Melness Community Wind Energy Project

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Melness Community Wind Energy Project

Technical Description and Environmental Studies

Report OSE/2525

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Volume 1: Technical Description and Environmental Studies

This report is presented in three volumes; Volume 1 contains the non-technical summary, the wind turbine technical description, the visual impact assessment, reports on archaeology, transport impacts, electromagnetic Interference, noise and shadow flicker impact, an assessment of possible impacts upon geological and hydrological features and a report on the socio-economic impact. Volume 2 contains the ecology report and Volume 3 has the Site Drawings, Maps and Photomontage Images.

Section 1 Non-technical Summary and Project Description

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Section 6 Geology, Superficial Deposits and Hydrology

Section 7 Environmental Health Impact Assessment

Section 8 Traffic and Transportation

Section 9 Socio-economics

Volume 2: Section 4 Ecology

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Volume 3: Site Drawings, Maps and Photomontage Images
Section 1

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Summary

The Melness Community Wind Energy Project is a locally owned community windfarm being developed by Melness Crofters Estate Ltd, with co-ordination by Mr Mark Brennan. Orkney Sustainable Energy have been contracted to design the project and complete environmental studies on behalf of the estate.

It is proposed that up to three wind turbines be installed on land belonging to the Estate, between the communities of Melness, Midtown, Talmine and West Strathan, to the west of the Kyle of Tongue. The preliminary turbine chosen for the development is the Vestas V52 850kW, manufactured at the Machrihanish factory in Campbelltown. The turbine model may change, subject to availability, however for the purposes of this report the Vestas V52 has been used to show a typical machine for the development. The electricity generated will be traded to meet the requirements of the Renewables Order (Scotland) 2002.

The concept of a locally owned, community wind energy development was initiated by Melness Crofters Estate. Following approval from the Ministry of Defence, approaches were made to Tongue and Melness Community Council, Highland Council Planning and Development, Historic Scotland, the Royal Society for the Protection of Birds, Scottish Natural Heritage, the Scottish Environment Protection Agency, Civil Aviation Authority, National Air Traffic Services, the Radiocommunications Agency the Scottish Executive Communications Department and the Northern Constabulary. No objections have been raised by these agencies, although the SNH did indicate that there were concerns regarding the scale of the turbines originally proposed.

As a result of the various design studies, the project was reduced in scale from 6MW to 2.5MW, with the project designed to avoid shadow impact and to have minimal noise impact upon neighbours. Landscape and visual impact studies have been completed, and it was recommended that the turbines should present a simple, clear relationship to the landform and other existing features. Ecological impact has been considered in depth, including a habitat survey, a mammal survey, a breeding bird survey, and an assessment of any protected species near the site. Detailed assessment on the archaeology of the site and surrounding area has been completed and analysis of the development includes a geological and hydrogeological survey, extensive photomontage modelling, a description of the wind turbines, detailed maps of the development and a description of the construction process.

It was concluded that a small wind energy project is feasible for this part of Sutherland, with low impacts upon ecology and the local community. Strong social and economic benefits can be achieved by constructing the Melness project, along with the associated climate change benefits resulting from renewable energy production.
1 Introduction

Sutherland has the potential to become an important area for wind energy development; a number of projects have been proposed for the county, primarily as large scale windfarms on hilltop and moorland locations. The Melness project is an alternative to this pattern of development, and has been designed as a small-scale cluster of wind turbines to avoid dominating the landscape, while providing strong economic benefits necessary for the economic security of the local community. The project shall also provide a further contribution to the development of clean energy as encompassed within government policy.

Orkney Sustainable Energy were approached by representatives of the community in the spring of 2004, leading to a preliminary design and initial consultation. Once the MoD, the Civil Aviation Authority and Inverness Airport confirmed that they had no objections, detailed ecological and environmental studies began, resulting in the detailed design and development of a three wind turbine project. Melness Crofters Estate have been leading the development, with the communities of Tongue and Melness fully consulted throughout the process.

The Melness project has been designed around the Vestas V52 850kW wind turbine, however the actual turbine model may alter nearer the time of construction; the site layout and all modelling has used a 49m turbine tower height and a maximum of 31m blade length. The nearest 33 kV electricity transmission line is located on the Tongue side of the Kyle of Tongue, with underground cabling proposed to link to a switchgear building and then new overhead wires on wooden poles used to connect the project to the National Grid.

The average wind speed on the Melness site is predicted to be around 7.6 metres per second (m/s), compared with 10 m/s predicted at the summits of Ben Hutig and Ben Loyal. This lower windspeed is due to the lower elevation of the site, chosen with the aim of reducing visual impact. Based on the manufacturers predictions, three 850kW wind turbines on Melness will produce around 8.4 GWh of electricity per annum, equivalent to the annual domestic requirements of 1500 households (Boardman et al 1997).

Electricity produced from renewable resources avoids the emission of pollution, and the production of 8,400 MWh is projected to avert the production of around 1000 tonnes of carbon per annum (Carbon Trust). Per head of population, the Melness project provides a very good contribution towards the Scottish Executive annual reduction target of 2,700,000 tonnes of carbon by 2010, http://www.scotland.gov.uk/Topics/Environment/Climate-Change/.
This report is presented in ten sections: Section 1 is a project description of the development, including non technical summaries of the environmental impacts, Section 2 of the report is the specification of the Vestas V52, Section 3 contains the landscape and visual impact assessment, Section 4 is the ecology report, subdivided into three parts, Section 5 is an archaeology survey, Section 6 is a geology and hydrology report, Section 7 contains the results of noise and shadow flicker assessment, Section 8 describes impact upon the road network and the construction of the site track, and Section 9 discusses socio-economic issues. Volume 2 of the report contains the site plans and drawings, maps, wireframe images and photomontages.

![Site Location and layout](image_url)
2 Development description

This part of the report describes the activities involved in delivering and constructing the wind energy project at Melness. The activities considered include civil engineering, transport of the equipment, installation of the wind turbines, operation and maintenance of the project and eventual decommissioning of the turbines.

2.1 Proposed location

The site for the development is on the plateau behind the Talmie and Melness communities, in the Kyle of Tongue area of Sutherland. Three wind turbines are proposed for an area of partially drained moorland, with the positions chosen to be on hard, stable underlying rock, figure 2.1. The possible grid references are as listed below, Table 2.1, with a note of the base elevation and overall height of each installation above sea level, including maximum wind turbine blade tip height. There will be a requirement for an external switchgear housing with approximate dimensions of 5m by 3m by 3m, located next to the overhead cables.

The set of overhead wires travelling across Melness is an 11kV system, and is the main supply for all farms and domestic properties in the area. The project will require a new 33kV system, with wires mounted on wooden poles between the switchgear building and the point of connection. All site cabling will be underground. The switchgear house will consist of a building designed to resemble a small garage or outbuilding, finished to match nearby buildings, and is located within a fenced enclosure hidden below a rise in the land.

<table>
<thead>
<tr>
<th>Turbine</th>
<th>Easting</th>
<th>Northing</th>
<th>Position elevation</th>
<th>Tower top elevation</th>
<th>Maximum elevation</th>
</tr>
</thead>
<tbody>
<tr>
<td>WT1</td>
<td>E256740</td>
<td>N962420</td>
<td>120m</td>
<td>169m</td>
<td>200m</td>
</tr>
<tr>
<td>WT2</td>
<td>E256725</td>
<td>N962090</td>
<td>123m</td>
<td>172m</td>
<td>203m</td>
</tr>
<tr>
<td>WT3</td>
<td>E256710</td>
<td>N961760</td>
<td>121m</td>
<td>170m</td>
<td>201m</td>
</tr>
<tr>
<td>Switchgear</td>
<td>E257750</td>
<td>N961250</td>
<td>73m</td>
<td>--</td>
<td>76m</td>
</tr>
<tr>
<td>building</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Table 2.1 Wind turbine locations and heights
Figure 2.1 – Three wind turbine layout, with switchgear building and intended track position
2.2 Wind assessment

Extensive wind measurement has not been conducted at the initial stages of the Melness project. A temporary mast may be erected for a period of one year to quantify annual mean wind speed, turbulence intensity, air flow roughness and to confirm that separation of wind flow does not occur. This mast will be the subject of a separate planning application.

![Windspeed Output In Grid Form](image)

Using NOABL, the national wind speed database, [www.bwea.com](http://www.bwea.com), the square kilometre containing the Melness turbines has an annual mean windspeed of 7.6 ms\(^{-1}\) at a height of 45 m above ground level, figure 2.2. At this site a Vestas V52 wind turbine will produce an annual energy yield of approximately 2800 MWh (V52 power curve), equivalent to that consumed by around 500 households in one year, with three turbines producing 8,400 MWh.

2.3 Carbon emission avoidance

In the UK electricity is mainly produced by fossil fuel power stations, and in 2005 the increasing cost of gas to the UK has increased the use of coal, with a corresponding increase in the volume of greenhouse gas emissions. CO\(_2\) emissions have been identified as the primary cause of climate change, sulphur dioxide and nitrogen oxide emissions are a cause of acid rain. Generation of this electricity by a mixture of conventional fossil fuels would result in pollution at a rate of 0.43 kg CO\(_2\) per kWh of generation (Carbon Trust); a three turbine development at Melness will therefore avoid the production of the following emissions (Boyle 1996):

- CO\(_2\): 3,600 tonnes per annum
- SO\(_2\): 135 to 200 tonnes per annum
- NO\(_x\): 30 to 40 tonnes per annum
2.4 Consultation and alternative locations

The proposed layout of the project has evolved from consultation with an extensive list of statutory and local organisations. From an initial proposal of three 2MW wind turbines, the layout and scale of the project has evolved to become three 850kW wind turbines, providing renewable energy equivalent to that used by the Melness and Tongue communities, while at the same time accommodating environmental and social constraints.

