in good working order. Any maintenance required would occur over hardstanding areas within the construction compound or on an alternative designated impermeable ground cover. ▪ Refuelling of machinery will be limited to a designated area which would also have an impermeable ground cover. ▪ Drip trays will be mandatory beneath all stationary construction vehicles and spill kits comprising absorbent mats or absorbent sands will be available on-site at all times. All relevant staff will be trained in their appropriate use. Any spills will be cleaned up as soon as possible with any contaminated sands bagged up and disposed of correctly. ▪ An Incident and Emergency Response Plan will be developed for use by contractors as part of the CEMP. <p>It will be particularly important to implement these measures effectively around construction activities where there is a direct pathway to groundwater and / or surface water and associated receptors, such as borrow pits or wind turbine excavations.</p> <p><i>Measures to reduce the likelihood of peat slide risk and impact to downstream surface water quality</i></p> <p>To reduce the likelihood of a peat slide occurring, the following measures will be implemented (as outlined in the Peatslide Hazard and Risk Assessment Interpretive Report (Appendix 10.1b Volume IV)):</p> <ul style="list-style-type: none"> ▪ Micrositing of turbine T6, approximately 50 m to the north west; ▪ Should turbine T6 remain in its current position, further detailed qualitative slope stability risk assessment prior to construction and further ground investigation may be necessary to determine the risk of instability affecting it. Adherence to strict engineering controls will be followed before construction is permitted to proceed. ▪ Where possible, the access track will be microsited to areas of lower risk. Any proposed track routes remaining within moderate risk zones may require further geotechnical assessment and adherence to strict engineering controls during construction.

Topic Area	Proposed Mitigation
	<ul style="list-style-type: none"> ▪ As far as possible, tracks will follow routes parallel to slopes and avoid steep sidelong ground. Track routes will be approved by a geotechnical engineer before construction commences. ▪ Special drainage measures along the track route may be necessary during construction as advised by the geotechnical engineer. <p>It is recommended that additional peat depth probing is carried out along the proposed access track routes within the turbine envelope once track design details have been finalised. This will enable peat depths and peat slide risk to be re-evaluated in key sections.</p> <p><i>Measures to reduce flood risk and impact to fluvial geomorphology</i></p> <p>All culverts will be designed and constructed in accordance with SEPA and CIRIA good practice guidance and the designs agreed with SEPA prior to construction. This will include:</p> <ul style="list-style-type: none"> ▪ The conveyance of a 0.5% AEP flow (1 in 200 year flood event) through / under crossings, and including of an allowance for climate change on future rainfall intensities; ▪ Considerations of overland flow routing so that in the event of a blockage, flow is able to be directed back into the watercourse downstream of any obstruction; and ▪ Culverts will be embedded so that the base is at grade with the streambed or lower to maintain bed form processes and minimise disruption to wildlife migration. <p>The constriction of channels particularly around watercourse crossings will be minimised by regular inspections of crossings for blockages. If any blockages are identified, remedial actions will be undertaken to reinstate the full capacity of the crossing.</p> <p><i>Measures to protect groundwater regime and dependent habitats</i></p> <p>If dewatering of foundations is required, to limit the disruption to surrounding groundwater from dewatering, treated water will be discharged through an area of vegetated ground designated for drainage, in the immediate vicinity of the turbine in order to maintain local groundwater levels. Excavations will remain open for the shortest time practical to limit the effect of any dewatering.</p> <p>To mitigate any potential reduction to groundwater recharge resulting from track construction, the tracks will comprise a semi-permeable surface to allow some infiltration. Trackside drainage will comprise either buffer strips or infiltration trenches which will be unlined to allow the standing water to infiltrate back into the ground.</p> <p>While no significant impacts to M23 and M6 habitats (which have been identified as possible GWDTE) are expected, mitigation measures have been developed to reduce any potential impacts. Specific mitigation is proposed to reduce the potential minor to negligible impact to M6 identified in the eight down gradient areas at</p>

Topic Area	Proposed Mitigation
	<p>risk. Figure 2 in Appendix 10.2 Volume IV identifies where mitigation could usefully be applied to ensure maintenance habitats potentially at risk of impacts. These will comprise:</p> <ul style="list-style-type: none"> ▪ Cross track drains where the access track intersects the habitat; and ▪ Cut off drains and subsequent re wetting upgradient of M6 at risk from dewatering to maintain hydraulic continuity to down gradient areas. <p>Drainage will be passed through settlement tanks, systems such as silt busters or settlement lagoons as appropriate to maintain water quality and then discharged appropriately down gradient to allowing water to infiltrate back into the ground, thereby maintaining the overall volume of groundwater.</p> <p>To reduce the likelihood of any indirect loss of habitats located down gradient of turbines, the period of dewatering, particularly at Turbine T5 and the adjacent crane hardstanding will be minimised during construction. This will reduce impacts to downgradient M6 habitats. Dewatering will also be designed to comply with the Water Environment (Controlled Activities) (Scotland) Regulations 2013.</p> <p><i>Measures to prevent the disturbance and degradation of peat and soils</i></p> <p>For the construction phase, a final PMP will be prepared prior to any site activity, which will outline the management practices around the excavation and storage of soils, this document will be included within the CEMP, to ensure soil disturbance is minimised. A draft PMP is included in Appendix 10.5 Volume IV. As discussed in Section 10.6, the majority of excavated peat will be re-used across the site in the reinstatement of infrastructure. There is an estimated surplus of approximately 10% of the volume of peat excavated. It is recognised that many assumptions have been made in the peat excavation and re-use calculations, and that micro-siting and detailed design may lead to differences in peat excavation and re-use calculations such that this surplus volume can be removed.</p> <p>The PMP outlines measures that will be followed when handling and temporarily storing excavated peat. Effective implementation of these measures will seek to reduce the volume of material to be excavated, minimise carbon losses and ensure that excavated material is kept as intact as possible for re-use. This will improve the use and restoration of peat within the site. Where possible, excavated peat will be re-used as close to the area of excavation as possible. Excavated peat will be stored in low height stockpiles with low slope angles to minimise carbon losses and reduce the risk of peat slide during storage. The peat will also be kept moist by dampening and/or water spraying to prevent drying out and erosion. Further detail is included in the Outline PMP.</p>

