



Carron Valley Wind Farm

Scoping Report

September 2011

Carron Valley Wind Farm LLP

Partnerships for Renewables

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1 Introduction

Overview

- 1.1 The Carron Valley Wind Farm LLP is proposing to construct and operate a wind farm at Cairnoch Hill, Carron Valley in Stirlingshire. Carron Valley Wind Farm LLP is the legal entity set up for the sole purpose of developing the Carron Valley Wind Farm. Carron Valley Wind Farm LLP is fully owned by Partnerships for Renewables Ltd (hereafter referred to as 'PfR'), who act as, and will be referred to, as the developer for this project.
- 1.2 The proposed wind farm will comprise turbines, access tracks, and other ancillary components. The precise number and layout of turbines will evolve over time, at this stage in the design evolution it is considered that the wind farm will comprise of up to 16 turbines with a likely rating of around 3 megawatts (MW) each. The proposed wind farm will therefore have a total generating capacity of up to 48 MW. The location of the proposed wind farm is shown in Figure 1.
- 1.3 The proposed wind farm is part of a number of wind energy developments being progressed by PfR which will contribute towards an overall increase in the generation of electricity from renewable energy sources driven by targets set by the Scottish Government, particularly:
- an interim target of a 42% reduction in Scotland's greenhouse gas (GHG) emissions by 2020, rising to an 80% reduction by 2050 (based on 1990 GHG emissions), as defined by the Climate Change (Scotland) Act 2009; and
 - in May 2011, the Scottish Government set a target for the supply of 100% of Scotland's electricity from renewable sources by 2020, recognising the extent of Scotland's renewables resource, with an interim milestone of 31% by 2011.
- 1.4 RPS Planning and Development Ltd (RPS) has been appointed by PfR to undertake the Environmental Impact Assessment (EIA) required for this project under the Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2011 (hereafter referred to as the 'EIA Regulations').

Partnerships for Renewables Ltd

- 1.5 PfR was set up by the Carbon Trust in 2006 to develop, construct and operate renewable energy projects on public sector land.
- 1.6 PfR works in partnership with the public sector bodies throughout the entire development process and covers all development costs. Focused on a development process tailored to the specific needs of the public sector, PfR provides a way for public sector bodies to access the economic and environmental benefits associated with renewables energy and contribute towards the fight against climate change without diverting public resources away from frontline services.
- 1.7 PfR is working with a number of public sector bodies across the UK including the Forestry Commission (as in this case), British Waterways, the Environment Agency, the Ministry of

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Justice, the Coal Authority, Oxford City Council, Caerphilly County Borough Council and the University of Reading.

- 1.8 Further information about PfR and its public sector partners can be found at www.pfr.co.uk.

The Forestry Commission

- 1.9 In October 2009, the Forestry Commission split the national forest estate into six separate regions with the intention of appointing commercial partners to help it investigate and deliver wind energy projects. Pfr was appointed in early 2010 to cover the borders and central belt area and has been working with the Commission over the past year to explore sites at Carron Valley, Camilty plantation, Cloich and Fauldhouse plantation amongst others.

- 1.10 These sites are part of an overall Scottish Government drive to generate clean and renewable energy and reduce the effects of climate change.

EIA Scoping

- 1.11 A planning application for the proposed wind farm will be submitted to Stirling Council under the Town and Country Planning (Scotland) Act 1997 as amended by the Planning etc. (Scotland) Act 2006.

- 1.12 Due to the scale and nature of the proposed wind farm, in line with the requirements of the Environmental Impact Assessment (Scotland) Regulations 2011 (the EIA Regulations), an Environmental Statement (ES) will accompany the application for planning permission, which will be submitted to Stirling Council for determination. An Environmental Statement (ES) is required to accompany the planning application under Schedule 2 of the EIA Regulations.

- 1.13 As part of the initial stages of the EIA process, the EIA Regulations provide an opportunity for those undertaking EIA to request a formal Scoping Opinion from the determining authority (in this case Stirling Council) on the information that it wishes to be presented in the ES. The information required in order to obtain a Scoping Opinion is presented within the form of a Scoping Report.

- 1.14 Pfr is committed to a robust EIA Scoping process in order to maximise the opportunity for statutory and other consultees to contribute to the issues addressed and the assessment methodologies proposed. The purpose of this Scoping Report is therefore to present this information and seek all views and other relevant information to inform the EIA process.

- 1.15 This Scoping Report sets out those aspects of the environment that will be assessed and the proposed approach that will be adopted. The EIA process is iterative and therefore the scope of the EIA may change as the project design evolves, for example as a result of the findings of technical studies or information supplied by consultees.

- 1.16 A number of technical assessments across the range of potential environmental effects and their significance will be undertaken as part of the EIA process and will be presented in the ES. These will include identification of mitigation measures for environmental impacts assessed as potentially significant. Each of the proposed technical assessments is outlined in Sections 4 to 15 of this Scoping Report. Certain initial information gathering to support these technical assessments has commenced, and any pertinent information collected to date is also outlined below.

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- 1.17 The remainder of this Scoping Report is structured as follows:
- Section 2 outlines the proposed wind farm proposal;
 - Section 3 outlines the overall approach to the EIA; and
 - Sections 4 to 15 outline each key technical environmental assessment proposed within the EIA.
- 1.18 RPS, on behalf of Pfr, is now seeking a formal Scoping Opinion from Stirling Council and any other comments from stakeholders on the proposed scope of the Carron Valley Wind Farm EIA.
- 1.19 Anyone wishing to discuss the content of this report in more detail is encouraged to contact the following party prior to responding to the EIA Scoping exercise, or at any time through the application process:

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2 Proposed Carron Valley Wind Farm

Proposed Site

Location

- 2.1 The site of the proposed wind farm is located approximately 10 km north-west of Cumbernauld in Stirlingshire, Central Scotland at a grid reference of NS 6970 8550. The site is located at Cairnoch Hill to the north of the Carron Valley Reservoir, as shown in Figure 1.
- 2.2 The southern boundary of the site is bounded by the B818 and the Carron Valley Reservoir. Carron Valley forest is located to the south of the reservoir.
- 2.3 A number of properties lie along the B818 and further isolated properties are situated within the vicinity of the site.

Land Use

- 2.4 The overall site covers approximately 645 ha. The site boundary is shown in Figure 2.
- 2.5 The elevation of the site varies between 225 m AOD (near the reservoir) and 413 m AOD (Cairnoch Hill peak).
- 2.6 The majority of the site consists of plantation forest. There are open hill areas that have not been afforested and other open areas within the forest awaiting planting post tree removal during harvesting operations.
- 2.7 Cairnoch Hill is drained by forestry drainage systems and by a number of small unnamed watercourses. The southern hill slopes drain towards Carron Valley Reservoir. Towards the north-east small watercourses discharge into the Earl's Burn which confluences with the River Carron downstream of Carron Valley Reservoir. The River Carron discharges into the Firth of Forth near Grangemouth. The north-western hill slopes drain via an unnamed burn to the Endrick Water. The Endrick Water flows west and discharges into Loch Lomond near Balmaha.

Statutory Designations

- 2.8 The site itself is not the subject of any international, national or local designated sites.
- 2.9 There are four Sites of Special Scientific Interest (SSSIs) within 5 km of the site: Endrick Water, Double Craigs, Denny Muir and Carron Glen. Endrick Water SSSI is the closest at approximately 1.4 km to the west of the site boundary and is also classified as Special Area of Conservation (SAC).
- 2.10 There are several historic environment assets of national importance within 10 km of the site. The remains of Sir John de Graham's Castle (Scheduled Ancient Monument) are located within the site boundary of the proposed development site, 500 m east of the northern end of the reservoir.
- 2.11 In terms of landscape related designations, the site is located within the Rugged Moorland Hills and Upper Carron landscape character area, which is a large scale, upland plateau landscape characterised by rugged landform, moorland vegetation, and a lack of modern

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development. There are two Gardens and Designed Landscapes (Gargunnock House and Touch) within 10 km of the site.

2.12 Designated sites in the vicinity of the site are shown in Figure 3 and Figure 4.

Wind Farm Components

2.13 The proposed wind farm consists of up to 16 variable pitch (three bladed) wind turbines, each with a maximum tip height of 126 m. Other components of the wind farm development include:

- crane hard-standing areas adjacent to each wind turbine;
- underground electrical and SCADA¹ cabling – linking each wind turbine with the substation building;
- a substation building;
- site access from the existing B818;
- permanent access tracks onto the site and between turbines;
- borrow pits (if technically feasible);
- one permanent anemometry mast; and
- temporary construction compound for materials storage and welfare facilities.

Wind Farm Layout

2.14 The proposed layout of the site will evolve throughout the EIA and design development process with the aim of avoiding or reducing significant environmental effects as far as reasonably practicable.

2.15 PfR is currently undertaking a detailed process of constraints analysis and wind farm design to minimise the potential impacts of turbines on sensitive areas and features and to maximise the efficiency of the proposed wind farm. This has included considering a number of aspects, in particular:

- initial consideration of potential impacts on noise and residential amenity through applying a buffer of at least 750 m from the nearest residential properties to the nearest turbine;
- applying a buffer of 50 m from watercourses on site;
- undertaking initial peat probing on a grid pattern across the site to identify and avoid areas of deep peat wherever possible;
- undertaking Phase 1 Habitat Survey and National Vegetation Classification (NVC) Survey to map and then avoid sensitive habitats and features;

¹ Wind Turbine 'System Control and Data Acquisition'.

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- consulting with communications links operators to identify links across the site and then applying the requested buffers to avoid interfering with communications links;
 - consulting with key aviation organisations and identifying radar visibility in order to avoid potential radar constraints;
 - initial consideration of potential impacts from shadow flicker; and
 - initial consideration of potential landscape and visual impacts, including the Zone of Theoretical Visibility (ZTV) and the predicted view from selected viewpoints that are likely to be included in the EIA, subject to confirmation with consultees.
- 2.16 The process of developing a layout to take account of these is ongoing, and will be fully detailed in the ES to provide justification for the selected turbine and infrastructure locations.

Grid Connection

- 2.17 The proposed wind farm will require a connection to the electrical transmission network. The connection is likely to be made at the Bonnybridge substation and PfR will investigate grid connection options and present them in the ES. The grid connection will be the subject of a separate application under the Section 37 of the Electricity Act 1989.

Temporary Anemometry Mast

- 2.18 In order to inform the assessments, a separate planning application for a temporary anemometry mast was lodged on 20 July 2011.

3 Environmental Impact Assessment

Introduction

- 3.1 The EIA will be conducted in accordance with the EIA Regulations. A key purpose of the EIA process is to influence and inform the design of the site in order to minimise the potential for significant adverse environmental effects and maximise the contribution of potential beneficial effects. EIA is a process that identifies the potential environmental impacts of development and then seeks to avoid, reduce or offset adverse effects through altering the design or proposing mitigation measures, and maximise the likelihood and overall contribution of beneficial effects. EIA follows a series of stages:
- screening, to determine if an EIA is required;
 - consultation with statutory and non-statutory consultees;
 - establishing baseline conditions of the existing environment;
 - assessment of potential environmental impacts and their likely significance;
 - identification of mitigation measures and assessment of residual effects;
 - preparation of the ES; and
 - submission of an application for permission with the ES.
- 3.2 The following overall advice and guidance documents are used to inform the overall approach to EIA:
- Planning Advice Note (PAN) 58 - Environmental Impact Assessment, October 1998;
 - Scottish Planning Circular; The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2011 (3/2011);
 - Scottish Natural Heritage: Environmental Assessment Handbook: Guidance on the Environmental Impact Assessment Process, 3rd Ed, 2009;
 - Environmental Impact Assessment - A Guide to Procedures, Department of the Environment, Transport and Regions (DETR), 2000;
 - Preparation of Environmental Statements for Planning Projects that require Environmental Assessment - A Good Practice Guide, Department of the Environment (DoE), 1995;
 - Impact Assessment Guidelines and ES Review Criteria from the Institute of Environmental Management and Assessment (IEMA), undated; and
 - Environmental Impact Assessment of Forestry Projects, Forestry Commission (2009).

- 3.3 In addition, a range of topic-specific policy, advice and guidance is used to inform the technical assessments as appropriate.