Consultation on the proposed wind farm has been favourable. In summary, there were no objections from the statutory consultees, however there were initial concerns from SNH on the scale of the turbines. SNH also provided advice on nearby Special Protection Areas (SPA), candidate Special Areas of Conservation (cSAC) and Sites of Special Scientific Interest (SSSI), and indicated that full ornithological and habitat survey should be completed, along with a visual and landscape assessment. The ecological studies have been undertaken, encompassing a vantage point survey, breeding bird surveys covering waders, raptors and divers, an extensive geese survey and assessment of impact upon mammals and vegetation. A landscape architect has completed a full landscape and visual impact assessment and a qualified archaeologist has completed the recommended archaeology assessment.

The following organisations have been consulted at various stages of the development:

- Highland Council, Planning and Development
- Tongue and Melness Community Council
- Historic Scotland, Edinburgh
- RSPB – historic bird records
- SNH
- SEPA
- Sutherland Plant Recorder
- Local Raptor Study Group
- Hope Estate Gamekeeper
- Orkney Bryophyte Recorder - mosses and liverworts
- Highlands and Islands Airports
- Ministry of Defence, Sutton Coldfield
- Civil Aviation Authority, London
- National Air Traffic Services, London
- Ofcom, the radiocommunications agency, London
- Scottish Executive, Communications and Information Services Division, Edinburgh
- Northern Constabulary, radiocommunications, Inverness
Wind energy development has been encouraged in Sutherland, however there are constraints to be considered. The wind turbines should not be a nuisance to neighbours and should be far enough away from properties to minimise noise and shadow effects; the turbines at this location are a minimum of 1.1km from neighbours. Other constraints considered are impact upon ecological concerns, mainly birds, and to ensure that any archaeological concerns are identified and impact avoided.

It is acknowledged that the Kyle of Tongue is a National Scenic Area, and that Ben Hutig and A’Mhoine to the west of the site are part of the Caithness and Sutherland Peatlands SPA / cSAC, with the Ben Hutig SSSI around 1.5km from the turbine locations. To the east the nearest SPA is Eilean Nan Ron SSSI, part of the North Sutherland Coastal Islands SPA, 7km to the north east of the site. The general principal used when identifying the site was to maximise the distance from all designated or protected areas, and then to conduct detailed ecological assessment of the chosen area. The section on ecological assessment discusses the results of the surveys in detail.

Three archaeological surveys were conducted, resulting in a change to the proposed access route to avoid scheduled and recorded monuments. The section on archaeology discusses consultation, the site surveys and the structures discovered.

The Radiocommunications Agency, now Ofcom, indicated that British Telecom have a major communications link that travels across the site, and following consultation with BT, the turbine positions were adjusted to avoid impact; a 300m wide corridor has been allowed between turbines 2 and 3, figure 2.3.

The Ministry of Defence was consulted using the standard Safeguarding procedure. It has been confirmed that the turbine site is outwith Tactical Low Flying Area 14T (LFA 14T) that covers much of northern Scotland, and they do not therefore object to the project. Figure 2.4 shows the location of LFA 14T with respect to the windfarm, along with the location of the designated and protected areas in North Sutherland and Caithness.
Figure 2.4 – Military and Environmental Constraints

- Site of Special Scientific Interest
- Special Protection Area
- Special Area of Conservation
- National Nature reserve
- National Scenic Area
- Kyle of Tongue Designated Shellfish Waters
- Marine Consultation Area
- Tactical Training Area LFA 14T
2.5 *Project design statement*

The Melness Community Wind Energy Project has been designed by identifying all ecological, social and technical constraints in the area, then completing a range of detailed environmental studies to ensure that the site was generally suitable for a wind energy development. Through an iterative process the turbine positions were then adjusted to produce an optimum layout, considering the view from each of 23 locations around the site. Given the proximity of the Kyle of Tongue National Scenic Area, the aesthetics of the development have taken priority over optimum energy production, and the turbines are not located on the highest land.

The site is a plateau known as Blar nan Lian, to the west of Melness House, in an area identified to have a hard stone base with a shallow and largely denuded peat covering. The wind turbines will be positioned at an elevation of 120m, spaced 1.1km away from the nearest neighbours, in a linear layout. The wind turbine locations consist of areas of hardstanding nominally 25m by 40m, with the turbine foundations located below ground level. A temporary trench will be excavated next to the track to accommodate the high voltage and telecommunications cabling. The area of hardstanding is required for the construction and assembly process. The cabling from the site is all underground, connecting to the National Grid at a switchgear building adjacent to the access track, with this building located behind a rise in the land.

To avoid shadow flicker nuisance, planning guidelines recommended that turbines should be a minimum of 10 rotor diameters from neighbouring properties, in this case 620m (PAN 45). This has been achieved with a large margin. Noise from wind turbines disperses naturally with distance, and will reach background level at around 800m. As a consequence of the large clearances to neighbouring properties, noise emissions and shadow flicker impacts are minimal at the Melness site, as detailed in Section 7 of the report.

The layout has been chosen to reflect linear features in the landscape, namely Ben Hutig when viewed from the south and east, the long ribbon of the Midtown and Talmine communities, the associated fields between the village and the Kyle of Tongue, and to follow the alignment of the Kyle itself. By ensuring a north – south alignment and equal spacing between turbines, overlapping rotors are avoided and the view of the site appears balanced from all viewpoints. Figure 2.5 is one of the project photomontages, clearly showing the linear nature of the landscape.
Figure 2.5 – View of Melness from Ben Tongue

2.6 Wind turbine selection

A range of alternative models has been considered, figure 2.6. The community indicated that the project should attempt to maximise generation within the identified constraints, with transport access and grid capacity the most important issues.

Figure 2.6 – Alternative wind turbines

Enercon E30

The Enercon E30 is one of the new generation wind turbines that do not use a gearbox; a specially constructed multipole generator is built into the wind turbine hub. Rotor speed is fully variable between 18 and 46 rpm, the rotor diameter is 30m and the tower height is 44m. The E30 has been specifically designed for remote and isolated sites, and areas with high average windspeeds; cut-out wind speed can be set at 34 m/s, 25% higher than most other wind turbines. An important feature of the E30 is the adaptive power output designed for
areas with a weak grid; should the grid voltage levels be seen to rise at times of low demand, the E30 automatically reduces the power output to reduce fluctuations.

**Vestas V52 and V66**

Vestas has a range of machines available rated from 600 kW to 3 MW. The Vestas V52 is rated at 850 kW and the V66 is rated at 1.75MW; both are manufactured in Scotland. These machines are an upwind design, with 52m and 66m diameter rotors respectively. Tower height for the V52 is 44m or 49m and is 60m for the V66. Noise levels are low, and can be set at 100 dB(A) at a windspeed of 8 m/s. Both turbines are IEC class 1A and can be recommended for sites where the annual mean windspeed reaches 10 m/s. They are recommended for locations requiring low noise emissions and good power quality, and the V52 was chosen for the Burray Community Wind Energy Project in Orkney.

**RE Power 2MW**

RE Power are relatively new manufacturers, and are concentrating on the large, offshore market. By using advanced technology, they have produced machines which are relatively more efficient for the size of the rotor, with a 35m blade rather than the more typical 40 to 42m. This machine is an upwind design, with a 70m diameter rotor, a tower height of 65m, variable speed operation of 12 to 19 rpm and is manufactured by Peter Brotherhood Ltd, in Peterborough, England.

**Selection process**

Each wind turbine has its own specific application. The Enercon E30 is a very robust class 1 turbine that has been developed for extreme environments. On site assembly is relatively easy, with a local crane able to lift the main turbine parts, however the turbine is relatively expensive for the energy produced. The Vestas V52 and V66 are manufactured in Scotland, are robust and have very similar installed costs per kW. The RE Power turbine is the most cost effective for installed cost per kW, however delivery of the larger turbines is difficult in this part of Scotland, with major restrictions at the Strathnaver Bridge at Bettyhill, and at the crossroads in the middle of Tongue village. Given the need avoid major road construction, the requirement of reduced visual impact, and the need to ensure minimal influence to the electricity network, the Vestas V52 was identified as being the most appropriate, figure 2.7. Note that turbine availability may change at the time of construction, and accordingly the planning application has allowed for a blade length of 31m and a tower height of 49m, giving a maximum overall height of 80m.
2.7 Equipment specification

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
</tr>
</thead>
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<td></td>
</tr>
<tr>
<td>Structure:</td>
<td></td>
</tr>
<tr>
<td>Colour of machine</td>
<td>Light grey, matt finish, RAL 7035</td>
</tr>
<tr>
<td>Tower type</td>
<td>Tubular conical steel</td>
</tr>
<tr>
<td>Tower base diameter</td>
<td>4 m</td>
</tr>
<tr>
<td>Hub height</td>
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</tr>
<tr>
<td>Total height</td>
<td>75 m</td>
</tr>
<tr>
<td>Rotor:</td>
<td></td>
</tr>
<tr>
<td>Number of blades</td>
<td>3</td>
</tr>
<tr>
<td>Blade material</td>
<td>GRP monocoque</td>
</tr>
<tr>
<td>Rotor diameter</td>
<td>52 m</td>
</tr>
<tr>
<td>Swept rotor area</td>
<td>2,860 m²</td>
</tr>
<tr>
<td>Rotational speed</td>
<td>Variable 14 - 31 rpm</td>
</tr>
<tr>
<td><strong>Switchgear building</strong></td>
<td></td>
</tr>
<tr>
<td>Dimensions</td>
<td>Rectangular building 3 m by 5 m</td>
</tr>
<tr>
<td>Material</td>
<td>Concrete block</td>
</tr>
<tr>
<td>Finish</td>
<td>Pebble dash, to be agreed</td>
</tr>
<tr>
<td>Total height</td>
<td>3.5 m</td>
</tr>
</tbody>
</table>

Table 2.2 Main specifications
2.8 **Transportation**

Section 8 of this report contains an assessment of transportation to site, including a route survey conducted by Vestas Celtic Wind Technology Ltd, a report on a trial run undertaken using a fully extended trailer, and analysis of all corners, turns and bridges. The turbine components will be delivered by sea from the Vestas factory at Machrihanish on the west coast of Scotland to Scrabster, near Thurso then delivered by extended trailer along the A836 to Melness. The manufacturer is experienced in transportation of their wind turbines, have conducted a preliminary access route assessment, and although larger scale wind turbines may not be feasible, Vestas do not foresee any difficulties in the transportation of V52 wind turbines from Scrabster to Melness.