Topic Area	Proposed Mitigation
	<p><i>Operation</i></p> <p><u>Sediment and drainage control</u></p> <p>Surface water will be managed during the operational phase in a similar manner as during construction. Tracks have been designed to effectively manage runoff to reduce the potential for impacts to downstream surface watercourses and associated receptors from the generation of turbid runoff caused by vehicular movement during operation. Drainage will be shed to trackside drains and there will be no direct discharges from areas of tracks to surface watercourses or drainage channels. Tracks will be regularly inspected and maintained throughout the lifetime of the development. Sediment and drainage control will be managed in a similar way as during construction, further details are available in the CEMP (Appendix 10.7 Volume IV).</p> <p><i>Measures to prevent pollution from fuels, oils and other chemical substances</i></p> <p>The control building and substation compound will be designed in accordance with good practice, such that there is no potential for leaks or pollution incidences from the building. The building will also be subject to routine checks and maintenance.</p> <p>The small quantity of sewage arising from the infrequent visits of maintenance staff will be removed periodically by a licensed contractor to be discharged off site. A rainwater collection system would be installed to provide water for flushing which, if necessary, would be topped up with water brought to site in containers.</p> <p>Excess rainwater falling on the roof of the building will be discharged to an infiltration drain or other Sustainable Urban Drainage System (SUDS) based system around the substation. The building will not be of a size to intercept significant quantities of water and no impact is expected to groundwater/surface water at the site.</p> <p>The turbines will be designed with fluid catch basins and containment systems to prevent accidental releases from leaving the nacelle. Any accidental gear oil or other fluid leaks from the wind turbines would be contained inside the towers as they are sealed around the base, with the entrance situated above ground level. Any spillage or leaks would be cleaned up once detected.</p> <p>The wind farm will be operated in accordance with good working practices and measures to protect the water environment in accordance with those set out within SEPA's Pollution Prevention Guidance notes. All vehicles visiting the application site will be equipped with sand trays to place below any oil or fuel filling activities and will be equipped with emergency oil spillage kits.</p>

Topic Area	Proposed Mitigation
	<p><i>Measures to reduce flood risk and impact to fluvial geomorphology</i></p> <p>Flood risk and geomorphology will be managed during the operational phase in a similar manner as during construction. Culverts have been designed to convey a 0.5% AEP (annual exceedance probability) flow with the inclusion of a climate change allowance on future rainfall intensities. These culverts will be regularly inspected to check for any blockages, and any observed blockages removed. In addition the substation will be designed to prevent any damage to sensitive equipment from surface water flooding.</p> <p><i>Decommissioning</i></p> <p>Some small scale excavations may be required as part of the decommissioning phase. The same control measures identified for the construction phase will be implemented as necessary, in accordance with good practice at that time.</p>
<p>Archaeology and Cultural Heritage</p>	<p><i>Construction</i></p> <p>There will be an impact of negligible significance on a small modern shepherd / walker’s cairn (A5). It is not proposed to mitigate this impact.</p> <p>Impact significance cannot be meaningfully assessed for unknown assets, as neither the sensitivity of the receptor nor the magnitude of the effect is known. Consequently, only the likelihood of construction impact is considered here.</p> <p>Above 400m AOD the potential for previously unrecorded assets to lie within the construction footprint and vulnerable to being affected by ground works is considered to be negligible. It is therefore considered that no mitigation is required within this area.</p> <p>Below 400m AOD in the area of improved grazing and farmland it is considered that there is low to moderate potential for previously unrecorded cultural heritage assets to survive. Construction works in this area involves the construction of the access track: approximately 600m of this track will be a new construction, while 660m will involve improving the existing farm and forestry track. Any construction impacts upon previously unrecorded cultural heritage assets will be mitigated through a programme of archaeological works, to be agreed with the WoSAS as archaeological advisors to East Ayrshire Council. This programme will allow for features to be recorded appropriately and is likely to comprise a watching brief on ground-breaking works with further work being undertaken as appropriate.</p> <p>Below 400m AOD in the area of plantation forestry it is considered that there is low potential for previously unrecorded cultural heritage assets. This area was not subject to a walkover survey in advance of this assessment as the nature of plantation forestry restricts</p>