Site Selection

- 3.4 National planning policy in relation to the siting of renewable energy development is contained in Paragraph 182-195 of Scottish Planning Policy (SPP), February 2010. SPP identifies that a diverse range of renewable energy technologies should be supported by planning authorities. Specifically in relation to wind farms paragraph 187 states that *“planning authorities should support the development of wind farms in locations where the technology can operate efficiently and environmental and cumulative impacts can be satisfactorily addressed”*.
- 3.5 Assessing the feasibility of the site is a critical component of renewable energy development. The ES will present an overview of the design evolution to demonstrate how the final layout has been arrived at in relation to the specific constraints and opportunities of the site as identified through the EIA process.

Preliminary Feasibility Studies and Consultations

- 3.6 The proposed wind farm has been subject to the following feasibility work to determine its suitability for wind farm development:
- wind energy yield analysis carried out using long-term wind data from meteorological stations, the wind flow analysis tool WAsP to indicate predicted average wind speed, direction and turbine array efficiency, the deployment of a Lidar (Light, Detection and Ranging) and CFD-modelling (Computational Fluid Dynamics);
 - feasibility of grid connection options and consultation with Scottish Power Energy Networks (SPEN);
 - planning policy overview to assess the location of the site in relation to the preferred areas in the structure and local plan;
 - preliminary route access study including Swept Path Analysis;
 - preliminary consultation with Ofcom to identify fixed links, and further consultation with the Joint Radio Company (JRC), Orange, Arqiva, Cable and Wireless Worldwide, BT and CSS Spectrum Management Services Ltd;
 - ongoing assessment of potential radar interference and consultation with the Ministry of Defence, Civil Aviation Authority and NATS;;
 - preliminary consultation with the BBC web based tool to identify potential for TV interference;
 - a plan detailing the Zone of Theoretical Visibility (ZTV) to 35 km, presented as Figure 5;
 - preliminary sites of cultural significance desktop studies;
 - ornithological surveys which commenced in 2010;

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- initial site walkover, Extended Phase 1 Habitat Assessment and National Vegetation Classification (NVC) survey; and
 - bat habitat suitability assessment/bat roost risk assessment by experienced ecologists to determine initial constraints and features of note.
- 3.7 A full list of proposed consultees is provided within Appendix 1. In addition, a programme of consultation with the local community and stakeholders is being designed and will be implemented.
- 3.8 Following consideration of the above, PfR considers the site to be potentially suitable for wind farm development, subject to careful design, siting and assessment.

EIA Approach

- 3.9 As far as possible, and dictated by the technical guidance and methodologies of each discipline, the technical assessments will follow a broadly consistent structure.

Baseline Conditions

- 3.10 The existing conditions will be established by means of:
- consultations;
 - desktop review of existing available data; and
 - site visits, site surveys and monitoring exercises.
- 3.11 Constraints will be identified and used to inform the development of the turbine and infrastructure layout.

Assessment of Environmental Effects and their Significance

- 3.12 The EIA Regulations require the identification of likely significant environmental effects arising from a proposed development.
- 3.13 The evaluation and determination of significance of environmental effects is carried out using identified criteria in the form of published standards and guidance where available. The methodologies used are identified in the relevant sections of this report, and will be described in detail in the respective ES chapters.
- 3.14 In general terms, there are a number of potential ways in which the environment may be affected by activities related to the proposed wind farm. For example, during construction effects may arise from:
- presence of people;
 - noise;
 - vegetation, top soil and sub-soil removal;
 - ground and excavation works;
 - construction of turbine foundations and access routes;
 - vehicular traffic;

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- creation of temporary construction compounds and storage areas;
 - routing of services and utilities (e.g. underground electrical lines and drainage);
 - removal of site offices/compounds and final site clear away after construction;
 - watercourse crossings;
 - habitat loss; and
 - habitat fragmentation.
- 3.15 During the operational phase, effects may arise from:
- vehicular traffic;
 - presence of people;
 - noise;
 - vibration;
 - drainage; and
 - wind turbine activity.
- 3.16 During decommissioning, effects are expected to be similar to those experienced during construction.
- 3.17 In general terms, the following factors are used to assess the significance of an environmental effect:
- the sensitivity of the receiving environment, which may be categorised in terms of factors such as rarity, vulnerability or protection by law;
 - the nature of the impact, in terms of its duration, extent, frequency, likelihood, reversibility, and compliance with recognised standards;
 - the magnitude of alteration from the baseline condition, both positive and negative; and
 - the potential for mitigation measures to be implemented.
- 3.18 Planning Advice Note PAN 58: Environmental Impact Assessment states that “...*methods for predicting environmental effects and their magnitude are specific to the environmental topic and are a matter of expert consultations.*” As such the specific methodologies to be employed for each assessment will be agreed with the appropriate consultees and will be described within the appropriate chapter of the ES.

Identification of Mitigation Measures

- 3.19 An assessment of residual effects will be made, taking into account all of the proposed mitigation measures. Mitigation measures will be presented as firm commitments in the ES, in order to enable an appropriate level of certainty in assessing the significance of residual effects. The ES will state explicitly whether predicted residual effects are considered to be significant in terms of the EIA Regulations.

Assessment of Residual Effects

3.20 The ES is likely to comprise 4 volumes:

- Non-Technical Summary;
- Environmental Statement;
- Figures; and
- Technical Appendices.

3.21 Each assessment will consider potential impacts during the construction, operation and decommissioning phase and also the cumulative impacts of the proposal. Each subject area will broadly follow the same structure, covering:

- Introduction;
- Assessment Methodology;
- Baseline Conditions;
- Identification and Evaluation of Key Impacts;
- Mitigation measures;
- Residual Effects;
- Cumulative Impacts and Effects; and
- Conclusions.

Preparation and Structure of the Environmental Statement

3.22 At this stage it is envisaged that the ES will contain the following chapters:

- Introduction;
- EIA Process and Methodology;
- Site Selection and Design Evolution;
- Description of the Proposed Wind Farm;
- Planning and Policy Framework;
- Landscape and Visual Impact Assessment;
- Archaeology and Cultural Heritage;
- Ecology and Nature Conservation;
- Ornithology;
- Forestry;
- Hydrology, Hydrogeology and Geology;
- Noise;
- Access and Transport;
- Socio-economic (including Tourism, Recreation and Land Use);

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- Shadow Flicker;
- Other considerations (aviation, telecommunications, waste management, carbon displacement, ice thrown and safety);
- Summary of Effects; and
- Schedule of Mitigation.

Planning Submission

3.23 The ES will be submitted as part of a suite of supporting documents to accompany the application for planning permission to Stirling Council. Other documents will include, but not be limited to:

- Planning Application Forms, Certificates and Drawings;
- Planning Statement; and
- Pre-Application Consultation (PAC) Report.

4 Planning and Policy

Overview

- 4.1 The proposed wind farm lies within the administrative boundary of Stirling Council. The Planning and Policy Chapter will identify and summarise:
- the European Union, United Kingdom and Scottish Government's climate change and renewable energy targets; and
 - the Development Plan policies and material considerations relevant to the determination of the planning application for the proposed development.
- 4.2 As well as identifying and summarising the key points of the development plan policies and material considerations, this chapter would also consider the weight that can be attached to the policy in the determination of the planning application. However, it is important to emphasise that it is not the purpose of the ES to include an assessment of the proposal against planning policy. This detailed analysis would be undertaken through a separate Planning Statement.

Development Plan

- 4.3 The Development Plan for the site of the proposed wind farm comprises the Clackmannanshire and Stirling Structure Plan (approved 2002) and the Stirling Local Plan (adopted 1999). An Alteration to the Structure Plan was approved by Scottish Ministers in 2004 which provides policy guidance on renewable energy developments.
- 4.4 The proposed wind farm is located within an 'Area of Search' for wind farm development as identified on the Clackmannanshire and Stirling Structure Plan renewable energy supplementary key diagram.
- 4.5 The Clackmannanshire and Stirling Structure Plan relevant to the proposed wind farm are:
- Policy SD1 – Key Principles;
 - Policy ENV1 – Nature Conservation;
 - Policy ENV2 – Protected Landscapes;
 - Policy ENV3 – Development in the Countryside;
 - Policy ENV6 – The Historic and Built Environment;
 - Policy ENV9 – Water Resources Management;
 - Policy ENV14 – Renewable Energy and Energy Efficient Development; and
 - Policy ENV16 – Wind Energy.
- 4.6 The Stirling Local Plan Policies relevant to the proposed wind farm are:
- KEY1 – Environmental Keynote Policy;
 - KEY2 – Environmental Keynote Policy;

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- POLE7 – Development in the Countryside;
- POLE10 – Renewable Energy Developments;
- POLE12 – Renewable Energy Developments;
- POLE15 – Areas of Great Landscape Value;
- POLE42 – Listed Buildings;
- POLE47 – Archaeology;
- POLE48 – Archaeology;
- POLE49 – Archaeology;
- POLE50 – Archaeology;
- POLE54 – Nature Conservation; and
- POLE55 – Nature Conservation.

Material Considerations

- 4.7 Material considerations include Scottish Planning Policy (SPP), the National Planning Framework 2 (NPF2) and advice set out in Planning Advice Notes (PANs). They also include the renewable energy generation targets, policies of emerging development plans and supplementary planning guidance prepared by Stirling Council.

Climate Change and Renewable Energy Regeneration Policy Targets

- 4.8 Recent years have seen the rapid development of strongly pro-renewables policy frameworks at EU, UK and Scottish levels. The main driver for these policy frameworks has been the need to reduce greenhouse gases and dependence on fossil fuels in order to combat climate change, and the requirements to fill the resulting energy gap with low carbon alternatives. A secondary driver within the UK has been energy security, with North Sea oil and gas production steadily in decline and concerns arising about sourcing energy from politically unstable regions.
- 4.9 The Climate Change (Scotland) Act 2009 requires Scotland's greenhouse gas emissions to be at least 80% lower in 2050 compared with 1990 levels. An interim target also requires emissions to be at least 42% lower by 2020 compared with 1990 levels. The Act also requires the Scottish Government to act:
- to reduce greenhouse gas emissions year on year, every year from 2011 to 2050;
 - to increase the rate of reduction from 2020 onwards to at least 3% per year; and
 - to specify more detailed annual targets in 2010, for each year to 2022.
- 4.10 In July 2011 the Scottish Government published its *2020 Routemap for Renewable Energy in Scotland*. The Routemap identifies that the Scottish Government has committed to meeting the EU's 2020 renewable energy target of 20% by setting a new target to source 30% of energy demand from renewables by 2020. For the electricity sector, targets have been set for

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the percentage of electricity demand which should be met from renewable sources by 2020. The current target is for 100% of Scotland's electricity to be generated from renewable sources by 2020, with an interim milestone of 31% by 2011.

- 4.11 European, UK and Scottish targets for the use of energy from renewables are summarised in Table 4.1 below.

By Date	EU Obligation	UK Target	Scottish Target
Energy	20%	15%	30%
Electricity	-	30%	100%

Scottish Planning Policy

- 4.12 SPP was published in February 2010 and is the current statement of Scottish Government policy. SPP outlines Scottish Ministers' commitment to increasing the proportion of electricity generated from renewable sources. It identifies that onshore wind is currently making the most significant contribution and that this is expected to continue.
- 4.13 Paragraph 187 establishes that planning authorities should support the development of wind farms in locations where the technology can operate efficiently and cumulative impacts can be satisfactorily addressed. It provides that development plans should provide a clear indication of the potential for development of all scales, and should set out the criteria that will be considered in deciding applications for all wind farm developments. It states that the criteria will vary depending on the scale of the development and its relationship to the character of the surrounding area, but are likely to include:
- landscape and visual impact;
 - effects on the natural heritage and historic environment;
 - contribution of the development to renewable energy generation targets;
 - effect on the local and national economy, tourism and recreation interests;
 - benefits and disbenefits for communities;
 - aviation and telecommunications;
 - noise and shadow flicker; and
 - cumulative impact.