The Vestas V52 has a 25m long blade, while the largest tower section would be 24.5m long, and no wider than 3.3m. Maximum weight is 30T for the bottom tower section, 24T for the nacelle, and the blades weigh a total of 17T. The V52 fulfils the requirements of the Construction and Use Regulations (Department for Transport) and can be delivered to site provided the Police and the local authority are given advance notice.

Three locations were identified that required further assessment; Strathnaver Bridge near Bettyhill, the sharp turn next to the hotel in Tongue and the Melness road junction off the A838, where some work will be required to ensure long vehicles can navigate the tight turn. These locations along with the full transport route have now been surveyed and it is confirmed that access will be possible.

It was found that the longest load that can be carried is just over 30m, allowing a slightly larger turbine than originally predicted. Although a trailer of this length can cross the Strathnaver Bridge, at Tongue the vehicle may have to drive forward at the tight junction, then reverse out of the village along the A835 and across the Kyle of Tongue causeway before turning in to the Melness road.

2.9 **Roads and foundation construction summary**

The road and track material will be extracted during construction of the turbine tracks foundations and from two existing quarries in Caithness and Sutherland. Stone and concrete will be supplied locally where possible, with two suppliers identified. The foundation construction must be completed a month in advance of turbine delivery and assembly.
The site access road will begin just south of Midtown, opposite the side entrance to Melness House. There is an existing track at this location which provides access to the mill burn, which will be enlarged and improved as required, with new track sections required from Allt a’ Mhuilinn to the site. A new concrete slab bridge is to be constructed to cross the burn. The track layout has been designed to minimise visual impact where possible by following hill contours; at the initial stages the track climbs over a slight rise in the land before dropping down into a slight dip. The project design has taken advantage of this varied topography to hide the access track and the substation from almost all of the Melness community.

a. Establish the widened entrance to the site access track from the public road south of Midtown.

b. Remove all gorse growing along the existing track to Allt a’Mhuilinn. Fill and level the existing track.

c. Used crushed stone to provide hard standing, graded to match existing slopes.

d. Site office, mess, toilets and any materials storage to be sited on permanent hard standing adjacent to the location of the switchgear building.

e. The peat extracted during the construction of the track to Allt A Mhuilinn should be stored on dry ground prior to distribution on the plateau.

f. Allt A Mhuilinn shall be bridged with a beam and cast slab structure, faced with stone at the completion of the project.

g. Roadways to be constructed with crushed rock from suitable excavated foundation material, with sub-base and bottoming layers of quarried stone as required.

h. Excavate soil and peat and cast foundation block on hard strata and bedrock.

i. Roadways and hardstanding are to be unsurfaced and porous with filter strips, and will not require active drainage.

j. Reinstatement of site track - no side slopes and track to be flush with existing ground.

k. Topsoil fill - finished to merge with existing slopes and reseeded to match adjacent land. Use extracted peat to fill the historic scarring and trenches on the plateau.
2.10 Wind turbine construction programme

The detailed turbine construction programme will be issued at the time of construction, but can be summarised as follows. The components for the turbines will be delivered to site using an extending trailer. Cranes will be needed to offload from the transporters and to lift and assemble the components. A 300T telescopic crane will be required:

1. Deliver and install the transformers into foundations.
2. Erect the lower tower sections directly off the trailer onto the foundation;
3. Deliver the upper tower sections and nacelles to the site;
4. Erect the upper tower sections and nacelles;
5. Deliver three sets of blades to the site and assemble on hubs into three rotors;
6. Install rotor assemblies on the turbine nacelles.

This would be the optimum and most efficient construction sequence, though it should be recognised that the weather at the time of construction may impact upon the erection programme. Full consultation will take place with the local community to minimise disruption.

2.11 Operation and maintenance

Operations and maintenance will be under the control of the development company established by the community. Over the operational lifetime of the project the wind turbines will require periodic inspection to maintain the condition of the machinery and structures. There will be an initial period during which it is expected that fault-finding and system fine-tuning will take place on a weekly basis, leading to a once per month inspection and maintenance programme. In addition, there will be an annual service to check and inspect the blades, fastenings and oil quality. Every five years there will be an extended service and maintenance period, with every subsystem inspected, and overhaul of the turbines carried out.

The turbine gearbox is self-contained, requiring an annual inspection; an oil change should only be needed if there was sign of degradation in quality. The blade and main brake activation systems are under hydraulic control, with this oil recycled on a five-yearly sequence.
Modern wind turbines are well engineered and are designed to operate on extreme sites for over twenty years. Consequently major failure of the turbine components is not predicted during normal operating conditions and accordingly the possibility of blade or tower failure is extremely unlikely to occur. In any event the Melness Community Wind Energy Project is located over 1km from any housing and public roads, with only limited access to the site. The probability of members of public being at risk from a turbine during operations and maintenance is therefore extremely low and insignificant.

2.12 Decommissioning

The expected operational lifetime of the project is 20 to 25 years, with the structures then removed from site. The steel, other metals and oils within the structures will be recycled. The glass fibre blades are classed as standard waste and would be handled through the normal disposal system. It is proposed that the areas of stone forming the hard-standings would be removed, and the foundations peat-covered and landscaped at the end of the project. The foundations have been designed to enable this restoration work without further disturbance of peat. The new access track will be left in place, providing continuing access to crofting land and establishing an alternative non-vehicular route to the West Strathan community.
3 Socio-economic and planning issues

3.1 Community involvement

The Melness Community Wind Energy Project was initiated by Melness Crofters Estate Ltd, MCEL, and has been designed and developed to provide environmental, economic and social benefits to the whole community around the Kyle of Tongue. A renewable energy project was considered ideal for developing the viability of the community by providing sustainable economic diversification, and assessment of the area indicated that the site would be appropriate for a small-scale wind energy cluster. Orkney Sustainable Energy Ltd were retained to provide advice to the community, and have become responsible for all design, planning, consultation and environmental assessment.

3.2 Governance and sustainability

The Melness Community Wind Energy Project is a viable mechanism of diversification, and is to be locally owned and controlled. The project developers have taken an open approach to the development and have fully engaged with the community and environmental agencies; both SNH and RSPB have been fully informed with interim results from the environmental impact assessment process. By consulting at an early stage of the development and by adjusting the development to take into account sensitive habitats, birds, landscape and proximity to neighbours, the project partners have demonstrated good governance, and it is felt that the Melness project is a good example of sustainable development.

The wind energy project is economically viable and is considered to be essential for the future vitality of the community, with financial benefits accruing from electricity production. The financial returns from the development will compensate Melness Crofters Estate Ltd for the loss of land required for tracks and foundations, and the project has been structured to provide a meaningful revenue, while at the same time offering an alternative to the large scale exploitation of commercial windfarms.

3.3 National planning context

The project has been designed and planned using the recommendations and advice contained within Best Practice Guidelines for Wind Energy Developments (BWEA), NPPG 6: Renewable Energy Developments (Scottish Executive 2000), Planning Advice Notes PAN 45: Renewable Energy Technologies (Scottish Executive 2002), PAN 56: Planning and Noise (Scottish Executive 1999), PAN 58:

The overarching aim of the Scottish Executive, as detailed in the above policies and advice notes is to have a prosperous rural economy, with a stable or increasing population that is more balanced in terms of age structure, and where rural communities have reasonable access to good quality services. SPP15 and PAN73 in particular indicate that planning authorities should take a more welcoming stance to development in rural Scotland and proactively enable and help create opportunities for development in sustainable locations, and in addition rural diversification should be embraced to help businesses and farmers start new enterprises in appropriate circumstances and at an appropriate scale.

The Melness Community Wind Energy Project is a rural diversification scheme: “Rural Diversification helps to broaden the economic activity of rural areas, providing opportunity and creating a more balanced and stable economy.” (PAN73) This Advice Note goes on to further discuss the diversity of the rural economy, “There are many activities that make a valuable contribution to the rural economy that are less immediately obvious such as….quarrying, waste disposal, hydro-electric schemes and wind turbines”.

### 3.4 Local Plan context

The Tongue and Farr local plan was adopted in 1995, and considers renewable energy proposals in Section 1, General Policies; 1.41 “The Council will encourage development of alternative energy schemes where these provide economic benefits, and are environmentally acceptable.” and 1.42 “Wind power is likely to have most potential, however the need to safeguard the landscape constrains development opportunities”. The specific plans for Tongue and Melness have not considered renewable energy projects, and do not provide any locational guidance, other than a general desire to safeguard the better agricultural land.

### 3.5 Structure Plan context

The Highland Council Structure Plan considers the relevance, suitability and sustainability of renewable energy projects in the Highland area, with a key aspect of safeguarding and
enhancing the environment. This Structure Plan is founded on three principles of sustainable development, and in a local context they are (part 1.4):

- Supporting the viability of communities
- Developing a prosperous and vibrant local economy
- Safeguarding and enhancing the natural and built environment

In the context of the Melness development, these aims are realised through community empowerment, diversification of the local economy, an improvement in the quality and quantity of employment opportunities, the optimal use of renewable resources, the efficiency of energy use and improvements to the quality of air, water and land.