Topic Area	Proposed Mitigation
	<p>visibility and the potential to carry out a successful survey. It is therefore proposed that a walkover survey of the construction footprint is carried out post-felling, yet prior to construction, to further inform the archaeological record. Any potential construction impacts identified through this survey will be taken into account and will be mitigated through a programme of archaeological works, to be agreed with the WoSAS. This programme will allow for features to be recorded appropriately and is likely to comprise a watching brief on ground-breaking works with further work being undertaken as appropriate.</p> <p><i>Operation</i></p> <p>There will be no operational impacts of greater than negligible significance. No mitigation is therefore proposed.</p> <p><i>Decommissioning</i></p> <p>There will be no residual impacts on cultural heritage assets as a result of decommissioning.</p>
<p>Noise</p>	<p><i>Construction</i></p> <p>The assessment has predicted that there will not be significant construction noise impacts at residential properties, and it will not therefore be necessary to develop specific mitigation measures. However, the best practicable methods for managing noise impacts on receptors will be adopted and in this respect guidance is given in BS 5228: 2009 as follows:</p> <ul style="list-style-type: none"> ▪ For any particular task, the quietest plant and/or machinery will be used where practicable. Where appropriate, plant/machinery must be constructed to meet the requirements of EC directives (e.g. Directive 2001/14/EC on noise emission in the environment by equipment use outdoors); ▪ All equipment will be maintained in good working order and fitted with the appropriate silencers, mufflers or acoustic covers where applicable; ▪ Stationary noise sources will be sited as far away as possible from noise sensitive residential properties and will be compliant with BS 5228:2009; ▪ The movement of vehicles to and from the application site will be controlled and employees will be supervised to ensure compliance with the noise control measures adopted. <p>The proposed hours of construction will be limited to those detailed in Chapter 4: Project Description.</p>

Topic Area	Proposed Mitigation
	<p><i>Operation</i></p> <p>As it has been demonstrated that the ETSU-R-97 limits can be met during the operation of the proposed development in an unrestricted mode during both day and night periods, there is no requirement to consider mitigation.</p>
<p>Traffic and Transport</p>	<p>Temporary effects relating to an increase in general construction traffic will be minimised through the implementation of an appropriate locally focused Construction Traffic Management Plan (CTMP), which will seek to promote the safe and efficient transportation of components and materials to the development in order to minimise congestion and disruption. The CTMP will be prepared prior to construction which will apply to all public road sections, enhanced with locally specific measures as appropriate. The CTMP will include but not be limited to:</p> <ul style="list-style-type: none"> ▪ a statement of which public roads are not to be used by construction traffic; ▪ a statement of which local settlements and community receptors are to be avoided and at which times; ▪ a statement of local event days, during which, construction deliveries will not be carried out; ▪ a commitment to monitor and ensure that damage to walkways, driveways, accesses, bridges, walls, verges and private property does not occur; ▪ a commitment to providing temporary signage at notified locations (e.g. to warn of turning construction traffic at the Development access); ▪ arrangements for on-going liaison with stakeholders including the local community (e.g. proposed communication strategy covering emergency services, the local authority and the local community). <p>Whilst significant effects on road infrastructure are not predicted, pre-construction, and post-construction road surveys will also be undertaken and any material change in infrastructure condition recorded. PWEL will ensure that any road sections, where there has been deterioration in road condition agreed as attributable to the development construction, will be restored to the standard as recorded in pre-construction surveys.</p> <p>With regards to abnormal loads, the following mitigation measures are proposed:</p> <ul style="list-style-type: none"> ▪ improvements to identified roads and / or junctions on the proposed TDV access route as detailed within the ALRA, see Appendix 13.1 Volume IV; ▪ all TDV movements will be programmed to take place outside of

Topic Area	Proposed Mitigation
	<p>peak flow hours, where practicable, in order to minimise disruption to general traffic flows on the network;</p> <ul style="list-style-type: none"> ▪ a haulier escort or police escort will accompany all TDVs; ▪ it will be necessary to stop traffic travelling in the opposite direction in order to allow abnormal load vehicles to negotiate specific pinch points on the route, as detailed within the ALRA Appendix 13.1 Volume IV; ▪ appropriate warning signs will be used to warn other road users of the presence of TDVs; and ▪ discussions with Transport Scotland and EAC will be necessary in order to determine traffic management measures for the TDV movements. ▪ continuous monitoring during construction is not necessary. <p>It is proposed that the CTMP will ensure that frequent inspections are carried out to ensure that agreed mitigation measures, as outlined above, are being undertaken.</p> <p><i>Operation</i></p> <p>Suitable signage will be erected advising of the appropriate access to the proposed development.</p> <p><i>Decommissioning</i></p> <p>The existing baseline data is unlikely to be relevant during decommissioning, therefore, it is considered more effective to consider any mitigation measures closer to the time of decommissioning to ensure traffic impacts are minimised.</p>
<p>Socio-economics</p>	<p><i>Construction</i></p> <p>The mitigation required for the construction phase with respect to the right to access to the application site has been developed to protect the health and safety of recreational users. Health and safety is of paramount importance to PWEL and whilst it will allow public access as far as possible to the application site, during construction, access will need to be closely controlled in areas of construction activity.</p> <p>The borrow pits, construction compounds, control building and substation compound and turbine foundations when being actively worked will be fenced, as will any open excavations where required. Likewise when turbines are being erected access to these areas will be restricted and controlled. All plant, equipment and welfare units will be shuttered up, locked and parked within the construction compounds when not in use.</p> <p>Where access requires to be restricted at any time, clear signage /information boards following the Scottish Outdoor Access Code (SNH, undated) branding guidelines (as requested by SNH) will be used, for example at entry points to the application site to inform</p>