Scottish Government On-line Renewables Advice

- 4.14 In February 2011, the Scottish Government introduced the first tranche of web based renewables advice which supersedes PAN 45 and Annex 2. The guidance provides that the suggested areas of focus for planning authorities should include:
- providing greater clarity on where groups of wind turbines can be located by ensuring that a spatial framework for wind farms >20 MW has been set out in the development plan and addressing the potential below 20 MW where appropriate;
 - detailing criteria to be applied in assessing wind turbine applications; and

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- ensuring that planning conditions and agreements for wind turbine approvals are reasonable and proportionate.
- 4.15 The guidance provides greater detail on the criteria that should be used by planning authorities in determining wind farm applications. These criteria closely reflect those within SPP and include landscape impacts, impacts on wildlife and habitats, impacts on communities (as a result of shadow flicker, noise, electro-magnetic interference and ice throw), aviation and other defence matters, road traffic impacts and cumulative impacts.

Stirling Landscape Sensitivity and Capacity Study for Wind Energy Development

- 4.16 In order to update the current Clackmannanshire and Stirling Structure Plan policies on renewable energy developments, Stirling Council commissioned a study in July 2007 regarding the visual impact of wind turbines and their effects upon landscape character and quality. The study, which was produced by Horner & MacLennan, was published in November 2007.
- 4.17 In March 2008, Stirling Council endorsed the findings of the study and adopted the study report as a material consideration for the purposes of determining planning applications.

Supplementary Planning Guidance: Interim Locational Policy & Guidance for Renewable Energy Developments (Wind Turbines)

- 4.18 In March 2011 Stirling Council resolved to adopt (with amendments) Supplementary Planning Guidance on Locational Policy & Guidance for Renewable Energy Developments (Wind Turbines). Stirling Council has specified that the policies adopted would be material consideration for the determination of relevant planning proposals, pending inclusion in the new Local Development Plan.
- 4.19 The Supplementary Planning Guidance was produced in order to provide an updated and more detailed locational policy for wind turbines for Development Management purposes than that currently found in the Clackmannanshire and Stirling Structure Plan, and to provide comprehensive development guidance for all scales of turbine development. The locational guidance provided within the Supplementary Planning Guidance is strongly based upon the Stirling Landscape Sensitivity and Capacity Study.
- 4.20 The proposed wind farm is located within an 'Area of Significant Protection' as designated on Policy Map 1 (South). The following policies within the Supplementary Planning Guidance are therefore relevant to the proposals:
- Policy 1(b) Wind Energy: General;
 - Policy 2 Wind Energy: Visual and Landscape Impacts;
 - Policy 3 Wind Energy: Cumulative Impacts; and
 - Policy 6 Wind Energy: Community Benefit.
- 4.21 The Supplementary Planning Guidance also lists locational guidance criteria for all wind turbine proposals.
- 4.22 The Supplementary Planning Guidance also lists locational guidance criteria for all wind turbine proposals.

Stirling Council Local Development Plan

- 4.23 Stirling Council is at present preparing a Local Development Plan under the requirements of the Planning etc (Scotland) Act 2006. The Council published the Main Issues Report (MIR) for consultation in April 2010. The Proposed Plan is timetabled to be published in October 2011 for an eight week consultation period. Following consultation the Proposed Plan will become a material consideration in the determination of this planning application.

5 Landscape and Visual Impacts

Introduction

- 5.1 The proposed wind farm site will involve up to 16 turbines with a maximum blade tip height of 126 m.
- 5.2 The site is located within an area of commercial forestry surrounding most of the Carron Valley Reservoir on the North Lanarkshire, East Dunbartonshire, Stirling and Falkirk council boundary in the Campsie Fells and Kilsyth Hills, approximately 10 km north-east of Glasgow. Cairnoch Hill (to the north of Carron Valley Reservoir) is within the Stirling Council area (Figure 1)
- 5.3 A landscape and visual impact assessment (LVIA) of the proposed wind farm will be undertaken to identify and assess potential impacts from the proposed development on the landscape resource and visual amenity, and assess the significance of the effects caused by those impacts.
- 5.4 The LVIA considers the potential impacts of the proposed development on changes in landscape character (landscape impact assessment) and the nature and extent of visual impacts (visual impact assessment). These are separate, but linked assessments.
- 5.5 The LVIA will form part of the Environmental Statement (ES) submitted to Stirling Council and circulated to all other statutory consultees.

Methodology and Guidance

- 5.6 The methodology and further approach to the LVIA will be developed using current industry best practice.
- 5.7 The LVIA will be undertaken with reference to published assessment guidance including:
- Landscape Institute and Institute for Environmental Management and Assessment, (2002), *Guidelines for Landscape and Visual Impact Assessment 2nd Edition*;
 - Countryside Agency in conjunction with Scottish Natural Heritage (2002), *Landscape Character Assessment Guidance for England and Scotland*;
 - Horner and MacLennan and Envision, (29.03.2006), *Visual Representation of Windfarms Good Practice Guidance, Report No: FO3 AA 308/2* prepared for Scottish Natural Heritage, Scottish Renewables Forum and Scottish Society of Directors of Planning, and
 - Landscape Institute, (March 2011), *Photography and photomontage in landscape and visual impact assessment, Advice Note 01/11*.
- 5.8 The LVIA also takes account of advice within the following business sector related best practice documents:
- Scottish Natural Heritage, (December 2009), *Siting and Designing windfarms in the landscape Version 1*;

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- Scottish Natural Heritage, (2001), Guidelines on the Impacts of Windfarms and Small Scale Hydroelectric Schemes;
 - Scottish Natural Heritage, (Version 2 revised April 2005), Guidance on the Cumulative Effects of Windfarms;
 - Scottish Natural Heritage, (update March 2009), Strategic Locational Guidance for Onshore Windfarms in respect of the Natural Heritage, Policy Statement No. 02/02, Scottish Natural Heritage; and
 - University of Newcastle, (2002), Visual Assessment of Windfarms: Best Practice, Scottish Natural Heritage Commissioned Report F01AA303A.
- 5.9 Planning policy is set out in Scottish Planning Policy (SPP) document and Planning Advice Notes (PANs) from the Scottish Government and the Structure Plans and Local Plans produced by Councils. Specific policies in relation to landscape exist in:
- Scottish Planning Policy, February 2010;
 - Scottish government web based guidance “Onshore wind turbines”;
 - PAN60: Planning for Natural Heritage (2000); and
 - Supplementary Planning Guidance: Interim Locational Policy & Guidance for Renewable Energy Developments (Wind Turbines).

Landscape Resource

- 5.10 Scottish Natural Heritage (2005) *Strategic Locational Guidance for Onshore Windfarms in Respect of the Natural Heritage*, contains guidance with regard to the sensitivity of Scotland in terms of its natural heritage, based on a desktop assessment of landscape and natural heritage designations. Areas of high (Zone 3), medium (Zone 2) and low (Zone 1) sensitivity are identified across Scotland, as well as intermediate areas (hatched areas on Map 5: Zones of Natural Heritage Sensitivity (SNH 2009) of the document). The proposed wind farm site falls within Zone 2 on landscape grounds.
- 5.11 As assessed in the Central Region Landscape Assessment and the Glasgow and the Clyde Valley Landscape Assessment, the site is located within the Rugged Moorland Hills and Upper Carron landscape character area, which is a large scale, upland plateau landscape characterised by rugged landform, moorland vegetation, and a lack of modern development. The forested nature of this site area is distinctly different to the moorland open character and of mid to late 20th century forestry plantations. In addition recent wind farm developments in the area contribute towards a change in landscape character. The Central Region Landscape Assessment identifies the long curving sweep of the Carron Valley Reservoir as the dominant feature of the Upper Carron landscape, created when the River Carron was dammed in the 1930s.
- 5.12 The area is reported to have a moderate sense of apparent naturalness and remoteness contrasting sharply with the surrounding lowlands. The landscape character assessment notes a high capacity to absorb change, an established value for recreation, and scope to enhance the scenic quality of the forestry through design.

Landscape Planning Designations

- 5.13 The presence of the Carron Valley Reservoir and surrounding forestry increases the scenic quality of this landscape such that the site area is important for recreation and is a natural focus accommodating over 30,000 visitors to the visitor facilities it contains. Notably the site and surrounding landscape are designated an Area of Great Landscape Value (AGLV)/Regional Scenic Area (RSA).
- 5.14 There are a high number and considerable extent of designated landscapes and cultural heritage features within the study area, as follows:
- Loch Lomond and the Trossachs National Park;
 - Loch Lomond National Scenic Area (NSA);
 - The Trossachs National Scenic Area (NSA);
 - River Earn National Scenic Area (NSA);
 - Campsie Fells Area of Great Landscape Value (AGLV);
 - Ochills Hills Area of Great Landscape Value (AGLV);
 - Callender and The Trossachs Area of Great Landscape Value (AGLV);
 - Campsie Fells Regional Scenic Area (RSA);
 - Antonine Wall World Heritage Site; and
 - Gardens and Designed Landscapes (GDL): Gargunnoch House, Touch, Cardross House, Airthrey Castle, Kings Knot, Doune Park, Blair Drummond, Duntreath Castle, Callendar Park, Rednock House, Inchmahome Priory, Dunmore Park, etc.
- 5.15 The designated areas relevant to the assessment are shown on Figure 3 and 4.

Proposed Approach

- 5.16 In accordance with current best practice, the study area for the landscape and visual effects would extend to 35 km from the outermost proposed wind turbine within the wind farm, as recommended in Table 2 of Visual Representation of Wind Farms: Good Practice Guidance (Scottish Natural Heritage 2007) and in Visual Assessment of Windfarms: Best Practice, (p.58, para. 6.1.8) (University of Newcastle 2002).
- 5.17 The LVIA will be presented in six broad parts, each of which is further subdivided into sections. These are:
- Methodology;
 - Baseline Conditions;
 - Assessment of Effects;
 - Cumulative Study;
 - Summary of Effects; and
 - Conclusions.

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5.18 The principle aims of the LVIA will be to:

- describe and evaluate the existing landscape character at the site and in the 35 km study area, including designated landscapes, in order to identify significant landscape features that may be affected by the proposed development;
- determine the assessment criteria and the significance thresholds, using established guidance and professional judgement;
- identify sensitive visual receptors with views of the proposed development and describe the existing visual relationships between the site and its surrounding area;
- identify the potential landscape and visual effects due to the proposed development on the landscape character and views of the site and surrounding area;
- assess the capacity of the landscape to accommodate the proposed wind farm;
- identify and assess the cumulative effects in combination with other wind farms that are existing, consented and those in planning;
- assess the significance of the predicted effects together with criteria used for the assessment; and
- identify the scope of mitigation, which would be in character with the existing landscape.

Identifying Impacts

5.19 The Guidelines for Landscape and Visual Impact Assessment (GLVIA) describe different types of effects as follows: *“Effects can be negative (adverse) or positive (beneficial); direct, indirect, secondary or cumulative and be either permanent or temporary (short, medium or long term). They can also arise at different scales (local, regional or national) and have different levels of significance (local, regional or national)”* (para 7.6, GLVIA 2002).

5.20 The guidance does not provide further detail or definitions of these impacts. The type of impact is therefore one that requires reasoned professional opinion and interpretation.

Landscape Impacts

5.21 *“Landscape effects derive from changes in the physical landscape which may give rise to changes in its character and how this is experienced. This may in turn affect the perceived value ascribed to the landscape”* (para 2.14, GLVIA 2002).

5.22 The physical impacts on the landscape are the direct impacts from the proposed wind farm on the site, which can alter the land cover, landscape features and the landscape character of the site. In addition, the activities associated with the proposed wind farm, including the movement of vehicles within the construction, operation and decommissioning phases, can extend the direct physical impacts beyond the immediate site area.

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Visual Impacts

- 5.23 *“Visual effects relate to the changes that arise in the composition of available views as a result of changes to the landscape, to people’s responses to the change, and to the overall effects with respect to visual amenity” (para 2.15, GLVIA, 2002).*
- 5.24 The assessment of visual impacts will be made through an in-depth analysis of agreed viewpoints, selected to represent the range of views and viewer types from where the proposed development is theoretically visible and to determine whether the effects are likely to be significant.