Wind energy proposals are examined in more detail part 2 of the Structure Plan. The plan recognises that all electricity in the Highland area is derived from renewable resources, comprising hydro and wind energy, and that this resource should be reconciled with environmental issues, section 2.12.2. It is further stated that it is important that there is a local benefit derived from meeting UK targets of non-fossil sources of energy. Policy E1 states: “The Council supports the utilisation of the region’s distributed renewable energy resource…” and “Approvals for renewable energy developments will normally be for a temporary period, tied to the lifetime of the project”.

Small scale wind energy developments are examined in section 2.12.5 of the Plan: “Small scale wind energy developments, for a single building or a community, are considered to be particularly relevant for Highland, given the remote nature of many settlements. Such applications will generally be supported”. Section 2.12.11 further examines small scale projects: “A key means by which new renewable energy projects can provide local benefit is if they improve the supply of electricity for local residents or communities…The Council views small-scale community projects as particularly appropriate for the Highland area, especially for remoter settlements in the west and north”. Policy E8 states: “The Council will support efforts to make more provision for small community renewable energy projects”.

3.6 Highland Renewable Energy Strategy

Renewable energy has a long history in the Highland Council area. Large scale hydro electric schemes were constructed after the Second World War and these are now being added to by wind farms and smaller scale hydro projects, stimulated by central government policy to respond to climate change. Highland Council is the planning authority for wind energy
schemes up to 50 megawatts, and between February and August 2005, the Council convened a Renewable Energy Working Group with the objective of framing a comprehensive renewable energy policy for the Highlands.

Several reports have been commissioned to examine the potential for exploiting different forms of renewable energy in the context of various technical constraints and planning safeguards. In 2006 the Final Draft Highland Renewable Energy Strategy was published, identifying locations suitable for large scale development, and in the context of the Melness project, it also identified locations suitable for local scale developments. The Blar nan Lian plateau is a preferred development area, figure 3.1.

![Location of Melness project](image)

Figure 3.1 – Preferred development areas for local scale wind energy projects

### 3.7 Socio-economic benefits

Development of a wind energy industry is predicted to have significant economic and environmental benefits. With Highland Council strongly committed to encouraging community renewable energy developments, it is felt that the Melness project is particularly appropriate and relevant to the socio-economic development of this part of Sutherland. The wind turbines will be manufactured in Scotland and there will be additional design, civil and electrical engineering requirements, approaching one third of the total project costs. The
development team intends to ensure that much if not all of this work is completed by local organisations. New long term employment opportunities will also arise from the project, with local support necessary for the long term operation and maintenance of the site.

Wind energy projects in Scotland have been mainly developer-owned, with project profits diverted from local economies. The exceptions to this have been the Burray wind energy project in Orkney, where there has been a commitment to encourage local investment in a wind energy development, and the community wind energy project on Gigha. The Melness project will be a community owned project and will replicate the Gigha development, using new wind turbines to ensure long term economic security and stability.

Melness Crofters Estate Limited, together with Tongue, Melness & Skerray Community Council, has developed the Melness Community Wind Energy Project to substantially improve the social and economic conditions for the whole community around the Kyle of Tongue. This is a typically disadvantaged peripheral community, with high out-migration of young people and a general lack of social and economic opportunities, particularly for the young. Overall, the project aims to tackle these problems by considering a range of measures, detailed in Section 9 and summarised below:

- Construct a relatively small cluster of up to three community-owned wind turbines on Melness Crofters Estate
- Develop and establish a local community enterprise to manage and distribute all profits for local community purposes
- Invest up to £6m over 20 years in community social and economic development projects, such as the redevelopment of Talmine Pier, a new sports and recreation facility in Melness, and the refurbishment of Melness Community Centre (as well as invest up to £3m in Scottish companies during project development and construction)
- Improve local electrical infrastructure through the provision of a robust three-phase supply in Melness to support SME development that requires industrial and commercial electrical equipment, as well as to support local water service equipment
- Introduce and improve local energy efficiency measures to offset increasing energy costs and fuel poverty
- Broaden and strengthen the local economic base to provide up to 25 new FTE jobs over the next 20 years, as well as retain up to a further 23 FTE’s
4 Summary of environmental impacts

The environmental impacts and benefits of wind energy projects are largely recognised, however both the specific implications of constructing a wind energy project at Melness and the possible cumulative effects of other wind energy projects proposed for the area require consideration. The Melness wind energy project is located on a plateau known as Blar nan Lian, situated between the Melness communities of Midtown, Skinnet and West Strathan. The plateau was historically the main source for peat extraction in the area and the turbines are positioned on the edge of the plateau, on underlying metamorphic bedrock. The following concerns have been addressed in detail, summarised below:

- visual impact upon the landscape
- ecological impact
- hydrogeological and hydrology impact
- environmental impact during construction and operation
- pollution impact during construction and operation
- disturbance from noise
- shadow flicker nuisance
- impact on archaeology
- radio communications interference

From the outset the community expressed the desire to minimise the environmental impact of the project, with independent studies completed as part of the assessment. Advice from Jenny Taylor, the project landscape architect, suggested that single line of wind turbines positioned away from the summit of nearby hills would be most appropriate. Assessment of the site ecology was completed by the project ecologist, Andrew Upton, and has included a vantage point survey, wader, diver and raptor breeding bird surveys, and assessment of geese, mammals and vegetation. Hydrogeological impact and the risk of peat slide has been assessed, the assessment of the risk to archaeology was conducted by David Lynn, noise impact has been predicted using a cumulative geometric spreading calculation, and the risk of shadow impact at neighbouring properties has been assessed and in all aspects the project achieves planning guidelines.

Impact upon sensitive habitats has been avoided, impact upon bird species will not be significant, and although there is archaeology in the area, the turbine positions and the access track have been located to avoid known sites. Noise, shadow flicker and pollution impacts will be minimised and the wind turbines have been positioned to avoid interference with radio-communications systems.
4.1 Visual impact upon the landscape

The visual impact of wind turbines in a coastal area is affected by the topography of the land and the relationship that the land has with the sea and the sky. Jenny Taylor, the project landscape architect, gave initial recommendations and has completed an assessment of the landscape and the impact of the project upon it. To aid assessment of the visual impact of the development, a series of wireframe images and photomontages has been produced, Volume 2 of the report. Maps showing the Zone of Visual Influence (ZVI) of the project has also been produced, showing the locations where the turbines can be seen.

It was recommended that the turbines should present a simple, clear relationship to the landform and other existing features; cluttered, overlapping, unbalanced and partial views have been avoided by using a simple linear layout. The turbines have been positioned back from the road, and the access road has been designed to use the existing tracks where possible. The project switchgear building was located away from the turbines and is positioned behind the Midtown community, near to existing overhead cables.

The Kyle of Tongue is a National Scenic Area, and the coastal edge encompasses areas of Great Landscape Value. Accordingly the wind turbines have been located to achieve minimum impact; the site is outwith designated areas, and the turbines are orientated in a compact linear layout, giving a strong and logical relationship with the Melness communities, the Kyle of Tongue and the Ben Hutig ridgeline.

Figure 4.1 – Landscape Designations and Character
Zone of Visual Influence

Zone of visual influence (ZVI) diagrams were generated using the WindFarm programme along with Ordnance Survey gridded topographic ‘Panorama’ data. This shows the full extent of visibility of the project, measured to uppermost tip height, assuming very clear weather conditions. A 25km boundary has been chosen, in accordance with the recommendations in ‘Visual Assessment of Windfarms: Best Practice.’ though it should be considered that in very clear conditions the site may be seen from areas beyond this boundary, and similarly no account has been taken of the reduction of views through obstruction by trees and buildings, particularly from local communities. The edge of the ZVI is defined to the west by the Ben Hutig – A’Mhoine ridge, to the south by Ben Loyal and Ben Hope and the east by the raised land east of the Kyle of Tongue. It can be seen that the ZVI is most concentrated within 5km of the site, especially to the east, and the turbines will mainly be seen from parts of the Melness community and from Tongue – figure 4.2.

Figure 4.2 – Zone of Visual Influence; 80m tip height
Impact on Visual Resource

The significance of the impact of the development on the area was considered from 23 viewpoints, selected in consultation with Highland Council and Scottish Natural Heritage. The sensitivity of these viewpoints and the significance of impact was assessed, along with consideration of the magnitude of change. Only viewpoints from which the turbines would be visible have been used, with the exception of view 2, Talmine Mill. It should be noted that none of the viewpoints contain views of Ben Loyal, Ben Hope or the Watch Hill, the key elements of the National Scenic Area. This is because there are no views towards the proposed development which has these landscape elements in the background.

The factors used to assess the sensitivity of each viewpoint include the quality of the landscape and views, and value of the landscape, whether or not there are any discordant or prominent features and the type and number of possible viewers. Visual sensitivity and magnitude of change was then graded from negligible to very high, giving an overall significance of change to the visual resource.

Wireframe images and photomontages have been produced using the WindFarm software programme, a recognised tool used to help design wind energy projects. Photographs were taken from each of the following viewpoints, mainly on clear or slightly cloudy days to show maximum visibility. A conventional SLR camera with a 50mm lens was used to ensure that the image best matches that seen by the human eye.