Topic Area	Proposed Mitigation
	<p>visitors of the construction activities so that active construction areas can be avoided. Signage will show the location of the construction activities and the access tracks and will be agreed with East Ayrshire Council. An Outdoor Access Management Plan will be produced and agreed with EAC.</p> <p>All construction staff will be required to undertake an induction to alert them to the potential for recreational users and to the environmental, health and safety measures that need to be taken. All delivery drivers and plant operators will be briefed during tool box talks (i.e. an onsite presentation to the workforce) as to the crossing (and also initial temporary use and redirection) of the PRow that is onsite. The approaches along the PRow to the stretch within the application site will be signed to warn users of the approaching hazard.</p> <p>All operatives and delivery drivers will be informed to advise site management of any deterioration of crossing point safety. All drivers will be requested to keep within an onsite speed limit of 15 mph and to reduce this speed further when passing recreational users.</p> <p>A Health and Safety risk assessment will be undertaken. If this identifies that additional mitigation is required to ensure the safety of the public, then further measures will be considered, which may include the use of banksmen, for example when plant is operating during the construction of new tracks or site access. The role of the banksmen would be to ensure that anyone exercising their right to access or to use the right of way is able to do so in safety away from any active or dangerous works.</p> <p>Proposed mitigation measures to address adverse impacts during the construction phase also include the continued engagement with the community to listen to, and respond to, their concerns as the proposed development progresses. An ongoing communication strategy will be implemented to ensure that the local community and interested stakeholders are engaged with respect to any issues of concern and provided information regarding the proposed mitigation. The construction programme and details will also be communicated to the local community in order to reduce any inconvenience or disturbance.</p> <p><i>Operation</i></p> <p>The proposal, if consented, will contribute the agreed sum of money per MW (retail price index linked) of installed capacity to an annual community trust fund, in accordance with EAC's community benefits policy which is currently being updated.</p> <p>Engagement with the local community will also continue to keep the public and stakeholders informed as to activities relating to the operational phase. Opportunities for mitigation/enhancement to the PRow will be considered through consultation with the Coalfield</p>

Topic Area	Proposed Mitigation
	<p>Environment Initiative and the New Cumnock Access Network.</p> <p><i>Decommissioning</i></p> <p>Consultations with local residents and stakeholders will be undertaken prior to the decommissioning phase beginning in order to inform them of the proposed schedule and activities to be undertaken during this phase. This will provide information on the expected impacts of this phase, and allow consultees to feedback their concerns and queries. Health and safety will again be of paramount importance and a range of measures will be employed in a similar manner to those described above for the construction phase and in accordance with a risk assessment which will be prepared prior to the start of this phase.</p>
<p>Telecommunications, Aviation and Air Defence</p>	<p>Prior to the commencement of construction, details of the turbine locations and heights and the construction start date would be provided to the MoD to enable the application site to be marked on aeronautical charts.</p> <p>Prior to the construction of the proposed development, mitigation measures to maintain the performance of the Glasgow Prestwick International Airport primary surveillance radar will be implemented. PWEL is in discussion with Prestwick Airport on the nature of the mitigation. Prestwick Airport is currently considering a blanking and in-fill solution using one of two candidate technologies for the in-fill radar. The selected radar mitigation scheme will be secured by a suspensive planning condition.</p> <p>Prior to the construction of the proposed development, mitigation measures to maintain the performance of the BT microwave link from Windy Standard Windfarm to Mauchline will also be implemented. PWEL is in discussion with BT and the owners of the Windy Standard Windfarm on the nature of the mitigation.</p> <p>To improve visibility of the turbines to military pilots flying at low level at night, MoD-approved infra-red lighting would be fitted to the turbines.</p>
<p>Climate Change</p>	<p>Although the results from the climate change assessment show that the impact of the proposed development on climate change mitigation is positive after an estimated 2.1 years of operation, there are ways to reduce this payback period further.</p> <p><i>Design Phase</i></p> <p>The project has been designed to avoid, where practicable, identified environmental constraints, including areas of deeper peat, particularly sensitive habitats, locations occupied by protected species, watercourses and cultural heritage features. Where avoidance has not been possible, mitigation measures have been</p>

Topic Area	Proposed Mitigation
	<p>proposed to prevent significant effects. More details about the design principles can be found in Chapter 2: Site Selection, Design and Alternatives and Chapter 4: Project Description.</p> <p><i>Construction</i></p> <p>The following activities will contribute to lower greenhouse gas emissions during the construction phase:</p> <ul style="list-style-type: none"> ▪ Implement a Site Waste Management Plan (SWMP) (Outline SWMP provided in Appendix 15.1 Volume IV) to reduce materials wastage; ▪ Implement a vehicle idling policy to ensure that, where practicable plant and equipment are turned off when not in use as part of the CEMP; ▪ Implement a Peat Management Plan (see Appendix 10.5 Volume IV) to minimise disturbance to peat where possible and to manage the extracted peat to maximise possibility of restoration in or ex situ; and ▪ Maximise restoration of extracted peat on site, maintaining the acrotelm layer in its proper position.

Glossary

Term	Meaning
AADT	Average Annual Daily Traffic
Access Track	A road/track required to support and accommodate vehicles to allow for construction of turbines and associated infrastructure as well as maintenance during the operational lifespan
AEP	Annual Exceedence Probability
Aerodynamic Noise	Noise generated by the turbine blades passing through the air
AGLV	Areas of Great Landscape Value
AGL	Above Ground Level
AJSP	Ayrshire Joint Structure Plan
ALRA	Abnormal Local Route Assessment
AM	Amplitude Modulation
Anemometer	The anemometer and the wind vane are used to measure the speed and the direction of the wind.
AOD	Above Ordnance Datum
Application site	The location where the proposed development will be built defined by the application boundary.
Aquifer	A body of permeable rock that can contain or transmit groundwater.
ARG UK	Amphibian and Reptile Groups of the UK
Assessment	An umbrella term for description, analysis and evaluation.
ATC	Air Traffic Control
ATC	Automatic Traffic Counter
ATCSMA	Air Traffic Control Surveillance Minimum Altitude
Attenuation	The reduction in level of a sound between the source and a receiver due to any combination of effects including: distance, atmospheric absorption, or screening by topography, vegetation or buildings.
Audible Frequency	Any frequency of a sound wave that lies within the frequency limits of audibility of a healthy human ear, generally accepted as being from 20 Hz to 20,000 Hz
ASFB	Association of Salmon Fisheries Boards
Avoidance	Making changes to the project's design (or potential location) to avoid adverse effects on an environmental feature. This is considered to be the most acceptable form of mitigation.
A-weighting	This is a measure of the overall level of sound across the audible spectrum with a frequency weighting (i.e. 'A' weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.
BAP	Biodiversity Action Plan
Baseline Studies	Desk based and survey work carried out to determine and describe the existing environmental conditions against which any future changes can be measured or predicted and assessed.
BBC	British Broadcasting Corporation
BC	Before Christ
BCT	Bat Conservation Trust
Bedrock	Solid rock underlying loose deposits such as soil