Cumulative Assessment

- 5.25 The assessment of cumulative impacts describes the impact of other wind farms (operational/constructed, under construction, approved and formally within the planning system) within a 35 km study area of the proposed Carron Valley Wind Farm in terms of how it will interact with the proposed wind farm. This assessment will include supporting graphics such as cumulative ZTVs and cumulative visualisations. In addition to a detailed assessment of cumulative impacts within the 35 km study area, other wind farms within a search area of 70 km will be identified.
- 5.26 Cumulative effects on visual amenity can be experienced either from static viewpoints, where two or more developments can be seen from a single location (combined visibility); or sequentially, where in the process of moving along a route two or more wind farms are visible.
- 5.27 In this case, particular attention will be paid to operational wind farms in close proximity of the proposed wind farm site. Including, amongst others, the existing operational Earlsburn Wind Farm, located 800 m to the north alongside Earlsburn Extension (consented), the operational Craigengelt Wind Farm with the nearest turbine located 500 m north-east of the site boundary and Muirpark Wind Farm located 5km north-east of the site.
- 5.28 Three types of cumulative visual impact will be considered in the assessment: combined, successive and sequential (Guidance taken from Cumulative Effect of Windfarms, Scottish Natural Heritage, issued 13/04/05). Combined and successive impacts are from static viewpoints, whereas sequential impacts relate to viewers that are moving.
- Combined impacts occur where a static observer is able to see two or more developments from one viewpoint within the observer’s arc of vision at the same time.
 - Successive impacts occur where two or more wind farms may be seen from a static viewpoint but the observer has to turn to see them.
 - Sequential impacts occur when the observer has to move to another viewpoint, for example when travelling along a road or footpath, to see the different developments. Sequential impacts may range from frequent (the features appear regularly and with short time lapses between, depending on speed and distance) to occasional (long time lapses between appearances due to a lower speed of travel and/or longer distances between the viewpoints).
- 5.29 As with the assessment of significance of effects of the Carron Valley Wind Farm development in isolation, the significance of cumulative effects is determined through a

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combination of the sensitivity of the landscape receptor or view and the magnitude of change upon it.

Principal Visual Receptors

Zone of Theoretical Visibility

- 5.30 The geographical extent of potential visibility will be established by the production of a Zone of Theoretical Visibility. The ZTV map will be generated using WindFarm™ computer software version 4.1.2.3 to demonstrate where all or part of the turbines may theoretically be seen from any point within the study area.
- 5.31 The ZTV will be based on a 'bare ground' model (Ordnance Survey (OS) Landform Panorama data based on a 50 m grid terrain model derived from 1:50,000 scale mapping) presenting a worst case scenario. This information is limited by the detail of the digital terrain model data used and this should be borne in mind in the consideration and use of the ZTVs. The limitations of the ZTV mean that while the ZTVs are used as a starting point in the assessment, providing an indication of where the development will theoretically be visible, they do not necessarily provide a completely accurate or representative impression of the visibility of the turbines. These limitations mean that the ZTV maps tend to overestimate the extent of the influence on the landscape and visibility of the proposal.

Viewpoint Selection

- 5.32 Initial viewpoints have been selected to be representative of sensitive residential and recreational receptors situated within the study area at different distances and directions from the scheme. The representative viewpoints will be used to assess the potential visual impacts of the proposed wind farm in the different range of views towards the site.
- 5.33 The following viewpoints have been selected with reference to the initial Zone of Theoretical Visibility (Figure 5). The pattern of ZTV indicates some limited potential visibility from within the Loch Lomond and the Trossachs National Park and more widespread areas within Stirling / the Forth Valley and North Lanarkshire.
- 5.34 Table 5.1 lists the indicative viewpoints with their locations also presented in Figure 5. Comment on the proposed viewpoint locations is invited as part of this request for a Scoping Opinion. The final selection of viewpoints to be presented in the ES (LVIA) will be the subject of discussion and agreement with SNH, Historic Scotland and Stirling Council.

No.	Viewpoint Name	Approx Distance (km)	Direction	Reason for Inclusion
1	Todholes Bridge	0.8km	West	AGLV/main route
2	Cringate Law	1.6km	North west	AGLV
3	Minor Road near Earls Hill	1.7km	North	AGLV/recreation route
4	Carron Reservoir Southeast	1.3km	South east	AGLV/Regional Scenic Area
5	Minor road from Kilsyth	4.3km	South east	Recreational route
6	Carron Valley Reservoir South	1.5km	South	AGLV/recreation area+
7	B822	5.7km	South west	AGLV/route to Lennoxtown
8	Fintry	7.1km	West	Settlement/AGLV
9	Earl's Seat	11.6km	South west	AGLV
10	Balfron	13.1km	West	Settlement
11	Stirling Castle	12.5km	North east	International tourism attraction /History
12	Wallace Monument	15.0km	North east	International tourism attraction /History
13	Dumyat Hill	18.3km	North east	Ochills AGLV

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TABLE 5.1 – PROPOSED VIEWPOINTS				
No.	Viewpoint Name	Approx Distance (km)	Direction	Reason for Inclusion
14	Cowie	14.1km	East	Settlement with existing cumulative impact
15	Alloa Tower	19.9km	North east	Tourism/History
16	Slamannan	18.9km	South east	AGLV /Settlement with potential cumulative view
17	Antonine Wall/Grangemouth	25.8km	South east	World Heritage Site /Settlement
18	West Highland Way	20.4km	North west	West Highland Way/National Park/AGLV
19	Menteith Hills	20.4km	North west	AGLV/National Park
20	Ben Ledi	26.2km	North west	National Park/AGLV

5.35 A location plan will be generated for each viewpoint location and these will be supported by wirelines of the landform for each viewpoint in order to establish a visual fit for the turbines and the existing landscape.

5.36 For viewpoints that are likely to experience significant effects, photomontages will additionally be prepared.

Wind Farm Siting and Design in Relation to Landscape and Visual Characteristics

5.37 It is important to design a wind farm so that it relates to the qualities of a specific site and its setting. Early landscape work has informed, and will continue to inform, the design evolution process to ensure that the most appropriate layout of wind farm components is proposed. As part of this process, opportunities for landscape mitigation and enhancement will be identified where appropriate.

5.38 According to Siting and Designing Wind Farms in the Landscape (Scottish Natural Heritage, December 2009) the main variables which should be addressed through the LVIA include:

- layout and number of wind turbines;
- size, design, and proportion of wind turbines;
- route and design of access tracks, including the junctions with public roads;
- location, design and restoration of temporary borrow pits;
- location, design and restoration of temporary construction compounds;
- location and size of wind monitoring masts;
- positioning and mitigation of turbine lighting (if required);
- visitor facilities, including paths, signs, parking and visitor centre (if proposed); and
- land management changes, such as muirburn, woodland management, fences, and stock grazing.

Summary

5.39 The objective of the LVIA is to identify and evaluate the predicted significant landscape and visual effects arising from the proposed wind farm. The assessment will inform the final layout in an effort to prevent, reduce or offset the significant landscape and visual impacts. In order to provide a level of consistency and transparency to the assessment, and allow

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comparisons to be made between the various landscape and visual receptors, the assessment of significance will be based on pre-defined criteria and methodology.

- 5.40 It is important to note that judgements in the LVIA will be impartial and based on professional experience and opinion informed by best practice guidance. By assembling and presenting information in a systematic and comprehensive manner, the assessment will provide an understanding of the individual landscape and visual effects of the proposal, and give an insight into the overall effects of the proposed wind farm.

6 Archaeology and Cultural Heritage

Overview

- 6.1 This chapter will assess the potential for impacts on buried archaeology, cultural heritage sites and historic environment features in the wider surroundings. Cultural heritage features will be identified through a desk-based assessment, including a review of historical maps and aerial photographs, checking databases of known sites, consultation with Historic Scotland and Stirling Council, and a targeted site walkover.

Legislation, Policy and Guidance

- 6.2 The cultural heritage and archaeological assessment will be conducted in accordance with:
- Ancient Monuments and Archaeological Areas Act 1979;
 - Planning (Listed Buildings and Conservation Areas) (Scotland) Act 1997;
 - Town and Country Planning (General Development Procedure) (Scotland) Order 1992;
 - Scottish Planning Policy (SPP) February 2010;
 - PAN2/2011 Planning and Archaeology;
 - Scottish government web based guidance “Onshore wind turbines” <http://www.scotland.gov.uk/Resource/Doc/212607/0114118.pdf>;
 - Managing Change in the Historic Environment: Setting (Historic Scotland, October 2010);
 - Stirling Council’s Local Development Plan;
 - Code of Conduct Institute for Archaeologists 2010; and
 - Standard and Guidance for Archaeological Desk-Based Assessment Institute for Archaeologists 2008.

Existing Site

- 6.3 The remains of Sir John de Graham’s Castle (Scheduled Ancient Monument) are located within the site boundary of the proposed development site, 500 m east of the northern end of the reservoir. In addition, several Scheduled Ancient Monuments are located within 10 km from the site.
- 6.4 Several Category A Listed Buildings are also located within 10 km from the site. The nearest is Culcreuch Castle approximately 5.8 km to the northwest of the site. There are also several Category B and C Listed Buildings within 10 km from the site.
- 6.5 The buffer zone for the Antonine Wall World Heritage Site passes approximately 6.1 km south of the site.

Proposed Assessment Methodology

- 6.6 An extended desk based assessment of available information will be conducted to establish baseline conditions to enable assessment of both direct effects (physical) within the site, and indirect effects (visual effects on the settings of historic features etc) within the site and a study area around it.
- 6.7 The primary information resource will be the Sites and Monuments Record, supplemented by relevant published documentary and cartographic material, as appropriate. Information on Scheduled Ancient Monuments, listed buildings, Inventoried Gardens and Designed Landscapes etc will be obtained from Historic Scotland.
- 6.8 Information sources may also include (amongst others):
- Online datasets, in particular Pastmap;
 - National Monument Record of Scotland (NMRS); and
 - Published and manuscript maps held by the National Library of Scotland.
- 6.9 The study area will be as follows:
- For buried archaeological sites that are recorded on the Sites and Monuments Record but not otherwise designated, the study area is a 1.5 km buffer zone around the proposed wind farm site and access roads. Whilst there is no potential for direct effects on cultural heritage features outside this study area, it is considered that information from the study area may inform the assessment of the sensitivity of the application site and the archaeological resources within it.
 - For designated historic environment resources of regional and local significance the study area is a circle of 3 km radius centred on the proposed wind farm. The study area has regard to the advice on the perception of turbines in Figure 8 of PAN 45, to the nature and extent of the proposed development. It is not considered that the potential for likely significant environmental effects on a cultural heritage resource of regional or local importance exists beyond 3 km. Only those receptors that fall within the ZTV will be identified and described.
 - For designated cultural heritage resources of international and national significance the study area is primarily a circle of 10 km radius centred on the proposed wind farm. Subject to the professional judgement of the cultural heritage consultant, a precautionary approach will be employed where more distant cultural heritage features of international and national significance are included in the initial stages of assessment, these only being discounted after a detailed assessment of their setting has been made. The study area is demonstrably robust to ensure that any likely significant environmental effects can be identified. Furthermore, the study area is consistent with advice in Figure 8 of PAN 45, which advises on the general perception of turbines within the landscape at certain distances. Given these distances, and having regard to the nature and scale of the

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proposed wind farm, and experience it is considered that the potential for likely significant adverse effects will be confined to resources within 10 km.

- 6.10 Data for various classes of monuments and designated features will be collected at appropriate ranges from the proposed wind farm development area. Consideration will be given to any Historic Land Use Assessment that exists for the site, in assessing effects upon the setting and character of the historic landscape.
- 6.11 Consultations with Historic Scotland and the Archaeology Service at Stirling Council will be undertaken as appropriate.
- 6.12 Supplementary data will be gathered through a reconnaissance field survey of the proposed site in order to provide information on the archaeological potential of the area. This fieldwork will be conducted to:
- assess and validate data collected as part of the Desktop Assessment;
 - identify the extent and condition of any visible archaeological monuments, including any not previously recorded;
 - assess the topography and geomorphology of the proposed site; and
 - inform an assessment of the site context as part of the wider historic landscape.
- 6.13 In order to inform the assessment of indirect effects on the setting of cultural heritage features, key receptors outside the proposed wind farm development area will be visited, as appropriate and subject to access constraints. Such receptors may include Scheduled Ancient Monuments, Listed Buildings and other designated features, such as Inventoried Historic Parks and Designed Landscapes. Features visited will include those identified by the desktop studies and those specifically identified via the consultation process.
- 6.14 The assessment will examine any potential direct effects (physical disturbance) and indirect effects (visual impact on cultural heritage features and their settings) of the proposed wind farm during the construction, operation and decommissioning stages. Reference will be made to visual resources and effects identified in the Landscape and Visual Impact Assessment (see Section 5). Potential significant impacts and mitigation measures will be detailed in the ES, and an assessment of residual effects presented.