1: West Strathan, looking south
2: Talmine mill (no turbines visible)
3: East of Manse Bridge, Talmine
4: Behind Midtown
5: A838 west of Meliness
6: Kyle of Tongue causeway
7: Tongue House pier
8: Castle Varrich, looking north
9: South of Braetongue
10: Memorial at A836 junction
11: A836 east of Tongue
12: Coldbackie beach
13: Skullomie road
14: Ben Loyal summit
15: Ben Hope summit
16: A’Mhoine summit
17: A838 west of Meliness
18: Ben Tongue summit
19: A836 west of Borgie
20: A836 east of Borgie
21: East of Bettyhill
22: Strathy point, looking west
23: Dun Mhaigh broch
Cumulative Impact

Cumulative impact is not an important issue for the Melness project. Figure 4.3 shows the ZVI of the project along with the maximum extent of all other wind energy projects already constructed, with consent or in the planning process, mainly located in Caithness rather than Sutherland. The nearest wind energy project is Forss, a distance of 43km from Melness. It can be seen that only the community around Armadale Bay is a potential area of cumulative impact, however not one of these dwellings can see the Melness project. An assessment of cumulative impact was undertaken by the landscape architect, including the sequential impact of projects viewed from the north coast road. It was concluded that the Melness project would not contribute in any way to cumulative sequential effects on the north coast road.

The proximity of the Ministry of Defence low flying Tactical Training Area to the south of the Kyle of Tongue, along with the extensive areas of Natura designated land throughout this part of Sutherland, figure 2.4, has made site selection particularly difficult, and consequently it is unlikely that other wind energy project will be proposed for the area, much reducing the possibility of cumulative affects in the future.
4.2 Ecological Impact

Aims and scale of ecology survey work
Survey work was carried out on and around the Melness development site between April 2004 and October 2005. Information has been gathered regarding the vegetation, birds and mammals, with the following aims:

- to produce a vegetation map by National Vegetation Classification;
- to survey the breeding birds close to the site;
- to find out whether any divers or scarcer raptors nest in the vicinity;
- to gauge the extent to which cited species from the nearby Special Protection Areas (SPAs) might use or overfly the site;
- to locate the dens and resting places of protected mammals near the site.

Visits were made on 81 days or part days between 23rd April 2004 and 11th October 2005. More than 445 hours were spent in the field on bird work, with 76 hours dedicated to vegetation and 28 hours to mammal survey. The timing and number of hours spent on each survey are summarised in Table 4.1 below.

Table 4.1. Timing and hours for ecological survey work [VP= vantage point]

<table>
<thead>
<tr>
<th>Birds</th>
<th>J</th>
<th>F</th>
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<th>M</th>
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<td>Vegetation</td>
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<td>76</td>
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<td>Mammals</td>
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<td>Goose checks</td>
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<tr>
<td>Raptor checks</td>
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<td>Dusk checks</td>
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<td>12</td>
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<tr>
<td><strong>Total fieldwork hours</strong></td>
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<td><strong>549</strong></td>
</tr>
</tbody>
</table>

Setting and management of the development site
The site proposed for the wind turbines is on Blar nan Lian, a plateau inland from the coastal villages of Midtown, Skinnet and Talmine. In the vicinity, the main sites designated for nature conservation are:

- Caithness and Sutherland Peatlands SPA, designated for breeding birds;
- Caithness and Sutherland Peatlands cSAC (candidate Special Area of Conservation), designated for vegetation, Otter, Salmon and Freshwater Pearl Mussel;
• Caithness and Sutherland Peatlands Ramsar site, designated as an internationally
  important wetland;
• North Sutherland Coastal Islands SPA, designated for wintering Barnacle Geese

The Peatlands sites share contiguous boundaries, their closest points lying about 1.25km to
the northwest and 2.5km to the southwest of the proposed turbine positions. The nearest part
of the Coastal Islands SPA is some 7km to the northeast. Although it is not part of any
designated area, the vegetation around the plateau merges seamlessly across the cSAC
boundary. However, the peat bodies on which the development will lie are hydrologically
distinct from the cSAC, being separated by burns and watersheds. On Blar nan Lian peat
cutting has occurred extensively in the past and still occurs on a small scale today. The area is
grazed in the summer by sheep and throughout the year by Red Deer. Both peat cutting and
grazing have affected the vegetation.

VEGETATION

Vegetation – general description

Melness is flanked on the west by open peatlands, and on the east by the Kyle of Tongue.
There is only a narrow strip of cultivated land behind the shore. Much of the western
hinterland, from the coast at Ben Hutig and southwards, is part of the Caithness and
Sutherland Peatlands cSAC. On the shallower lower slopes of the cSAC, and at Melness, the
vegetation is at first sight remarkably uniform, with Deergrass *Trichophorum cespitosum* the
most conspicuous plant for many kilometres. This expanse is broken up where there are
steeper slopes or flatter bottoms and alongside burns, lochans and cuttings. Figure 4.4 shows
the distribution of vegetation types on and around the development site

Vegetation types

Although Blar nan Lian and its surrounds are almost entirely overlain by blanket peat, the
main vegetation type is wet heath in which Deergrass predominates. ‘True’ mire
communities, with extensive *Sphagnum* mosses or Hare’s-tail Cottongrass *Eriophorum
vaginatum* occupy more localised flatter parts. Heather *Calluna vulgaris* is more prominent
in some areas, but proper dry heath communities are confined to scattered knolls and ridges.
Grassland is present where there has been some influence from man or livestock, with narrow
fringes alongside some of the peat tracks and burns, and close-cropped swards on knolls by
the access gates onto the plateau.
Figure 4.4 Vegetation map, Melness
Key to Melness vegetation map

Wet heaths and derivatives

- M15 *Trichophorum cespitosum-Erica tetralix* wet heath, *Cladonia* sub-community (Deergrass the most conspicuous element)
- M15 *Trichophorum cespitosum-Erica tetralix* wet heath, typical sub-community in fine mosaic with other vegetation types (e.g. M6, H10) - not mapped in more detail
- M15 *Trichophorum cespitosum-Erica tetralix* wet heath subject to heavier grazing pressure from sheep (Heather the most conspicuous element)
- M15 *Trichophorum cespitosum-Erica tetralix* wet heath on area of past peat cutting
- Dissected deep peat; vegetation now dominated by leggy Heather

Dry heaths

- H10 *Calluna vulgaris-Erica cinerea* heath and other more natural dry heaths
- H10 *Calluna vulgaris-Erica cinerea* heath derived from grazing pressure on deep peat

Mires and bog pools

- M1 *Sphagnum denticulatum* bog pool community
- M3 *Eriophorum angustifolium* bog pool community
- M6 Carex echinata-Sphagnum fallax/denticulatum mire, *C. echinata* sub-community
- M6 Carex echinata-Sphagnum fallax/denticulatum mire, *Juncus effusus* sub-community
- M9 Carex rostrata-Calendula cespitosa/Caltha palustris mire, *Cynodon dactylon* stellatum-Scorpidium scorpioides sub-community
- M10 Pingualioio-Caricetum dioicae mire, *Carex demissa-Juncus bulbosus/Acroh* sub-community (mostly Schoenus flushed)
- M17 *Trichophorum cespitosum-Eriophorum vaginatum* blanket mire, *Drosera rotundifolia-Sphagnum* sub-community
- M25 *Molinia caerulea-Potentilla erecta* mire, *Erica tetralix* sub-community

Other habitat types

- Exposed substrate and adjacent bare peat
- Mixed semi-improved/unimproved grassland types
- Open water
- W23 *Ulva europaea-Rubus fruticosus* scrub
- Broad-leaved plantation
- Bracken stand

Miscellaneous

- ✗ Proposed turbine location (to scale with rotor blade diameter)
- Proposed (dotted) and existing (solid) access track
On the deeper peat of the plateau, now much dissected and dried out due to past cutting, the vegetation is again mostly of wet heath. There is recolonisation on some of the lower cut surfaces by *Sphagnum*-rich mire vegetation. Peat-cutting and subsequent erosion has also left areas and channels of bare peat and underlying stone. The bare peat shows varying degrees of colonisation by Common Cottongrass *Eriophorum angustifolium* and heathland plants are beginning to cover the stony substrate. On the areas unaffected by peat cutting, there is a distinct change in appearance of the wet heath on either side of the Blar nan Lian fence, heather being much more obvious than Deergrass on the plateau. This presumably reflects differential grazing practices, with a concentration of sheep in the summer on the plateau, and low-density cattle grazing throughout the year on the slopes around.

There are small and scattered flushes on some slopes, usually showing species characteristic of base-rich situations such as Black Bog-rush *Schoenus nigricans*. One pond on the plateau itself, and the system of bog pools to the southwest, hold aquatic plants, but the burns and rills are narrow, without distinct stands of vegetation.

Large shrubs and trees are generally absent, apart from recent plantings on Cnoc Eilig and some Gorse *Ulex europaeus* thickets adjacent to the cultivations by the Kyle of Tongue. More natural remnant woodland survives along the steep, rocky sides of Strath Melness Burn between Cnoc Eilig and Dalvraid, although this was outside of the vegetation survey area.

**Scarce and uncommon plants**

One nationally scarce plant, Alpine Bearberry *Arctostaphylos alpinus* was found within 500m of the turbines or access track, and several locally uncommon or nationally declining species: Heath Violet *Viola canina*, Field Gentian *Gentianella campestris*, Allseed *Radiola linoides* and Lesser Butterfly Orchid *Platanthera bifolia*.

The Alpine Bearberry and Heath Violet were found on heathy knolls and slopes that will be unaffected by the development. Some plants of Field Gentian, Allseed and Lesser Butterfly Orchid are located close to the road at the start of the access track, and there will be some loss to the development. Sampling of bryophytes was undertaken from each vegetation type along the route of the track and on the plateau. Specimens that were not identified in the field or office were sent to the Orkney County Bryophyte Recorder for determination. No nationally scarce or rare species were found.
Vegetation – impacts considered

The impact on vegetation will be largely one of habitat loss and disturbance, and the loss of some individuals of locally uncommon or nationally declining species. The area of each vegetation type that will be affected, and its conservation importance are shown in Table 4.2 below. The area lost is calculated to include all tracks, turbine hardstandings, a switchgear building and an access area by the road. The area disturbed is calculated as a zone of potential disruption, 2m in width, along or around all infrastructure (extended out to 10m on deep peat) and a temporary site compound.