Term	Meaning
BERR	Department of Business Enterprise and Regulatory Reform, in existence between 2007 and 2009.
BGS	British Geological Survey
Biodiversity	The variety of life, within a habitat or ecosystem.
BSI	British Standards Institution
BT	British Telecoms
BTO	British Trust for Ornithology
Buffer Zone	An area of land designated around a feature for environmental protection
Bund	An embankment
BWEA	British Wind Energy Association renamed 'RenewableUK' in 2012.
CAA	Civil Aviation Authority
Camber	A slightly convex or arched shape of a road or other horizontal surface.
CAP	Civil Aviation Publication
CAR	The Water Environment (Controlled Activities) (Scotland) Regulations, 2011
CCDP	The Climate Change Delivery Plan 2009
Catchment	The area contributing flow to a point on a drainage system.
CEI	Coalfield Environment Initiative
CEMP	Construction Environmental Management Plan
CIRIA	Construction Industry Research and Information Association
CLG	Department for Communities and Local Government
Climate Change	A significant and lasting change in the statistical distribution of weather patterns over periods ranging from decades to millions of years
CMS	Construction Method Statement
CO ₂	Carbon dioxide
CO ₂ e	Carbon dioxide emissions
Collision Risk	The risk of injury or death to a bird through being hit by rotating blades of the turbine.
Compensation	The act of counteracting the effects or losses caused by a new development.
Consultee	A person who is formally consulted or asked for advice on a matter
Corridor	A strip of land which connects and aids the movement of species between areas of natural habitat thus increasing the overall area available to species.
Crane Hardstandings	An area at the base of the turbine which provides a safe and stable location for cranes to erect and work on wind turbines.
CTMP	Construction Traffic Management Plan
Culvert	A tunnel carrying a stream or open drain under a road or track
Cumulative Effect	The combined effect of more than one project/wind farm.
dB	Decibel
dB(A)	A-weighted decibel
DBERR	Department for Business, Enterprise and Regulatory Reform
DECC	Department of Energy and Climate Change
DEFRA	Department for Environment, Food and Rural Affairs

Term	Meaning
Decibel	The scale on which sound pressure level is expressed. In air it is defined as 20 times the logarithm of the ratio between the root-mean-square pressure of the sound field and a reference pressure (2x10 ⁻⁵ Pa).
Decommission	To dismantle, remove or withdraw from active service
Designated Sites	Sites that are designated for their nature conservation or landscape value
DfT	Department for Transport
DIO	Defence Infrastructure Organisation
Direct Effects	An immediate result of the development
DSFB	District Salmon Fishery Board
Dti	Department of Trade and Industry
DTM	Digital Terrain Model
EAC	East Ayrshire Council
EALDP	East Ayrshire Local Development Plan
EALP	East Ayrshire Local Plan 2010
EALWCS	East Ayrshire Landscape Wind Capacity Study
EC	European Commission
ECDU	Energy Consents and Deployment Unit, Scottish Government
Echolocation	The location of objects by reflected sound used by animals such as bats
Ecology	The study of the relationship of organisms with one another and with their physical surrounding
ECoW	Ecological Clerk of Works
Effect	The result of change or changes in specific environmental resources or receptors.
EGPS	Electricity Generation Policy Statement 2013
EHO	Environmental Health Officer
EIA	Environmental Impact Assessment
EMI	Electromagnetic Interference
EMP	Environmental Management Plan
Enhancement	To improve an area to provide a habitat of higher quality than is currently the case
Environmental Impact Assessment	The systematic process to identify, predict and evaluate the environmental effects of proposed projects, including mitigation and management of those identified impacts.
Environmental Statement	Document in which the results of an EIA are presented to decision-makers and the public.
EPS	European Protected Species
EQS	Environment Quality Standard
ES	Environmental Statement
ETSU	Energy Technology Support Unit
EU	European Union
Fauna	The animals of a particular region, habitat, or geological period
FCS	Favourable Conservation Status
FCS	Forestry Commission (Scotland)
FEH	Flood Estimation Handbook