Potential Cumulative Effects

- 6.15 The cumulative impacts of other wind farms within an agreed radius of the site which are either operational, under construction, consented or the subject of a full planning application will also be assessed. These will be identified through the LVIA (see Section 5), with the same cumulative developments assessed for consistency.

Viewpoints

- 6.16 Of the proposed viewpoints identified in Section 5 above, those relating to cultural heritage interest will be the subject of further discussion and agreement with the Archaeology Service of Stirling Council and Historic Scotland, as part of the baseline assessment. The final selection of viewpoints will inform the assessment of potential significant effects on the

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settings of designated cultural heritage resources. The exact number of viewpoints that will be used will not be determined until further baseline studies are undertaken.

- 6.17 Wireline diagrams of the proposals will be provided to illustrate the location and potential appearance of the wind turbines from each of the agreed viewpoints.

7 Ecology and Nature Conservation

Overview

- 7.1 This section describes the issues and impacts likely to affect terrestrial and aquatic habitats and species, excluding birds (which are covered separately in Section 8). The ecology assessment will consider the likely importance of species and habitats based on legal, conservation and biodiversity grounds.

Zone of Impact for Ecological Features

- 7.2 The zone of likely impact for ecological features varies, depending on the nature and behaviour of the habitat or species, and also the type of impact that may affect them.
- 7.3 To ensure comprehensive coverage of potential impacts, the impacts on individual habitats or species will be considered for the survey zones as identified in Table 7.1 below:

Ecological Feature	Survey Zone from Site Boundary
Internationally designated sites (SPA, SAC, Ramsar)	Within 5 km
Nationally designated sites (SSSI, NNR)	Within 5 km
Locally designated sites (LNR, Wildlife Sites)	Within 2 km
Badgers	Within 250 m
Water voles and otters	Within 500 m
Wildcat	Within 200 m
Bats	Within 200 m of rotor envelope and proposed access road

- 7.4 Where there are particular site-specific reasons for amending any of the above distances these will be identified and explained in the ES.

Initial Desk Study

- 7.5 The first phase of the ecological assessment comprised a desk study to investigate available information on designated sites, habitats and species in the vicinity of the proposed wind farm.
- 7.6 Desk based assessment was carried out using SNH's SiteLink database and the Joint Nature Conservation Committee's (JNCC) designated site databases. These are detailed below in Table 7.2 and shown on Figure 3. Sites designated for bird interest are covered under Section 8.

Site Name	Distance from Site (km)	Reason for Designation
Endrick Water SAC and SSSI	1.4 km west of site boundary	This site is designated for its fluvial geomorphology, freshwater and estuarine fish species, and vascular plant species.
Double Craigs SSSI	3.5 km west of site boundary	This site is designated for its geological igneous petrology and its sub-alpine calcareous grassland.
Denny Muir SSSI	4 km south-east of site boundary	This site is designated for its subalpine acid grassland, blanket bog and basin fen flora.
Carron Glen SSSI	4 km east of site boundary	This site is designated for its upland oak and mixed ash woodland, and lowland neutral grasslands.

- 7.7 No information has been sought on the presence of locally designated sites, such as Local Nature Reserves (LNRs) or Wildlife Sites (WS) at this time. This information will be obtained

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from Stirling Council and non-statutory consultees such as Scottish Wildlife Trust (SWT) via the EIA consultation process.

7.8 The methodology for the EIA will include a full desktop study to review all the available information on the site of the proposed wind farm and surrounding area. The data sources will include:

- Sitelink (www.snh.org.uk/snhi);
- National Biodiversity Network (NBN) Gateway (www.searchnbn.net);
- SNH;
- SEPA;
- The Scottish Wildlife Trust;
- Botanical Society of the British Isles (BSBI);
- Loch Lomond Fisheries Trust;
- Scottish Badgers;
- Central Scotland Bat Group;
- Stirling Council;
- British Bryological Society;
- Buglife; and
- Fungal Records Database of Britain and Ireland (www.fieldmycology.net/FRDBI).

Extended Phase 1 Habitat Survey

7.9 An Extended Phase 1 Habitat Survey of the proposed site was carried out based on the standard JNCC methodology². The survey comprised an assessment of the range of semi-natural habitats within and immediately adjacent to the site boundary. In addition to identifying habitat types, the vascular plants of each habitat were recorded. This survey also identified the presence of potentially suitable habitat for each of the protected species identified in the following section, and therefore determines the need or otherwise for more detailed protected species surveys.

7.10 Areas of particular botanical interest (e.g. habitats listed on Annex 1 of the Habitats Directive) will be further classified according to the National Vegetation Classification (NVC)³. This survey involves recording all plant species and their relative dominance within 2x2 m quadrants in visually different homogeneous vegetation types.

² JNCC, (2010). Handbook for Phase 1 Habitat Survey: A technique for Environmental Audit, Revised reprint. Joint Nature Conservation Committee. Nature Conservancy Council, Peterborough.

³ Rodwell, J. S. *et seq.* (1992) *British Plant Communities Vols 1-5*, Cambridge University Press: Cambridge.

Protected Species Surveys

- 7.11 A desk-based review combined with the Extended Phase 1 Habitat Survey and previous experience of the site and its environs, will inform the potential existence of a number of protected species. Surveys for these species will be undertaken as outlined below.
- 7.12 Information from the above sources also established there to be negligible habitat potential for great crested newt and limited importance of the site for pine marten. Hence, it is considered that in these cases a desk-based approach is sufficient for the final assessment. Note that this approach is subject to further consultation.

Badgers

- 7.13 A walkover survey for evidence of badgers will be carried out following standard methods to record field signs, identify sett locations and describe sett use^{4,5,6,7}.

Otter and Water Vole

- 7.14 All watercourses and waterbodies within the site that are potentially at risk of impact will be surveyed by an experienced ecologist for otter and water vole, searching for field signs in accordance with best practice^{8,9}.
- 7.15 Otter field signs (which are diagnostic of the presence of otter) are described in Bang & Dahlstrøm (2001)¹⁰ and Sargent & Morris (2003)¹¹. Otter and water vole surveys can be carried out at any time of year, although it is best practice to avoid surveying after periods of heavy rainfall, when field signs may have been washed away.

Red Squirrel

- 7.16 No evidence of squirrel presence was detected during the Extended Phase 1 Habitat survey therefore it is not deemed necessary for a targeted red squirrel survey to be undertaken. However due to the presence of potentially suitable habitat evidence of the presence of red squirrel will be searched for during the protected species walkover survey. This will look for and record all signs of red squirrel presence, such as, animal sightings, feeding remains and drey sites.

Wildcat

- 7.17 No evidence of wildcat presence was detected during the Extended Phase 1 Habitat. However, remote camera surveys are currently being undertaken in the Carron Valley area by the Forestry Commission. The results of this work will be incorporated into the assessment of site with regard to wildcat.

⁴ Harris, S., Cresswell, P. & Jeffries, D. (1991) *Surveying for Badgers*. Mammal Society.

⁵ Neal, E. & Cheeseman, C. (1996) *Badger*. Christopher Helm: London.

⁶ Bang, P. & Dahlstrøm, P. (2001) *Animal Tracks and Signs* Oxford University Press: Oxford.

⁷ Sargent, G. & Morris, P. (2003) *How to find & Identify Mammals* The Mammal Society: London.

⁸ Chanin, P. (2003) *Monitoring the Otter Lutra lutra. Conserving Natura 2000 Rivers. Monitoring Series No. 10*. English Nature, Peterborough.

⁹ Strachan, R. (1998) *The Water Vole Conservation Handbook*. Wildlife Conservation Research Unit, Department of Zoology, University of Oxford.

¹⁰ Bang, P. & Dahlstrøm, P. 2001 *Animal Tracks and Signs*. Oxford University Press, Oxford.

¹¹ Sargent, G. & Morris, P. 2003 *How to find & Identify Mammals*. The Mammal Society, London.

Bats

7.18 All bat species found in the UK are legally protected. Bat surveys will be conducted in accordance with the principles established within the Natural England interim guidance¹² and following methods designed with reference to Bat Conservation Trust (BCT) guidelines¹³. Due to the exposed, upland nature of the site, bats are unlikely to be prevalent at the site. The scope and approach of the bat surveys was agreed in discussion with SNH prior to commencement:

- Transect surveys – Monthly transect surveys are being undertaken in potentially suitable habitat between May and October 2011.
- Automated surveys - AnaBat detectors will be deployed at a sample of locations within the proposed turbine envelope for a period of two weeks within both the breeding and hibernation commuting seasons.
- Roost surveys - Data searches will be conducted to identify any known roost sites within 0.5 km of the site boundary. Potential bat roosts onsite will be identified during walkover surveys. If necessary, emergence/re-entry surveys (three separate survey visits of one location using at least two surveyors) will be conducted at potential roost sites, in order to determine the species and population present.

Fisheries Surveys

7.19 The Endrick Water SAC is located approximately 1.4 km downstream of the site. This site is designated due to its populations of Atlantic salmon, brook lamprey and river lamprey. The Loch Lomond Fisheries Trust (LLFT) will undertake fish surveys in the main watercourses within and adjacent to the site. LLFT has identified nine potentially important watercourses requiring sampling. The methodology for the surveys will involve electro-fishing using the three pass depletion method. Sampling will be undertaken by qualified personal to standard Scottish Fisheries Co-ordination Centre (SFCC) approved protocols.

Assessment Methodology

7.20 The impact assessment will follow the Guidelines for Ecological Impact Assessment¹⁴ ('IEEM guidelines'), which is the current best-practice ecological guidance and incorporates good practice from other published documents.

7.21 The EIA will include consideration of the ecological issues throughout the lifespan of the wind farm, including effects during construction, operation and decommissioning.

Value of Ecological Receptors

7.22 A value will be assigned to each ecological receptor based on the range of evaluation criteria outlined in the IEEM Guidelines. These include the following broad categories:

- geographic frame of reference, from an international to a local level;

¹² Natural England (2009) *Bats and onshore wind turbines: Interim guidance*. Natural England, Technical Information Note 051.

¹³ Parsons, K. *et al.* (2007) *Bat Surveys: Good Practice Guidelines*. BCT: London.

¹⁴ Institute of Ecology and Environmental Management, (2006). *Guidelines for Ecological Impact Assessment in the United Kingdom* (version 7 July 2006). <http://www.ieem.org.uk/ecia/index.html>

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- designation status (e.g. SAC, SSSI);
- biodiversity value (e.g. National and Local BAP habitats/species, significant populations of species, etc.); and
- social, community and economic value.

7.23 Where a receptor is considered to be of at least local-level importance, or is of lower than local-level importance but is protected by law, this receptor will be brought forward to the detailed impact assessment stage.

Characterisation of Impacts

7.24 The impacts on each receptor will be described in relation to a range of factors, specifically the magnitude, extent (either in area or population terms), duration, timing, frequency and reversibility of the effect on the structure and function of the ecosystem. Consideration will also be given to impacts operating in combination that may have a cumulative effect that is greater than when the same impact acts in isolation.

Potential Mitigation Measures

- 7.25 Mitigation measures that may be incorporated into the EIA where appropriate include:
- site design to avoid ecologically sensitive areas;
 - Habitat Management Plan (HMP) to ensure protection and enhancement of important habitats and organic material;
 - pre-construction checks for mobile species, such as badger, otter, water vole, red squirrel, pine marten and wildcat will be carried out to update information in the EIA;
 - an ecological clerk of works will be retained to manage the ecological issues during construction;
 - working areas will be clearly demarcated and restricted to cause minimum impacts upon the sensitive habitats;
 - roadstone will be sourced locally in order to preserve the acid balance within surrounding habitats;
 - during the construction of access tracks through sensitive areas, care will be taken to separate the soil layers of excavated material to allow for the re-use of the topsoil with its inherent seed bank for use elsewhere on the site;
 - any areas of temporary habitat loss will be restored after construction. Soil strata will be maintained by separation to allow natural regeneration to take place after restoration;
 - the storage of soils during the construction phase will be within areas where they can remain wet and will be away from nearby watercourses to restrict sediment runoff;

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- where appropriate small bunds using natural products (e.g. hay bales) will be introduced to provide further protection;
- speed limit restrictions and signage will be implemented on all operational tracks (10 mph) to minimise risks to wildlife; and
- a method statement will be produced detailing working methods designed to minimise the risk of sediment wash and pollution into the burns.