The areas of lost habitat (1.3 ha to 1.4 ha) and potentially disturbed habitat (about 2.1 ha) total around 3.5 ha. All of this is from semi-natural habitats, although the vegetation on the bulk of the blanket bog area has been considerably modified due to peat cutting and grazing. 3.5 ha represents some 0.2% of the 16.5 km² (1,650 ha) of undesignated heath and mire vegetation lying between the cSAC, the A838 and the Melness coastal road.

Table 4.2. Areas of habitat loss and disturbance due to the development

<table>
<thead>
<tr>
<th>Vegetation type</th>
<th>Area lost</th>
<th>Area potentially disturbed</th>
<th>Regional level of conservation evaluation</th>
<th>Site specific comment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>m²</td>
<td>ha</td>
<td>m²</td>
<td>ha</td>
</tr>
<tr>
<td>Upland heath (wet)</td>
<td>7,912</td>
<td>0.791</td>
<td>9,228</td>
<td>0.923</td>
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<tr>
<td></td>
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<td></td>
</tr>
<tr>
<td>Upland heath (dry)</td>
<td>475</td>
<td>0.048</td>
<td>300</td>
<td>0.030</td>
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<td></td>
<td></td>
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<tr>
<td>Blanket bog (good)</td>
<td>891</td>
<td>0.089</td>
<td>3,960</td>
<td>0.396</td>
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<tr>
<td></td>
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<tr>
<td>Blanket bog (degraded)</td>
<td>2,188</td>
<td>0.219</td>
<td>6,980</td>
<td>0.698</td>
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<td></td>
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<tr>
<td>Rush &amp; sedge mire</td>
<td>202</td>
<td>0.020</td>
<td>180</td>
<td>0.018</td>
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<td></td>
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<tr>
<td>Flush</td>
<td>9</td>
<td>0.001</td>
<td>8</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Herb-rich grassland</td>
<td>198</td>
<td>0.020</td>
<td>176</td>
<td>0.018</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scattered Gorse</td>
<td>117</td>
<td>0.012</td>
<td>104</td>
<td>0.010</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Broken heath along old path</td>
<td>1,125</td>
<td>0.112</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Roadside ditch</td>
<td>54</td>
<td>0.005</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Burn crossing</td>
<td>-</td>
<td>-</td>
<td>14</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTALS</td>
<td>13,171</td>
<td>1.317</td>
<td>20,950</td>
<td>2.095</td>
</tr>
</tbody>
</table>
The largest losses and potential disturbance are to wet heath and blanket bog vegetation. Disturbed areas will remain semi-natural, but may be more broken and are likely to show a change in flora indicative of drier conditions, as along the old paths at present. The amount of disturbance of wet heath may be considerably less than calculated where the peat is very shallow along the old path and minimal excavation is required. As noted, much of the loss of blanket bog is of degraded habitat.

Both blanket bog and wet heath are evaluated at a UK level of importance; however, they are the most widespread vegetation types in the vicinity and such a scale of loss would not be regarded as significant.

**Vegetation – mitigation**

There are several steps that can be taken to reduce the level of impact:

- Re-use of excavated peat to fill eroding and bare channels on the central plateau area;
- Re-use of excavated peat to slow down drainage from the central plateau area;
- Re-use of vegetation from beneath the tracks and hardstandings as a ‘turf’ on infilled and other bare areas on the central plateau;
- Transplanting of Orchids and Field Gentian at the start of the access track into adjacent dry heath;
- Removal of soil from the roadside where Allseed occurs at the start of the track (this should contain its seeds) and distribution along adjacent sections where the plant is currently absent.

Together these measures will reduce the impact on uncommon plant species and will act to improve the condition of the blanket bog on the central plateau area.

The overall, and specific, impacts of the development on vegetation are considered to be insignificant. Residual impacts after mitigation will be less still, and may constitute a net positive impact on blanket bog vegetation.
MAMMALS

Mammals – work done
Survey work was undertaken between May and October 2005, covering the area within 500m of the turbine positions and within 100-250m of the finalised track route. This included bankside searches along a 1km stretch of the Allt a Mhuilinn and around the northern shoreline of Loch a Mhuilinn.

Mammals – summary of findings
Four protected species were found on or near the development site (Pipistrelle, Water Vole, Otter and Badger) with inconclusive signs of a fifth (Wildcat). Of these, the Pipistrelle and Badger were more or less confined to the proximity of the coastal villages and roadside and might only interact with the development at the start of the access track. Here there were no Badger setts within 250m and no suitable sites for bat roosts within about 50m.

Otter and Water Vole signs were distributed along the course of the Allt a Mhuilinn which must be crossed by the access track. Otter sprainting points were found on average every 125m along the burn. The nearest identified Otter holt was at 220m from the crossing point, and a larger cave-like hollow, perhaps used as a breeding den, was about 380m distant.

Several Water Vole burrows were detected at 40m from the crossing point, with possible feeding signs within 10m. However, a much greater concentration of activity occurred downstream, where 33 burrows and 13 latrines were counted along a 150m stretch of the burn. The nearest point of this dense colony lies at 470m from the crossing point.

Possible signs (droppings) of Wildcat were found in two places, but gave no indication of the whereabouts of any den in the area.

Apparently occupied holes under rocks, with no indication of the owner’s identity, were found at 60m, 90m and 150m from the track route. Two of these three were unused over the summer, although they had seemed occupied in May.

Mammals – impacts considered
For each of these species it is a legal requirement that the development should not damage any resting place or cause disturbance to animals within a resting place. If it is considered
that it would do either of these things, to any of the species, then a licence would need to be granted to allow the development to proceed.

From the survey work undertaken, it is clear that there will be no damage to the resting places of Pipistrelle, Otter, Badger or Wildcat. It is also considered that there will be no disturbance to any of these species. However, there is a possibility that damage to Water Vole burrows or disturbance to the voles might occur were the animals to dig any burrows closer to the crossing point prior to bridge construction. Further survey will be required in advance of the construction work to establish how close the nearest burrows are to the crossing point. If they are within about 10m of the crossing point then a licence and agreed mitigation procedure would need to be obtained from SNH.

The structure of the bridge will be such as to leave a minimum of 1m of bank undeveloped on either side of the burn, so allowing free access beneath for aquatic animals. Assuming appropriate measures are taken for Water Vole, there would be no significant impact on mammals and no further mitigation would be required. In purely ecological (rather than legal) terms, the impact of the development on mammals is expected to be minimal.

**BIRDS**

**Birds – objectives and target species**

This work was undertaken to gather information regarding the birds on and around the Melness development site throughout the year. The primary target species were those listed as qualifying interests of the Caithness & Sutherland Peatlands SPA/Ramsar site and the North Sutherland Coastal Islands SPA:

- Greylag Goose
- Barnacle Goose
- Black-throated Diver
- Red-throated Diver
- Golden Eagle
- Hen Harrier
- Merlin
- Short-eared Owl
- Golden Plover
- Dunlin
- Greenshank
- Teal

Four other species noted as SPA/Ramsar qualifying interests were not seen during any of the fieldwork (Wigeon, Scaup, Common Scoter and Wood Sandpiper).

Breeding surveys and detailed records of flight paths were noted for each of the SPA species. The potential development impacts are considered in relation to all these species, and to the following additional categories of species:
• all other Annex 1 species – Whooper Swan, Greenland White-fronted Goose, Osprey and Peregrine (also noted in A Mhoine SSSI citation);
• species occurring in internationally important numbers – Pink-footed Goose;
• species noted on neighbouring SSSI citations – Great Skua (Eilean nan Ron);
• species occurring in nationally important numbers – Snow Bunting.

Briefer notes were kept of all other species occurring close to the turbine positions; these results are presented briefly in the main report, but they have not been included in the impact assessment.

**Birds – summary of work**

The RSPB and SNH (Golspie offices) and Scottish Ornithologists’ Club (Highland Region) were approached for any known information. Useful knowledge was also obtained from local sources, including workers on the land, a birder formerly resident in the area and a member of the local raptor study group. Reference has been made to the Joint Nature Conservancy Council and Wildfowl and Wetlands Trust websites for information on European protected areas and geese. Table 4.3 below gives a summary of the time spent on bird survey work.

**Table 4.3. Summary of bird work undertaken [VP = vantage point]**

<table>
<thead>
<tr>
<th>Main VP survey (hours)</th>
<th>Other specific VP (hours)</th>
<th>Brown &amp; Shepherd survey (no. hours) &amp; Raptor checks (days &amp; approx hours)</th>
<th>Diver checks (days &amp; approx hours)</th>
<th>Goose drive-rounds (no. &amp; approx hours)</th>
<th>Dusk visits to plateau (no. &amp; approx hours)</th>
<th>Total hours in field for bird work</th>
</tr>
</thead>
</table>

In addition to the hours noted above, there was time spent walking in to and out from each vantage point or survey route; this would have amounted to several hours each month. Some birds and bird movements were also noted whilst carrying out vegetation and mammal surveys.

**Vantage point survey – method**

A total of 200 hours, over 48 different days, between April 2004 and August 2005 was spent in vantage point (VP) surveys from points to the north and south of the plateau. These were all located at greater than 500m from the turbine positions so as not to affect bird activity there, and these comprised the main VP survey. The aim was to record the flight activity of
all target species within 1-2km of the turbine positions; this was often considerably exceeded
where visibility permitted e.g. around the summit of Ben Hutig.

Two points, VPA and VPC, were used to the north; VPC was less far to walk in, and was used
from October to March. It provided a very similar view of the plateau as VPA but had less
visibility into Strath Melness Burn. VPA was used over both summers since it was
considered important to be able to see along the burn because of the nesting opportunities
there.