Term	Meaning
Field Survey	Collection and gathering of information at the local level
Flora	The plants of a particular region, habitat, or geological period
Fossil fuel	Fuel which is derived from the remains of living organisms and formed in the geological past e.g. coal, oil and natural gas.
FTE	Full Time Equivalent
Geology	The science that deals with the earth's physical structure and substance, its history, and the processes that act on it
GCN	Great crested newt
GDL	Gardens and Designed Landscapes
GHG	Greenhouse gas
GIS	Geographic Information System
GLVIA3	Guidelines for Landscape and Visual Impact Assessment (Third Edition, 2013)
GPA	Glasgow Prestwick Airport
GPG	Institute of Acoustics (IoA) document 'A Good Practice Guide to the application of ETSU-R-97 for Wind Turbine Noise Assessment' 20th May 2013
GPS	Global Positioning System
Greenhouse Gas Emissions	The release of the six main gases that contribute to climate change, into the atmosphere. These are carbon dioxide, methane, nitrous oxide, hydroflourocarbons, perflourocarbons and hexafluoride
Grid Connection	Electricity cable or point at which an electricity generator connects to the national electricity grid or local electricity distribution network.
Ground effect (Agr)	The modification of sound at a receiver location due to the interaction of the sound wave with the ground along its propagation path from source to receiver.
GW	Gigawatt
GWDTE	Groundwater Dependent Terrestrial Ecosystem
GWh	Gigawatt hours
GWP	Global Warming Potential
ha	Hectare
Habitat	A natural environment considered as home by an organism, animal or plant.
HAP	Habitat Action Plan
HER	Historic Environment Record
HGV	Heavy Goods Vehicle
HMP	Habitat Management Plan
HS	Historic Scotland
Hub	The part of the turbine between the tower and the blades, where the nacelle is located.
Hub height	The distance from the turbine base to the hub of a wind turbine
Hydrogeology	An area of geology which studies the distribution, flow and quality of groundwater in the soil and rocks of the Earth's crust
Hydrology	The branch of science concerned with the properties of the Earth's water, especially its movement in relation to land
Hz	Hertz

Term	Meaning
ID	Identification
IEEM	Institute of Ecology and Environmental Management
IEMA	Institute of Environmental Management and Assessment
IHT	The Institution of Highways and Transportation
ILS	Instrument Landing System
Indirect effects	Not a direct result of the development, but often produced away from it or as a result of a complex pathway, for example a visual effect in respect of effects on setting issues.
Infiltration trenches	A shallow, excavated trench that has been backfilled with stone to create an underground reservoir.
Infrasound	Sound that is lower in frequency than 20Hz
<i>In situ</i>	In its original place
Intervisible	In sight of one another
IoA	Institute of Acoustics
JNCC	Joint Nature Conservation Committee
JRC	Joint Radio Company
Km	Kilometre
kV	Kilovolts
kW	kilowatt
L _{A90}	Acoustic nomenclature indicating that this noise level is exceeded for 90% of the period of interest.
L _{Aeq}	The abbreviation of the A-weighted equivalent continuous sound pressure level, i.e. the notional steady sound level which, over a stated period of time, would contain the same amount of acoustical energy as the A-weighted fluctuating sound measured over that period.
Landform	A natural feature of the earth's surface
Landscape Capacity	The degree to which a particular landscape character type or area is able to accommodate change without unacceptable adverse effects on its character. Capacity is likely to vary according the type and nature of change being proposed.
Landscape Character	A distinct and recognisable pattern of elements that occurs consistently in a particular type of landscape and how this is perceived by people. It reflects particular combinations of geology, landform, soils, vegetation, land use and human settlement. It creates the particular sense of place of different areas of the landscape.
Landscape Designations	Areas protected either by law or through planning policies for reason of their landscape attributes or general amenity e.g. National Parks.
Landscape Elements	A component part of the landscape, such as trees, woodland and ponds.
Landscape Features	Prominent eye-catching elements, e.g. wooded hill tops and church spires.
Landscape Patterns	Spatial distributions of landscape elements combining to form patterns, which may be distinctive, recognisable and describable e.g. hedgerows and stream patterns.
Landscape Quality (or condition)	Based on judgements about the physical state of the landscape, and about its intactness, from visual, functional, and ecological perspectives. It also reflects the state of repair of individual features and elements which make up the character in any one place.
Landscape Receptor	Physical landscape resource, special interest or viewer group that will experience an effect.