7.26 Measures specific to the potential impacts identified will be developed throughout completion of the EIA and reported in the ES.

Assessment of Impact Significance

7.27 In the ecological assessment, an ecologically significant residual effect will be defined as an impact (adverse or positive) on the integrity of the site or ecosystem(s) and/or the conservation status of habitats or species within the identified zone of impact for the development. The definitions of integrity and conservation used for this assessment will be those detailed in the IEEM Guidelines.

8 Ornithology

Overview

- 8.1 This section describes the issues and impacts likely to affect birds in and around the proposed wind farm site. The ornithological assessment considers the likely use of the site by sensitive bird species and evaluates the potential for habitat loss, disturbance, displacement and collisions with turbines.
- 8.2 The understanding of the likely ornithological issues at the site has been based on initial desk study work, as well as ongoing site survey work specific to the proposed wind farm, undertaken by RPS on behalf of PfR, beginning in September 2010. All ornithological survey methods and subsequent assessment at Carron Valley are based on Scottish Natural Heritage Guidance (hereafter referred to as the SNH Guidance). SNH has produced a range of guidance documents relating to the assessment of bird/wind farm interactions as identified below and these will be used in the ornithological assessment:
- SNH (2010). Survey Methods for Use in Assessment of the Impacts of Proposed Onshore Wind Farms on Bird Communities. SNH Advisory Services and National Strategy¹⁵;
 - SNH (2005). Cumulative Effect of Wind Farms. Guidance Note, March 2005¹⁶;
 - SNH (2006). Assessing significance of impacts from onshore windfarms on birds outwith designated areas. SNH, Battleby¹⁷;
 - Band, W., Madders, M. & Whitfield, D.P. (2007). Developing field and analytical methods to assess avian collision risk at windfarms. In: Birds and Windfarms. De Lucas, M, Janss, G. and Ferrer, M. (Eds). Lynx Edicions, Barcelona¹⁸;
 - SNH (2009). Monitoring the impact of onshore wind farms on birds. Guidance Note, January 2009¹⁹; and
 - SNH (2010). Use of Avoidance Rates in the SNH Wind Farm Collision Risk Model. SNH Avoidance Rate Information and Guidance Note²⁰.

Zone of Impact for Ornithological Features

- 8.3 The zone of likely impact for ornithological features varies, depending on the nature and behaviour of different species, and also the type of impact that may affect them. The zone of impact considered for bird species is taken from good practice guidance for designated sites, and from the SNH guidance for surveying on onshore wind farms, as identified in Table 8.1.

¹⁵ http://www.snh.org.uk/pdfs/strategy/renewable/bird_survey.pdf

¹⁶ <http://www.snh.gov.uk/docs/A305440.pdf>

¹⁷ <http://www.snh.org.uk/pdfs/strategy/renewable/Significance%20of%20bird%20impacts%20July%202006.pdf>

¹⁸ Band, W., Madders, M., and Whitfield, D.P. (2007). Developing field and analytical methods to assess avian collision risk at wind farms. In: Birds and Wind Farms. De Lucas, M, Janss, G. and Ferrer, M. (Eds.) Lynx Edicions, Barcelona.

¹⁹ <http://www.snh.gov.uk/docs/C205416.pdf>

²⁰ <http://www.snh.gov.uk/docs/B721137.pdf>

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Ornithological Features	Zone of Impact
Internationally designated sites (SPA, Ramsar, Important Bird Area (IBA))	Within 20 km
Nationally designated sites (SSSI, NNR)	Within 5 km
Locally designated sites (LNR, Wildlife Sites)	Within 2 km
Breeding Bird species	As per SNH Survey Guidance
Sensitive species - collision risk	Within 200 m of rotor envelope

- 8.4 Where there are particular site-specific reasons for amending any of the above distances these will be identified and explained in the ES.

Initial Desk Study

- 8.5 In order to inform the ornithological surveys, desktop searches were undertaken using the MAGIC Map²¹ and SNH Sitelink²² websites to identify the presence of any SPAs, Ramsar sites and SSSIs for which birds were a principle reason for notification or designation, within 20 km of the proposed wind farm site. These are shown in Figure 3.
- 8.6 Pre-scoping consultation was undertaken with SNH and RSPB Scotland with regard to bird survey methods. Forestry Commission Scotland was also consulted with regard to the location of Schedule 1 breeding birds within its property.
- 8.7 As part of the EIA, further desk study and consultation will be undertaken in an attempt to gather all the available ornithological information on the site and surrounding area. As part of this process, the following information resources will be searched and consultees contacted:
- MAGIC Map;
 - Sitelink;
 - National Biodiversity Network (NBN) Gateway²³;
 - SNH;
 - Royal Society for the Protection of Birds (RSPB);
 - The Scottish Raptor Study Group (SRSG); and
 - The Scottish Ornithologist's Club (SOC).

Field Surveys

- 8.8 The purpose of ornithological field surveys on proposed wind farms, as described in the SNH Survey Guidance (SNH 2010), is to provide information on:
- the type and number of birds that may be displaced (whether through disturbance or habitat loss), and the extent and importance to bird populations of the area from which they may be displaced; and
 - levels of flight activity and types of flight behaviour, which can be used in assessing collision risks.

²¹ www.magic.gov.uk

²² www.snh.org.uk/snhi

²³ www.searchnbn.net

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8.9 As mentioned above, surveys to identify the use of the site by birds are ongoing. These involve:

- Vantage Point (VP) Surveys;
- Winter Walkover Surveys;
- Moorland Bird Surveys;
- Plantation Point Count Surveys;
- Breeding Raptor; and
- Barn owl Surveys.

Vantage Point Surveys

8.10 VP surveys are designed to record the flight activity of target bird species such as raptors through the proposed wind farm site, allowing the identification of regularly used flight-paths and providing data upon which the theoretical risk of bird collision with turbines can be calculated.

8.11 In order to quantify levels of flight activity around the proposed wind farm site, VP watches are ongoing at three vantage points (Figure 6). These are located at: NS 68623 84144 (VP1), NS 69159 87122 (VP2) and NS 71688 86313 (VP3).

8.12 In accordance with the SNH guidance, a minimum of 36 survey hours per season will be completed at each vantage point.

8.13 Target species recorded during the ornithological surveys are selected as per SNH guidance (2010) and include species listed on Annex 1 of the EC Birds Directive, Schedule 1 of the Wildlife and Countryside Act 1981 (as amended), Red-listed birds of conservation concern²⁴ and migratory waterfowl, especially geese.

8.14 The impact of the proposed development on the target species through the risk of collision will be assessed as part of the EIA.

Wintering Birds

8.15 Wintering bird surveys comprise seven monthly visits between September and March within the proposed site boundary plus a 500 m buffer. Each visit follows a pre-determined route incorporating brief vantage point watches. Routes are reversed in alternate months.

Moorland Bird Surveys

8.16 These surveys involve three visits during April, May and June covering all areas of open moorland within a 500 m buffer of the site boundary. Surveys are based on the Brown and Shepherd²⁵ methodology for upland birds.

²⁴ Eaton, M. A., Brown, A. F., Noble, D. G., Musgrove, A. J., Hearn, R., Aebischer, N. J., Gibbons, D. W., Evans, A. and Gregory, R. D. (2009). Birds of Conservation Concern 3: the population status of birds in the United Kingdom, Channel Islands and the Isle of Man. *British Birds* 102: 296-341.

²⁵ Brown, A. F. & Shepherd, K. B. 1993. A method for censusing upland breeding waders. *Bird Study*, 40: 189-195.

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Plantation Point Count Surveys

- 8.17 Surveys are undertaken from a grid of survey points within the site boundary and a 500 m buffer. Three visits are undertaken during April, May and June. All birds seen or heard are recorded in three distance bands: 0-50; 50-100; and 100+. Due to a variation in forest structure, habitat within 100 m of each point is recorded into one or more categories: Open space/unplanted; Clearfell; pre-thicket <3 m (incl. restock); Closed canopy >3 m; and other (windblow, tracks).

Breeding Raptors

- 8.18 Surveys encompass suitable areas within 2 km of the proposed site boundary to investigate the presence of breeding raptors of conservation importance within or close to the site. Surveys, based on recommended guidance, involve a combination of vantage point watches and walkover. Three visits are undertaken between mid-March and July.

Barn Owls

- 8.19 Breeding barn owl surveys comprise checks for occupancy between November and January, and a follow up visit during May to August, following the protocol in Hardey *et al.*²⁶. All areas of suitable habitat within 1 km of the indicative turbine layout are surveyed, including: old farm buildings; derelict domestic buildings; and large deciduous trees. At this site, local Forestry Commission staff are also consulted with regard to breeding barn owls.

Incidental Observations

- 8.20 In addition to birds recorded through the formal surveys detailed above, all incidental observations of target species were also recorded.

Assessment Methodology

- 8.21 The impact assessment will follow the principles of the SNH Guidance on Assessing Significance Outwith Designated Areas Areas¹⁷, Guidelines for Ecological Impact Assessment²⁷ ('IEEM Guidelines'), and the SNH/BWEA assessment methodology²⁸.
- 8.22 The stages in the assessment will be as follows:
- determine the nature conservation value of the ornithological interests present within the study area;
 - identify the potential impacts based on the nature of the proposed development;
 - determine the scale and magnitude of those effects;
 - determine the significance of those effects based on the magnitude and duration of the effects on the nature conservation value of the bird populations affected;

²⁶ Hardey, J., Crick, H., Wernham, C., Riley, H., Etheridge, B. & Thompson, D. 2009. *Raptors – A Field Guide for Surveys and Monitoring*. The Stationery Office, Edinburgh.

²⁷ Institute of Ecology and Environmental Management, (2006). Guidelines for Ecological Impact Assessment in the United Kingdom (version 7 July 2006). <http://www.ieem.org.uk/ecia/index.html>

²⁸ SNH/BWEA (2002). Methodology for Assessing the Effects of Wind Farms on Ornithological Interests.

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- identify and assess mitigation measures required to address significant adverse effects; and
 - determine the significance of any residual effects once the benefits of the prescribed mitigation measures have been assessed.
- 8.23 The national breeding bird populations will be taken from Baker et al. (2006)²⁹ and regional population figures taken from The Birds of Scotland (2007)³⁰, augmented by further desk study and consultation. The conservation importance in numeric terms will be assessed by using the standard 1% criterion method detailed in Austin et al.³¹ where >1% of the national population is considered to be nationally important and >1% of the international population is internationally important. Regional bird populations will be assessed in the context of the SNH Natural Heritage Zone (NHZ) in which the site falls (NHZ Zone 17, West Central Belt), following SNH guidance (if species populations at the NHZ level are not available, a suitable alternative will be used where possible). Collision risk modelling, as per SNH methodology will be carried out for all target species (e.g. raptors, waders and waterfowl) recorded regularly within the collision risk zone during the surveys.
- 8.24 The EIA will include consideration of the ornithological issues throughout the lifespan of the wind farm, including effects during construction, operation and decommissioning.
- 8.25 In addition, the assessment will also consider the cumulative effect of the impacts of the proposed wind farm in combination with those associated with all other wind farm developments (where scheme information is available) within 20 km of the proposed wind farm. The key issue is likely to be cumulative potential collision risk for target bird species. In addition consideration will be given to other developments within the same radius of the proposed wind farm which might also have cumulative impacts on birds, although few other developments might be predicted to pose a collision risk to birds.

Value of Ornithological Receptors

- 8.26 A value will be assigned to each ornithological receptor based on the range of evaluation criteria outlined in the guidelines produced by the Institute for Ecology and Environmental Management (The IEEM Guidelines)³² and SNH Assessment Guidance. These include the following broad categories:
- geographic frame of reference, from an international to a local level;
 - designation status (e.g. SPA, Ramsar, SSSI);
 - biodiversity value (e.g. National and Local Biodiversity Action Plan (BAP) species, significant populations of species, Birds of Conservation Concern listing etc.); and
 - social, community and economic value.

²⁹ Baker, H., Stroud, D.A., Aebischer, N.J., Cranswick, P.A., Gregory, R.D., McSorley, C.A., Noble, D.G. & Rehfisch, M.M. (2006). Population estimates of birds in Great Britain and the United Kingdom. *British Birds* 99: 25–44.