Three points were used to the south, VPB(i), VPB(ii) and VPD. Initially VPB(i) was loc ated
over a kilometre away from the edge of the plateau, but from 2nd June 2004, by which time
the possible location of the turbines had been more closely identified, it was moved closer to
VPB(ii). VPD was used from October 2004 since it allowed a slightly closer view of the
plateau and a considerably shorter walk-in. It also allowed a better view across Loch a
Mhuilinn and VPD was therefore used for the rest of the survey in 2005.

The VPs and fields of view from VPA and VPB(i) are shown on the maps in the main report,
and on Figure 4.5, below. All the points are at roughly the same level as the plateau, allowing
views along its slopes and across parts of the level area. Because of the gentle dips on the
plateau, not all of it could be seen down to ground level. However, any bird flying at more
than a few metres above any part of it would have been visible from any of the VPs. The
summit of Ben Hutig was visible from each of the vantage points.

An additional 30 hours were spent much closer, at points on the edge of the plateau itself, in
order to better gauge the movements of smaller species across the plateau (Merlin and the
waders). These species would have had relatively low detection rates from the main VPs.

**Vantage point survey – results for target species.**

Section 4 of the main report gives details of the times, wind and weather conditions and the
number of target species detected from each individual watch. Table 4.4 below summarises
the sightings from the main and close-up VP watches across the whole visible area.
### Table 4.4. Summary of sightings of target species across whole survey area from timed VP watches (main & close-up VPs).

<table>
<thead>
<tr>
<th>Species</th>
<th>No. of observations</th>
<th>Expected season of occurrence</th>
<th>Hours watched during season of occurrence</th>
<th>Observation interval during season of occurrence (hours between observations)</th>
<th>Range of flock sizes per observation</th>
<th>No. flights at risk within 200m of turbines</th>
<th>No. birds at risk within 200m of turbines</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whooper Swan</td>
<td>1</td>
<td>Mar/Apr &amp; Sep-Nov</td>
<td>70</td>
<td>70.0</td>
<td>2</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Greylag Goose</td>
<td>44</td>
<td>all year</td>
<td>233</td>
<td>5.3</td>
<td>1 – 75</td>
<td>3</td>
<td>51</td>
</tr>
<tr>
<td>Pink-footed Goose</td>
<td>23</td>
<td>Apr/May &amp; Sep/Oct</td>
<td>64</td>
<td>2.8</td>
<td>3 – 180</td>
<td>2</td>
<td>25</td>
</tr>
<tr>
<td>Barnacle Goose</td>
<td>8</td>
<td>Oct-Apr</td>
<td>94</td>
<td>11.8</td>
<td>5 – 200</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Teal</td>
<td>1</td>
<td>Apr-Aug</td>
<td>150</td>
<td>150.0</td>
<td>3</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Black-throated Diver</td>
<td>1</td>
<td>Apr-Aug</td>
<td>150</td>
<td>150.0</td>
<td>1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Red-throated Diver</td>
<td>37</td>
<td>Apr-Aug</td>
<td>150</td>
<td>4.0</td>
<td>1 – 3</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Osprey</td>
<td>1</td>
<td>Apr-Sep</td>
<td>162</td>
<td>162.0</td>
<td>1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Golden Eagle</td>
<td>49</td>
<td>all year</td>
<td>233</td>
<td>4.8</td>
<td>1 – 2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Hen Harrier</td>
<td>4</td>
<td>all year</td>
<td>233</td>
<td>58.2</td>
<td>1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Merlin</td>
<td>25</td>
<td>Feb-Oct</td>
<td>197</td>
<td>7.9</td>
<td>1 – 2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Peregrine</td>
<td>11</td>
<td>all year</td>
<td>233</td>
<td>21.2</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Golden Plover</td>
<td>36</td>
<td>Feb-Aug</td>
<td>177</td>
<td>4.9</td>
<td>1 – 30</td>
<td>8</td>
<td>19</td>
</tr>
<tr>
<td>Dunlin</td>
<td>6</td>
<td>Apr-Aug</td>
<td>150</td>
<td>25.0</td>
<td>1</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Greenshank</td>
<td>2</td>
<td>Apr-Aug</td>
<td>150</td>
<td>75.0</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Great Skua</td>
<td>21</td>
<td>Apr-Sep</td>
<td>162</td>
<td>7.7</td>
<td>1 – 4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Short-eared Owl</td>
<td>2</td>
<td>all year</td>
<td>233</td>
<td>116.5</td>
<td>1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Snow Bunting</td>
<td>14</td>
<td>Nov - Apr</td>
<td>102</td>
<td>7.3</td>
<td>1 – 37</td>
<td>2</td>
<td>57</td>
</tr>
</tbody>
</table>
Figure 4.5 – Fields of view from vantage points
Greylag Geese groups were usually small, with the largest number from timed watches being a flock of 75 birds. Although seen throughout the year, flights were most frequent, and in the largest numbers, during the passage periods; at such times they would mostly have involved birds of Icelandic origin (i.e. not those qualifying under the Peatlands Ramsar citation). The birds at risk across the turbine positions were in April (going north) and November, and all were probably Icelandic birds.

In addition to the sightings from VP watches, Pink-footed Geese were also frequently observed from other fieldwork during the passage periods. In spring the birds headed north or northwest across a front from the Kyle of Tongue to the Moine watershed; in autumn they tended to travel southeast parallel to the overall direction of the coastline.

The large flocks of Barnacle Geese from VP watches were all along the shore of the Kyle, mostly visible when disturbed from their feeding fields. Only one group of 5 was seen inland during timed watches (but not close to the turbine positions) along with one other group of 20 birds outside of timed watches.

Red-throated Divers were seen at a rate of one sighting every 4.0 hours from April to August, but none flew across the plateau. They used a well-defined route between the Moine watershed and the Kyle of Tongue, which took them over the lower ground by the road, and over the waters of An Dubh-loch and Loch a Mhuilinn. Birds frequently stopped off at both of these lochs.

The most frequently observed species overall was the Golden Eagle with 49 sightings throughout the year, at an average of one flight every 4.8 hours. Birds were mostly quite distant. Of the 51 eagle flights, 20 occurred on just 3 days when one or two birds were up around the summit of Ben Hutig, and 9 occurred on one day when two birds were above Cnoc Eilig for over an hour. Only one bird, a subadult, flew across the plateau.

Merlins were seen between February and October at a rate of one sighting every 7.9 hours. However, the close-up VPs indicated that a high proportion of the flights across the plateau were likely to have been missed from the main VP survey. This has been taken into account in the collision risk workings.

Golden Plovers were seen at a rate of one sighting every 4.9 hours between February and August. Again, the close-up VPs indicated that many flights were likely to have been missed from the main VP survey and this has been taken into account in the collision risk workings.
One of the close-up watches, early on the morning of 17\textsuperscript{th} June 2005, accounted for 8 of all the observed flights in just 1.5 hours. This particular watch also accounted for 5 of the 6 Dunlin observations, with the sixth being of a single bird at the shore of Loch a Mhuilinn.

Great Skuas were seen in the summer only, mostly singly, or up to three birds together, and generally heading westwards. Both 2004 and 2005 were poor breeding seasons for this species, and the birds seen might have been failed breeders dispersing early from Orkney and Shetland.

Short-eared Owls were seen more frequently from other fieldwork than from VP watches; all birds on or near the plateau were foraging at low level.

Nearly all the Snow Buntings (185 of 188) were seen passing westwards on 14\textsuperscript{th} March 2005, mostly westwards.

The maps and tables in section 4 of the main report detail all observed flights of target species. Those for Golden Eagle, Merlin and Pink-footed Goose are reproduced in figures 4.6, 4.7 and 4.8 below.

**Goose checks – methods**

Specific checks were made from October to April to establish the movements of the flock of Barnacle Geese that roost on Eilean nan Ron, at the mouth of the Kyle of Tongue. These included dawn watches from points above Talmine, from which the island was visible. Initially these commenced during the dark, an hour or more before first light. However, when it became clear that the geese flew in beyond hearing range over the Kyle, and had regular foraging fields close to the shore, watches were made from first light and confirmed by subsequent checks of the foraging fields. On several occasions the geese were located on the ground before dusk in order to follow their route back to roost. On each occasion they flew up after dark and were detectable only by ear, but headed back directly along the Kyle, above the water. Drive rounds were made on ten dates from December to April to locate feeding birds, covering the improved fields visible from the road between West Strathan, Tongue and Coldbackie. The fields below Melness House were also checked whenever a vantage point watch was done at VPD (an additional ten dates).
Figure 4.6  All observed Golden Eagle flights 2004 and 2005, by age.
Figure 4.7  All Merlin flights 2004 and 2005, by vantage point
Figure 4.8  Pink-footed Goose – all observed flightpaths 2004 and 2005
Figure 4.9  Barnacle Goose flight paths and feeding areas 2004/2005
**Goose checks – results**

Two favoured feeding areas were found for the Barnacle Geese, in the fields just below Melness House and on the promontory below Castle Varrich near Tongue. Geese were found at Melness House on 65% of checks there, and at Castle Varrich on 30% of checks there. On only three dates were there no Barnacles located: 25\textsuperscript{th} January, 22\textsuperscript{nd} March and 27\textsuperscript{th} April. On this last date they had probably already departed north to their breeding grounds. The maximum number seen was about 250 on 24\textsuperscript{th} January, when birds were at both the favoured sites, and when 105 birds fed for a time in fields to the north of Tongue (the only occasion that they were seen there). Of nineteen separate sightings, twelve were of 150 birds or more, indicating that for a considerable proportion of the time most of the flock stay together as a single unit.