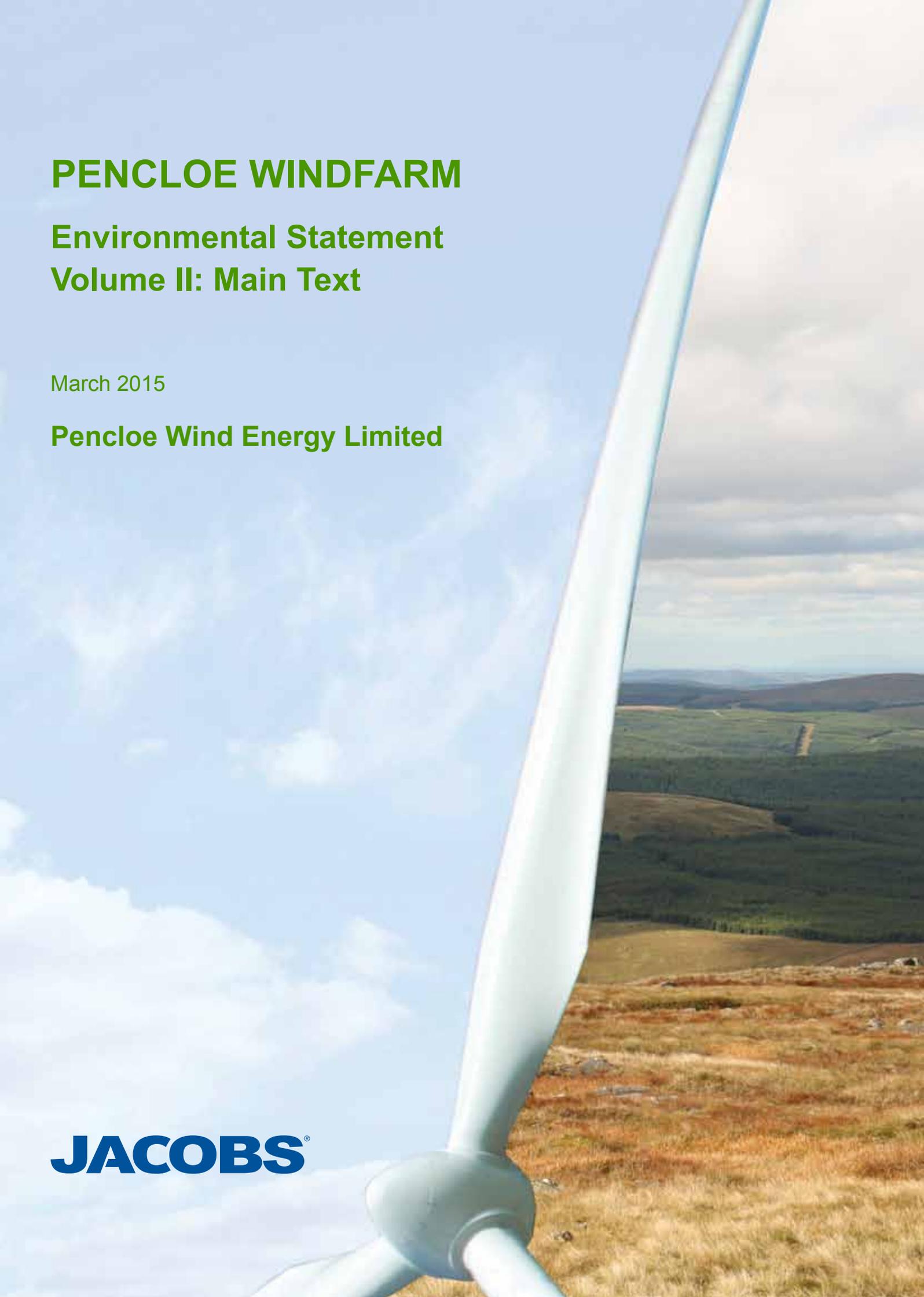
Term	Meaning
Landscape Resource	The combination of elements that contribute to landscape context, character, and value.
Landscape Value	The relative value or importance attached to a landscape or view; (often as a basis for designation) which expresses national or local consensus, because of its quality, including perceptual aspects such as scenic beauty, cultural associations or other conservation issues.
Laydown Area	An area that has been cleared for the temporary storage of equipment and supplies.
LBAP	Local Biodiversity Action Plan
LCA	Landscape Character Assessment
LCT	Landscape Character Type
LGV	Light Goods Vehicle
Listed Buildings	A listed building, in the United Kingdom, is a building that has been placed on the Statutory List of Buildings of Special Architectural or Historic Interest.
LNR	Local Nature Reserve
Low Frequency Noise	Sound in the range around 20-200Hz
LPA	Local Planning Authority
LVIA	Landscape and Visual Impact Assessment
L _{WA}	A-weighted Sound Power Level
m	Metres
MAFF	Ministry of Agriculture, Fisheries and Food
m/s	Metres per Second
Magnitude	A combination of the scale, extent and duration of an effect also defined as 'degree of change'.
Megawatt	A million watts
Micrositing	The siting of an individual wind turbine within a wind farm.
Microwave Links	The technology of transmitting information via radio waves, e.g. linking regional telephone exchanges.
Mins	Minutes
Mitigation	Any process, activity, or design to avoid, reduce, remedy or compensate for adverse environmental impact or effects of a development.
mm	Millimetre
MOD	Ministry of Defence
mph	Miles per hour
MW	Megawatt
Nacelle	The nacelle contains the gearbox, and the electrical generator and is located at the hub. Service personnel may enter the nacelle from the tower of the turbine.
NATS	National Air Traffic Services
NBN	National Biodiversity Network
NCN	National Cycle Network
NDB	Non-Directional Beacon
NDSFB	Nith District Salmon Fisheries Board
NE	Natural England
Negligible	Not significant or important enough to warrant consideration.

Term	Meaning
NERL	NATS En Route Ltd
NGR	National Grid Reference
NHZ	Natural Heritage Zone
NMRS	National Monuments Record of Scotland
NNR	National Nature Reserves
NOABL	The Department of Energy and Climate Change's national wind speed database (NOABL - Numerical Objective Analysis Boundary Layer)
Non-Technical Summary (NTS)	Information for the lay reader to facilitate the understanding of the main environmental impacts of the proposed development without having to cross-refer to the ES.
NPA	Neighbouring Planning Authority
NPF	National Planning Framework
NPPG	National Planning Policy Guideline
NRTF	National Road Traffic Forecast
NSA	National Scenic Area
NTS	Non-Technical Summary
NVC	National Vegetation Classification
NOMIS	Office for National Statistics
Ofcom	Office of Communications
Offset	Something that balances, counteracts, or compensates for something else.
OHMP	Outline Habitat Management Plan
Operational Phase	The time expected/acceptable for a turbine or wind farm to be in service.
ORPA	Other routes with Public Access
OS	Ordnance Survey
PAC	Pre-Application Consultation
PAN	Planning Advice Note
Phase 1 Habitat Survey	This identifies the different habitats that are contained within or make up a site, and the key plant species for each of those habitat types.
Photomontage	An illustration of a computer generated perspective model of the proposed development that has been superimposed or combined onto a photograph from a recorded location.
PSHRA	Peat Slide Hazard and Risk Assessment
PMP	Peat Management Plan
PPG	Pollution Prevention Guidelines
Protected Species	Species which, as a result of their rarity, vulnerability or persecution, are given some form of special protection through wildlife legislation.
Proposed Development	Pencloe Windfarm
PRoW	Public Right of Way
PWEL	Pencloe Wind Energy Limited
PWS	Private Water Supplies
Radar	The use of radio waves to detect the presence of objects in the atmosphere.
RAF	Royal Air Force
Ramsar Sites	Wetlands of international importance designated under the Ramsar Convention.