³⁰ Forrester, R.W., Andrews, I.J., McInerney, C.J., Murray, R.D., McGowan, R.Y., Zonfrillo, B., Betts, M.W., Jardine, D.C. & Grundy, D.S. (eds) 2007. *The Birds of Scotland*. The Scottish Ornithologists' Club. Aberlady.

³¹ Austin, G. E., Collier, M. P., Calbrade, N., Hall, C. and Musgrove, A. J. (2008). *Waterbirds in the UK 2006/07: the Wetland Bird Survey*. BTO/WWT/RSPB/JNCC, Thetford.

³² IEEM (Institute of Ecology and Environmental Management) (2006). *Guidelines for Ecological Impact Assessment in the United Kingdom*. <http://www.ieem.net/ecia.asp>

- 8.27 Where the value of a receptor is of at least regional importance or of lower than regional value but protected by law, this receptor will subsequently be brought forward to the detailed impact assessment stage.

Characterisation of Impacts

- 8.28 The impacts on each receptor will be described in relation to a range of factors, specifically the magnitude, extent (either in area or population terms), duration, timing, frequency and reversibility of the effect on the structure and function of the ecosystem. Consideration will also be given to impacts operating in combination that may have a cumulative effect that is greater than when the same impact acts in isolation.

Assessment of Significance Impacts

- 8.29 In the ornithological assessment, a significant impact will be defined as an impact (adverse or positive) on the integrity of the site or ecosystem(s) and/or the conservation status of habitats or species within the local Natural Heritage Zone of the site (in this case NHZ Zone 1). The definitions of integrity and conservation status used for this assessment will be based on the IEEM Survey Guidelines.

Potential Mitigation Measures

- 8.30 It is not possible at this stage to determine appropriate mitigation for any significant impacts at the site, or indeed identify whether ornithology-specific mitigation measures will even be required. However, general construction site best practice measures will be proposed and these will be likely to reduce impacts upon birds at the site.

9 Forestry

- 9.1 In order to determine the effects of the proposed wind farm on the existing forestry at the site, an assessment of the current condition of the forestry regarding species, height, condition, yield potential and current management regime will be undertaken. It will take account of the current approved Forest Design Plan and look at any significant changes as a result of the wind farm development. The forest will be visited and surveyed to sample the extensive data already held about the site by the owners to ensure information and data are current.
- 9.2 The assessment will consider the current turbine layout, manufacturer's requirements turbines relative to tree crops and the impacts on turbulence and turbine efficiency. It will assess the impacts of any tree removal, early felling and short rotation practices.
- 9.3 Following agreement on the extent of tree removals, the effects of tree removal, early felling and short rotation forestry required will be assessed and mitigation planting proposed following the guidance in the Scottish Government's policy on the Control of Woodland Removal³³. It will consider the impacts of the associated forestry operations required by the development and assess opportunities provided by the wind farm and renewables locally to make improvements to environment, recreation and access as mitigation.
- 9.4 The assessment will also include consultation with Forestry Commission Scotland and other consultants/agents. In addition desk based research will be undertaken to obtain further information regarding forest practice and past management with reference to the UK Woodland Assurance Scheme and its guidance documents³⁴. Reviews of any existing forest and other plans will also take place. An assessment of the impacts on employment that is reliant on the forestry in the area will be undertaken. It will also include an assessment of recreation activities undertaken in the forest and the impact on these activities from the forest removal and wind farm construction.

³³ Forestry Commission Scotland (2009). Scottish Government's Policy on Control of Woodland Removal. Available at: [http://www.forestry.gov.uk/pdf/fcfc125.pdf/\\$FILE/fcfc125.pdf](http://www.forestry.gov.uk/pdf/fcfc125.pdf/$FILE/fcfc125.pdf)

³⁴ UK Woodland Assurance Scheme. <http://www.ukwas.org.uk/>

10 Hydrology, Hydrogeology and Geology

Overview

- 10.1 This section will assess the potential for significant environmental effects as a result of the proposed wind farm on the hydrology, hydrogeology and geology of the site.

Existing Site Conditions

- 10.2 The proposed wind farm is situated on Cairnoch Hill, north of the Carron Valley Reservoir. Cairnoch Hill is part of the upland range between Stirling and Glasgow. The Campsie Fells are towards the south and southwest of the site, the Fintry Hills towards the west and the Garnunnock Hills and the Touch Hills towards the north.
- 10.3 Cairnoch Hill is drained by the typical forestry drainage systems and a number of small unnamed watercourses. The southern hill slopes drain towards Carron Valley Reservoir. Towards the north-east small watercourses discharge into the Earl's Burn which confluences with the River Carron downstream of Carron Valley Reservoir. The River Carron discharges into the Firth of Forth near Grangemouth. The north-western hill slopes drain via an unnamed burn to the Endrick Water. The Endrick Water flows west and discharges into Loch Lomond near Balmaha.

Legislation, Policy and Guidance

- 10.4 The Hydrology, Hydrogeology and Geology assessment will be conducted in accordance with the following legislation, policies and guidelines:
- The Water Framework Directive (2000/60/EC) (WFD);
 - Water Environment and Water Services (Scotland) Act 2003;
 - Dangerous Substances Directive (2006/11/EC);
 - Freshwater Fish Directive (2006/44/EC);
 - The Water Environment (Controlled Activities) (Scotland) Regulations 2011;
 - Scottish Planning Policy 2010;
 - PAN 61 Planning and Sustainable Urban Drainage Systems;
 - PAN 79 Water and Drainage;
 - SEPA Controlled Activities Regulations: A Practical Guide;
 - SEPA Policy No. 19: Groundwater Protection Policy for Scotland v3 (November 2009);
 - SEPA Policy No. 26: Policy on the Culverting of Watercourses;
 - SEPA Pollution Prevention Guidelines as relevant;
 - SEPA Position Statement PS-06-02 Culverting of Watercourses;

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- SEPA Position Statement - Developments on Peat, February 2010;
- Scottish Executive: Peat Landslide Hazard and Risk Assessments; Best Practice Guide for Proposed Electricity Generation Developments (2006);
- Scottish Renewables, SNH, SEPA and Forestry Commission Scotland: Good Practice During Windfarm Construction (2010);
- Forestry Commission Forests & Water Guidelines, Fourth Edition;
- Scottish Executive (2000) River Crossings and Migratory Fish: Design Guidance. A Consultation Paper;
- CIRIA C502 Environmental Good Practice on Site (2002);
- CIRIA C515 Groundwater Control – Design and Practice;
- CIRIA C697 The SUDS Manual (2007);
- CIRIA C532 Control of Water Pollution from Construction Sites;
- CIRIA C648 Control of Water Pollution from Linear Construction Projects; and
- CIRIA C689 Culvert Design and Operation Guide (2010).

Baseline Assessment

10.5 In order to establish the existing hydrology, hydrogeology and geology at the site, an initial desktop information gathering exercise will be carried out followed by site surveys, in order to verify the following information:

- location and condition of all watercourses and associated catchment areas;
- site drainage patterns;
- location of springs and flushes;
- details of local aquifers and groundwater;
- location and nature of water abstractions including public and private water supplies;
- existing water quality onsite and downstream of the development;
- freshwater ecology including fisheries onsite and downstream of the development;
- site geological conditions;
- soil associations and distribution onsite, including identification of any areas of peat; and
- identification of areas vulnerable to erosion or sediment deposition.

10.6 Information sources will include but are not restricted to:

- Ordnance Survey (OS) digital mapping;

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- NextMap digital terrain model;
 - water abstraction data from the SEPA, Scottish Water and landowners;
 - Geological Maps (Solid and Drift); and
 - British Geological Survey (BGS) Geo-Data Index.
- 10.7 Consultation will be carried out with SEPA, Stirling Council and Scottish Water as appropriate to agree assessment methodologies and mitigation and to identify any relevant data available.
- 10.8 This information will be mapped and the results used to inform the constraints plan and development of the proposed layout.
- 10.9 A comprehensive peat depth study will be completed as part of the EIA, and used to inform the scheme design in order to minimise peat disturbance and to avoid areas of deep peat as far as possible.

Proposed Assessment Methodology

- 10.10 Following establishment of baseline conditions, an assessment of the potential effects associated with construction, operation and decommissioning of the proposed wind farm will be carried out. This will follow the established source-pathway-receptor approach, and effects will be assessed as being either not significant or of minor, moderate or major significance. Potential effects include:
- hydrological change, including possible disturbance and modification of watercourses, existing drainage patterns, and groundwater recharge and flows;
 - sediment or chemical pollution of watercourses;
 - interruption or disturbance of public or private water supplies; and
 - effects on freshwater ecology due to pollution, obstruction of watercourses, or changes in the hydrological regime.
- 10.11 In addition, the ES will assess the potential for flood risk and will incorporate, where appropriate, sustainable drainage principles with a view to minimising the potential risk of flooding at the development site and preventing the development itself from causing flooding, groundwater or watercourse pollution.

Potential Mitigation Measures

- 10.12 Mitigation measures include inbuilt mitigation such as the design buffer zones around watercourses and other hydrological features identified above, and are also likely to include effective management and control of on-site activities during each phase of the development (construction, operation and decommissioning).
- 10.13 Mitigation will be suggested in line with, but not limited to, the following documents:
- SEPA Pollution Prevention Guidelines;
 - Forestry Commission Forests and Water Guidelines;
 - CIRIA C650 Environmental Good Practice on Site;

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- CIRIA C532, Control of water pollution from construction sites;
 - CIRIA C648, Control of water pollution from linear construction projects. Technical guidance; and
 - Controlled Activities Regulations (CAR).
- 10.14 Examples of mitigation measures likely to be employed during construction might include:
- discharge of sediment-laden water to grass plots, settlement ponds, or filter systems, use of silt traps and covering of exposed ground to avoid pollution of watercourses from sediment laden runoff; and
 - storage of fuel and chemicals in appropriately bunded tanks.
- 10.15 Method statements for activities identified as having potential to affect the water environment will be developed in consultation with SEPA.
- 10.16 If necessary, groundwater and surface water monitoring programs will be established to determine baseline conditions and monitor any change in water quality during construction, operation and decommissioning.
- 10.17 Sustainable drainage principles will be incorporated in the design of an outline drainage scheme. Typical solutions relevant to wind farms include swales, infiltration trenches and permeable surfaces. These can be used to attenuate rates of runoff for water purification benefits.
- 10.18 Mitigation of any construction, operation and decommissioning effects identified on ground water and surface water including public and private water supplies will be specified.

11 Noise

Overview

- 11.1 This chapter will assess the potential construction and operational noise effects of the proposed wind farm on the residents of nearby dwellings. The assessment will consider both the wind farm's construction and operation and also the likely effects of its decommissioning.

Legislation, Policy and Guidance

- 11.2 The noise assessment will be undertaken with reference to:
- Control of Pollution Act 1974 (as amended) (CoPA);
 - PAN 01/2011 and Technical Advice Note Assessment of Noise;
 - Scottish web based guidance "Onshore wind turbines";
 - BS 5228: Parts 1 & 2 2009 "Code of practice for noise and vibration control on construction and open sites"; and
 - ETSU-R-97 "The Assessment and Rating of Noise from Wind Farms". This provides a framework for the assessment and rating of noise from wind turbine installations and has become the accepted standard for assessing wind farm developments in the UK. The methodology will therefore be adopted for this assessment. In addition, the subsequent refinements to ETSU-R-97 methodology as described in the March/April 2009 issue of Acoustics Bulletin, published by the Institute of Acoustics (IoA) will be followed.