Term	Meaning
RAP	Renewables Action Plan
RCAHMS	Royal Commission on the Ancient and Historical Monuments of Scotland
RD(K)SFB	River Dee (Kirkcudbright) District Salmon Fishery Board
Reduction	Where avoidance is not possible, adverse effects can be reduced through sensitive environmental treatments/design.
REF	Renewable Energy Fund
Remediation	Where adverse effects are unavoidable management measures can be introduced to limit their influence.
Renewable Energy	A collective term used to describe energy which occurs from reoccurring sources within the environment. This can include energy from the sun, wind, tidal, wave and hydro, biomass, biofuels and geothermal sources.
Residual Effects	Those effects that would remain after the ameliorating effect of mitigation measures has been accounted for.
Rotor	The rotor blades and the hub
Rotor Blades	The rotor blades capture the wind and transfer its power to the rotor hub
RSA	Regional Scenic Area
RSPB	Royal Society for the Protection of Birds
SAC	Special Area of Conservation
SAP	Species Action Plan
SBL	Scottish Biodiversity List
SCADA	Supervisory Control and Data Acquisition
Scoping	Process of identifying the issues to be addressed in the EIA
Scoping Opinion	A response from the planning authority identifying issues which should be included within an Environmental Statement.
Scoping Report	A report prepared as part of the scoping process, giving a description of the proposed project, the potential impacts (environmental and other) and the plan of study for the EIA. The Scoping Report is submitted to the planning authority as part of the request for a Scoping Opinion.
Screening	The initial stage to identify if a proposal requires EIA or not.
SEPA	Scottish Environmental Protection Agency
Shadow Flicker	The pattern of alternating light intensity observed when the rotating blades of a wind turbine cause moving shadows within a receptor under certain wind and light conditions.
SHEP	Scottish Historic Environment Policy
Significant Effects	It is a requirement of the EIA Regulations to determine the likely significant effects of a development on the environment which should relate to the level of an effect and the type of effect. Where possible significant effects should be mitigated. The significance of an effect gives an indication as to the degree of importance (based on the magnitude of the effect and the sensitivity of the receptor) that should be attached to the effect described. Whether or not an effect should be considered significant is not absolute and requires the application of professional judgement.
SLA	Special Landscape Area
SLCA	Sensitive Landscape Character Area
SLM	Sound Level Meter
SM	Scheduled Monument
SNH	Scottish Natural Heritage

Term	Meaning
Socio-economics	The study of the interrelation between economics and social behaviour.
Sound Power Level	Sound power levels are a measure of the acoustic energy emitted by equipment. This is a property of the equipment and is independent of factors such as distance.
SPA	Special Protection Area
SPEN	Scottish Power Energy Networks
SPG	Supplementary Planning Guidance
SPP	Scottish Planning Policy
SSSI	Site of Special Scientific Interest
Stakeholder	A person with an interest or concern in something
SUDS	Sustainable Drainage System
Sustainability	The principle that the environment should be protected in such a condition and to such a degree that ensures new development meets the needs of the present without compromising the ability of future generations to meet their own needs.
SWMP	Site Waste Management Plan
TAN	Technical Advice Note
TDV	Turbine Delivery Vehicle
TMA	Terminal Control Area
SDMP	Sediment and Drainage Management Plan
SWT	Scottish Wildlife Trust
Telecommunications	Communication over a distance by cable, telegraph, telephone or broadcasting.
Temporal	Relating to or limited by time
Temporary or Permanent Effects	Effects may be considered as temporary or permanent, in the case of the Proposed Development the application is for a 25 year period after which the assessment assumes that decommissioning will occur and that the Application Site will be restored.
Topography	The arrangement of the natural and artificial physical features of an area.
Tower	The tower carries the nacelle and the rotor/blades. Generally, it is an advantage to have a high tower, since wind speeds increase with height.
Trunk Road	An important main road used for long-distance travel
TS	Transport Scotland
Turbine	A machine for generating rotary mechanical power from the energy of a moving force (such as water, hot gas, wind, or steam). A wind turbine converts the energy of the wind into electrical energy.
UHF	Ultra High Frequency
UK	United Kingdom
UK BAP	UK Biodiversity Action Plan
UKTAG	UK Technical Advice Group
UKWAS	UK Woodland Assurance Standard
UTC	Co-ordinated Universal Time
Visual amenity	The value of what is seen by visual receptors, taking account of all available views and the total visual experience. The assembly of components, which provide an attractive setting or backdrop for activities, to which value is attached in terms of what is seen.
VP	Vantage Point

Term	Meaning
Water table	The level below which the ground is saturated with water
WFD	Waste Framework Directive
WHO	World Health Organisation
Wirelines	A computer generated line drawing of the digital terrain model and the Proposed Development from a known location
WoSAS	West of Scotland Archaeology Service
WS	Wildlife Site
WTG	Wind Turbine Generator
Zone of Theoretical Visibility	Area or zone of visual influence or theoretical visibility of the Proposed Development within the study area for the visual assessment, generated by a computerised model of the Proposed Development and a digital terrain model of the landscape.
ZTV	Zone of Theoretical Visibility



PENCLOE WINDFARM

Environmental Statement Volume II: Main Text

March 2015

Pencloe Wind Energy Limited

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