Proposed Assessment Methodology

- 11.3 The following outline methodology is proposed:

Operational Noise

- Consult with Stirling Council to propose and agree a scope of works for the assessment. This will include agreeing noise monitoring locations, proposing ETSU-R-97 fixed daytime noise limits and agreeing the approach for the construction noise and vibration assessment. A noise contour map will be produced which will assist in the consultation process.
- Undertake baseline noise surveys at selected nearby noise sensitive receptors and analyse measured wind speeds for a period to be agreed with Stirling Council. There are a number of isolated properties within the proximity of the proposed wind farm site which have the potential to experience noise effects of the proposed wind turbine subject to the final layout design. The following properties are therefore proposed as locations for baseline noise monitoring:
 - Residential property at Todholes or Gartcarron;

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- Residential property at Cringate or Easter Clingate;
 - Residential property at Craigannet or Easterton; and
 - Other locations that may be considered as a result of the consultation process.
- Calculate corrections to the measured wind speed data to account for wind shear, and derive 10 m height standardised wind speeds. PfR intends to erect a temporary anemometry mast to a height of 70 m in order to obtain accurate wind speed data to be taken into account in the noise assessment.
 - Obtain candidate turbine manufacturer's measured/warranted/guaranteed noise emission data.
 - Predict noise levels at each receptor using a recognised computer model that implements the calculation method specified by ISO9613: Acoustics – Attenuation of Sound During Propagation Outdoors.
 - Reference measured noise levels and turbine noise emission data to derived 10 m height wind speeds.
 - Compare predicted levels with ETSU-R-97 noise limits.
 - Identify any necessary mitigation measures.

Construction and Decommissioning

- 11.4 Noise from construction operations will be predicted in accordance with BS5228:2009-1 "Code of practice for noise and vibration control on construction and open sites" which provides prediction methods and significance thresholds for use in EIA. Potential noise effects from decommissioning of the site will also be assessed. Subject to agreement with Stirling Council, the assessment of construction and decommissioning effects will be undertaken qualitatively and to reflect the reasonable worst case situation.

Potential Mitigation Measures

- 11.5 If it is predicted that noise from the wind turbine development has the potential to exceed agreed noise criteria at sensitive receptors during the construction, operation or decommissioning phases of the project, a range of mitigation measures will be considered. Potential mitigation for construction and decommissioning periods may include control of construction hours, modification of construction techniques, etc. Measures to mitigate the impact of operational noise may include changing the turbine layout through iterative design or choice of turbines.

Potential Cumulative Effects

- 11.6 An assessment of cumulative effects will also be undertaken taking into consideration the noise generated by turbines at the adjacent wind farms. A likely radius of 5-8 km will be used for the cumulative effects assessment for other wind farms which are either operational, under construction, consented or the subject of a full planning application.

12 Access and Transportation

Overview

- 12.1 This chapter will assess the potential environmental effects resulting from traffic and transport on the road network associated with the construction, operation and decommissioning of the proposed wind farm.

Site Access

- 12.2 In order to achieve access to the site, internal road tracks will be constructed and will join with the existing B818 which routes west to east and joins with the A872 at Stoneywood, which in turn routes onto the wider road network.
- 12.3 Abnormal turbine loads will be transported to the site via the M9, the A872 and the B818.
- 12.4 It is likely that turbine parts will be delivered by sea to Grangemouth Port and transported to site via the M9, the A872 and the B818.

Proposed Methodology

- 12.5 A full assessment of the traffic and transport implications of the construction, operation and decommissioning phases of the proposed wind farm will be undertaken, in consultation with the Roads Department of Stirling Council, and with Transport Scotland. This will:
- provide details of proposed access routes to the site, particularly for abnormal loads such as those associated with the transportation of turbine components;
 - demonstrate the ability of these routes to accommodate all large loads through the preparation of swept path analyses;
 - identify existing (baseline) traffic flows on these routes;
 - identify the increase in traffic numbers resulting from each phase of the project;
 - • assess the increases as a percentage of baseline flows against criteria derived from recognised guidance³⁵;
 - identify potential environmental effects arising as a result of the increased traffic; and
 - where necessary, propose mitigation measures to manage the increased traffic in order to minimise the resulting environmental effects, including an outline traffic management plan.
- 12.6 Current guidance for assessing the environmental effects of road traffic is set out in 'Guidelines for the Environmental Assessment of Road Traffic, Guidance Note No. 1', published by the Institute of Environmental Management and Assessment (IEMA) in 1993.

³⁵ Institute of Environmental Assessment: Guidance Notes No.1 Guidelines for the Environmental Assessment of Road Traffic, 1993 unless superseded

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- 12.7 The guidelines are based upon the forecast increase in traffic on a link resulting from the proposed development and sets out thresholds upon which more detailed assessments should be undertaken. The guidelines suggest that more detailed assessments should be undertaken for links where traffic flows, or the number of HGVs, are predicted to increase by more than 30% as a result of the proposed development. The guidelines suggest that in sensitive locations a 10% threshold should be used as a basis for undertaking assessments in more detail.
- 12.8 Table 2.1 of the Guidelines goes on to state that where more detailed assessments are required the following should be considered:
- noise;
 - vibration;
 - visual effects;
 - severance;
 - driver delay;
 - pedestrian delay;
 - pedestrian amenity;
 - accidents and safety;
 - hazardous loads;
 - air pollution; and
 - dust and dirt.
- 12.9 The environmental effect of road traffic resulting from the proposals will be assessed upon the local and wider road network in accordance with the above IEMA guidelines. Given the rural nature of the local area, it is considered that increases in traffic flow will not be sensitive and it is therefore appropriate to assess the forecast change in traffic flow resulting from the proposals against the 30% threshold. If any areas on the wider network route through sensitive areas, then the 10% threshold will be applied.
- 12.10 Assessments will be undertaken across a typical working day. On any link where increases in traffic flow are in excess of the threshold a detailed assessment will be undertaken in accordance with Table 2.1 of the Guidelines.
- 12.11 Stirling Police, Transport Scotland and Stirling Council will continue to be consulted during the EIA process.
- 12.12 It is likely that turbine parts will be delivered by sea to Grangemouth Port and transported to site via the M9, the A872 and the B818.
- 12.13 In terms of accessing the site itself, this is likely to be direct from the B818.
- 12.14 Access and egress solutions will be subject to a full swept path analysis and further discussions with Stirling Council and Transport Scotland as appropriate.

13 Socio-Economics, Including Tourism, Recreation and Land Use

Overview

- 13.1 An assessment will be carried out to identify the effects of the proposed wind farm on the socio-economics, land use and tourism interests in Stirling. A baseline study will be completed to identify:
- the socio-economic structure in Stirling;
 - tourist attractions in the vicinity of the site to include, amongst others, the Carron Valley Fishery, local shops, restaurant and accommodation facilities including bed and breakfasts etc;
 - proximity of the site to areas of recreational use, to include existing Carron Valley recreation on the national Forest Estate, car parking, toilet public rights of way, footpaths and cycle routes; and
 - the land use of the area.
- 13.2 Where direct or indirect effects are deemed significant under the EIA Regulations, mitigation measures will be proposed. These may include appropriate placement of access tracks and ancillary infrastructure; utilisation of existing tracks where feasible to reduce the area of land take and the production of a Traffic Management Plan during construction to effectively manage road users (motorists, walkers and cyclists) in the vicinity of the development. Additional facilities that enhance provision for recreational activities, particularly at Carron Valley on the National Forest Estate will also be considered, with a view to facilitating multi use under the terms of the Scottish Outdoor Access Code.
- 13.3 The proposed wind farm could also have the potential to influence the local economy of the area. In most cases, wind farms provide employment opportunities for local suppliers with relevant construction and maintenance experience during the construction and operational phases of the development. An assessment with regard to socio-economic aspects of the development will focus on short and long term employment opportunities.

14 Shadow Flicker

Overview

14.1 Shadow flicker may occur under certain combinations of geographical position and time of day, when the sun passes behind the rotors of a wind turbine and casts a shadow over neighbouring properties. As the blades rotate, the shadow flicks on and off, an effect known as shadow flicker. The effect occurs inside buildings, where the flicker appears through a window opening. The likelihood and duration of the effect depends upon the:

- direction of the property relative to the turbine(s): in the UK, only properties within 130 degrees either side of north relative to the turbines are affected, as turbines do not cast long shadows on their southern side;
- distance from turbine(s): the further the observer from the turbine, the less pronounced the effect (flicker effects have been proven to only occur within ten rotor diameters of a turbine). Scottish web based guidance “Onshore wind turbines” suggests that, as a general rule, shadow flicker effects should not occur beyond a separation distance of 10 rotor diameters;
- turbine height and rotor diameter;
- time of year and day; and
- weather conditions (i.e. overcast weather reduces the likelihood of effects occurring).

14.2 With the above in mind, and taking into account the location of existing residential properties, it is considered likely that shadow flicker effects can be avoided altogether through appropriate turbine siting to prevent any residential properties from falling within 10 rotor diameters and 130 degrees either side of north of any proposed turbine. This being the case, the assessment of shadow flicker effects will be scoped out of the full EIA and a dedicated ES chapter will not be presented. In this case, the design evolution will be expressly discussed in relation to its role in avoiding shadow flicker effects. If this cannot be avoided absolutely through turbine siting, then the methodology below will be followed and a dedicated ES chapter will be presented.

Proposed Methodology

14.3 If required, an assessment of the impact of shadow flicker will be carried out at residential properties located within 10 rotor diameters and 130 degrees either side of north of the proposed wind turbine locations.

14.4 Shadow flicker will be investigated at these properties using Resoft Windfarm 4.1.2.3 software³⁶ (or a subsequent version). This software creates a mathematical model of the proposed wind farm, the surrounding area and the location of properties. The software calculates the dates and times when the shadow of a wind turbine rotor may potentially cast a shadow onto a window.

³⁶WindFarm 4, Resoft Ltd, 2010

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- 14.5 The software models each façade of the receptors with windows facing the development, rather than individual windows. This technique provides a more comprehensible assessment.
- 14.6 A site visit will be undertaken to verify the location of sensitive receptors.
- 14.7 The assessment will include an analysis of the potential shadow flicker effects and potential cumulative effects on the residents of nearby dwellings and will propose mitigation through for example curtailing of turbines in relevant conditions.
- 14.8 However, if potential shadow flicker impacts can be avoided through the wind farm layout, it is not proposed to undertake a standalone shadow flicker assessment or present a chapter in the ES.

15 Other Considerations

Overview

- 15.1 The potential effects of the proposed wind farm on telecommunications, aviation, waste management, air and climate, ice throw and safety will be assessed.
- 15.2 Inappropriately sited wind turbines have the potential to interfere with aviation and telecommunications, including broadcast transmissions and scanning telemetry. To ensure the proposed wind farm does not cause problems with communication or aviation networks, consultations with television, radio, mobile phone and airport operators will be undertaken. The results of this consultation will determine if more detailed assessment of the wind farm on aviation and telecommunications is required.
- 15.3 A lifecycle analysis and carbon displacement assessment will be undertaken. It will involve a systematic assessment of fossil fuel displacement, quantifying the gains over the life of the project against releases of carbon dioxide during construction, including loss of peat bog and construction of road/tracks, turbine bases and other infrastructure.
- 15.4 Further investigation will be undertaken during the EIA process to address any potential issues relating to calculating potential carbon losses³⁷, waste management, ice throw and safety.

³⁷ <http://www.scotland.gov.uk/Topics/Business-Industry/Energy/Energy-sources/19185/17852-1/CSavings>

Figures

Figure 1	Site Location Plan
Figure 2	Site Boundary
Figure 3	Designations Map
Figure 4	Landscape Designations Map
Figure 5	ZTV/Potential Viewpoint Locations (35 km)
Figure 6	Vantage Point Survey Location

Appendix A

List of Proposed Consultees

Statutory Consultees

Stirling Council
Scottish Natural Heritage
Scottish Environment Protection Agency
Scottish Water
Historic Scotland (as a body designated by statutory provision)

Community Councils

Carron Valley & District Community Council
Gargunnoch Community Council
Fintry Community Council

Other Consultees

Arqiva
BAA
BBC
Botanical Society of the British Isles (BSBI)
British Bryological Society
British Horse Society
BT
Buglife
Cables and Wireless Worldwide
Central Scotland Bat Group
Civil Aviation Authority
CSS Spectrum Management Services Ltd
Forestry Commission Scotland
JRC
Loch Lomond Fisheries Trust
Ministry of Defence
National Air Traffic Authorities (NATS)
National Grid
Ofcom
Orange
Ramblers Association (Scotland)
RSPB
Scotland Gas Networks
Scottish Ambulance Service
Scottish and Southern Energy Ltd
Scottish Badgers
Scottish Enterprise
Scottish Raptor Study Group
Scottish Rights of Way and Access Society (ScotWays)
Scottish Wildlife Trust
Stirling Police
Sustrans
The Scottish Ornithologist Club (SOC)
The Scottish Gliding Centre
Transport Scotland
Visit Scotland
Vodafone