All but two observed flights were above the Kyle or close to the shoreline. Groups of c.50, 3 and c.60 were seen on different mornings flying in from the direction of Eilean nan Ron Ron, low above the Kyle. Larger flocks heard returning to roost after dark on two occasions were also along the Kyle, one departing from Melness and one from Varrich. Interim movements across the water were seen between the two feeding areas and from the Melness House fields to the tidal sandbanks below. One group of 5 birds on 23\textsuperscript{rd} March flew inland from Melness House, to the north of the plateau, and from mammal fieldwork on 11\textsuperscript{th} October 2005 a group of c.20 was also inland, flying uncertainly at the eastern edge of the plateau. Figure 4.9, above, shows all flight observations of Barnacle Geese and indicative flight paths for birds heard in the dark. Locations of feeding fields are also shown.

**Diver checks – methods**

Observations of divers were made from all elements of summer fieldwork. All flights were mapped (other than those low around an individual loch) and notes were made of divers present on the waters of Loch a Mhuilinn from all VPs overlooking the loch.

Specific checks were made for the presence of divers on Loch a Mhuilinn and An Dubh-loch and on the waters of the Moine watershed, from Loch Maovally north to the lochans and bog pools below Ben Hutig. In June and July 2005 these checks were made in accordance with the method set out in Gilbert et al\textsuperscript{1}; less rigorous checks had also been made in these areas in May and August 2004. Specific VP surveys for diver flightpaths to and from the Moine

\textsuperscript{1} Gilbert et al (1998) Bird Monitoring Methods, RSPB
watershed were made for eight hours in 2004, and a much more intensive 45 hours in 2005. The Moine watershed skyline was also visible from VPA and was included in the area scanned from there (a total of 65 hours across both summers).

**Diver checks – results**

All but one of the divers noted, from all fieldwork, were Red-throated Divers; they were detected between April and August. The single Black-throated Diver was on Loch a Mhuilinn in on 16th June 2005 and flew off westwards beyond the Moine.

Up to 4 divers were frequently present on Loch a Mhuilinn in 2004 and 2005, with some interaction between apparent pairs and single birds. One pair in 2005 spent some time inspecting the shoreline of the island, and the female even got out of the water very briefly on one occasion. However, there was no other indication of breeding there and it can safely be concluded that there was no nesting at the loch in either year.

A pair of Red-throated Divers was seen regularly at An-Dubh-loch in 2004, but with no indication of breeding then or from the two visits in 2005. Two visits to the Moine watershed in 2004 produced no divers at all on 13th May (in ideal evening conditions) and located two pairs, but with no sign of young, on 13th August. The first visit in 2005 (30th June) found one nest with 2 eggs on the central watershed, but there was no sign of any birds there on the second visit (24th July). In 2005, no other birds were seen on any other waters, from the lochans south of Moine House up to Loch Fada.

Eight hours of VP watching specifically for diver flights to and from the Moine in 2004 detected only one localised diver movement. Forty-five hours in 2005 detected just seven flights, four incoming and three outgoing. The sum of incoming flights to the Moine from all fieldwork totalled nine. The pattern was of an approach from Loch a Mhuilinn or An Dubh-loch towards Loch Maovally with an indication of dispersal north and south along the watershed from there.

The status of Red-throated divers in the vicinity would appear to be rather precarious, with only a small number of pairs in total, only one or two of which might attempt to breed. There was just one indication of successful nesting – in 2005 an adult carrying a fish was twice seen flying north from Loch a Mhuilinn towards the lochans at the northeast side of Ben Hutig. These sightings were late on in the survey, on the 18th and 30th of August 2005, implying that the young there would still have been present on the breeding loch into September.
Figure 4.10  Red-throated Diver – simplified flight paths 2004 & 2005
All flights to and from Loch a Mhuilinn avoided the plateau; only one bird was detected (heard in low cloud) along the Strath Melness Burn to the west of the plateau, all others staying to the east and south. Outgoing flights from the Moine watershed in 2005 included two that were heading in the general direction of Blar nan Lian, but these were both lost at heights of 100-200m above ground and their final bearing was not seen. Figure 4.10 shows all Red-throated Diver flight paths, sorted by direction (i.e. incoming or outgoing from breeding areas). The lines on this map have been simplified for clarity – many of the flights involved birds circling round to gain height, especially at Loch a Mhuilinn.

**Breeding raptors – methods**

A check for breeding raptors out to 2km from the turbine positions was made in 2005, in accordance with the method for Merlins shown in Gilbert et al. A member of the local raptor study group carried out these checks. Historical information was also available for a regular Merlin site to the west of the development site.

There are no extensive areas of nesting habitat suitable for moorland raptors; in particular there is very little long heather that might attract Hen Harriers, and few areas of rushes likely to be attractive to Short-eared Owls. However, banks and knolls of shorter heather, which could be used by Merlins are widely scattered across the area, concentrated particularly along the various watercourses. The nearest Golden Eagle eyries are known to be situated more than 5km to the west and to the south, and that of Peregrines is over on the eastern side of the Kyle of Tongue. Due to the discovery of a recently fledged Short-eared Owl chick by VPA on 2\textsuperscript{nd} June 2004, several visits were made at dusk from February to April 2005 specifically to look for Short-eared owls.

**Breeding raptors – results**

No breeding raptors were detected on the open areas of low-growing wet and dry heath on Blar nan Lian itself, or on its immediate slopes. The Short-eared Owl fledgling by VPA in 2004 indicated a nest site reasonably close by, but the dusk visits and other fieldwork in the spring of 2005 revealed no breeding owls. These dusk watches/walkovers covered the northern part of the plateau across to the radio mast in ideal, calm conditions on several evenings. Single owls were seen again, on and near the plateau, later in the season and were presumably foraging birds from some distance away.
A pair of Merlins bred at their regular site to the west of the development in 2005. In 2004 that area had been occupied by Ravens, and if Merlins bred in 2004 it was perhaps further to the south or west. There had been no obvious activity at their more usual alternative area (visible from VPA). A pair each of Buzzards and Ravens bred along the Strath Melness Burn in 2005, between Cnoc Eilig and Dalvraid. One or two more Buzzards and a pair of Kestrels are thought to be regular breeders along the burn, including the stretch to the north of Dalvraid. In August 2005 the calls of young Buzzards from the trees by Melness House indicated another territory there towards the eastern edge of the 2km zone around the turbines. Table 4.5 summarises the findings for each species, including the commoner raptors and Raven.

Table 4.5. **Summary of breeding status of raptors at Melness**

<table>
<thead>
<tr>
<th>Species</th>
<th>Inferred status around Blar nan Lian (within 2km of proposed turbine positions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Osprey <em>Pandion haliaetus</em></td>
<td><strong>Not breeding:</strong> 1 passing bird on 1\textsuperscript{st} June 2004 - it flew north along the Strath Melness Burn to Dalvraid, then turned back south to W of Cnoc Eilig.</td>
</tr>
<tr>
<td>Buzzard <em>Buteo buteo</em></td>
<td><strong>Breeding:</strong> an old nest, in low cliff along Strath Melness Burn – occupied in 2005, but not in 2004, situated at 500m to 1km from turbines. A further pair or two may nest along the burn within 2km. 1 or 2 pairs to the east, in trees at Talmine and Melness House, are also at 1 to 2km distant.</td>
</tr>
<tr>
<td>Golden Eagle <em>Aquila chrysaetos</em></td>
<td><strong>Not breeding:</strong> nearest known eyries are over 5km to the west and to the south. Adults from the western pair seen occasionally at the summit of Ben Hutig and once with a juvenile (in 2004) at Cnoc Eilig. The juvenile disappeared east across the Kyle and the adult returned to Ben Hutig. The plateau would appear to be at the very eastern edge of their territory.</td>
</tr>
<tr>
<td>Hen Harrier <em>Circus cyaneus</em></td>
<td><strong>Not breeding:</strong> habitat mostly unsuitable – not seen between March and late July in either 2004 or 2005. One juvenile foraging low over Blar nan Lian on 29 July 04 and a female passing by on 16\textsuperscript{th} Aug 05 were the only summer records.</td>
</tr>
<tr>
<td>Peregrine <em>Falco peregrinus</em></td>
<td><strong>Not breeding:</strong> not seen between mid-March and late June in either 2004 or 2005. 7 of the 8 definitely identified birds from all fieldwork were adults; a probable juvenile passed overhead southwards on 21\textsuperscript{st} July 2005. Old Red Grouse kills found on ground near Strath MelnessBurn and An Dubh-loch.</td>
</tr>
<tr>
<td>Merlin <em>Falco columbarius</em></td>
<td><strong>Breeding:</strong> a regular territory to the west, with three known nest sites within it since 1993. The most regular (4 of the six years checked from 1993-2005) is at 1.1km or more; the other two (used once each during those six years) are at about 710m and 580m. In 2005 two more occupied territories and were found at about 3km due south of the site. All three pairs in 2005 were successful, fledging 2 or 3 young each.</td>
</tr>
<tr>
<td>Kestrel <em>Falco tinnunculus</em></td>
<td><strong>Breeding:</strong> known from Strath Melness Burn - would be at 500m or more from the nearest turbine.</td>
</tr>
<tr>
<td>Short-eared Owl <em>Asio flammeus</em></td>
<td><strong>Possibly breeding:</strong> a newly fledged chick near the radio mast on 2\textsuperscript{nd} June 2004, at about 800m from the nearest turbine – no other indications of breeding in either 2004 or 2005. Single birds hunting and perched on ground occasionally on and near plateau.</td>
</tr>
<tr>
<td>Raven <em>Corvus corax</em></td>
<td><strong>Breeding:</strong> A regular pair along Strath Melness Burn – in 2004 at 1km and in 2005 at 500m-1km. In 2004 young first seen flying on 24 June when up to 5 birds together.</td>
</tr>
</tbody>
</table>
Breeding waders – method and results

Brown & Shepherd survey is the standard means of counting and mapping breeding waders in unenclosed upland areas. It comprises two or three walkovers of the study area, approaching within 100 – 150m of every point on the ground. 1:10,000 field maps and a global positioning system (GPS) were used to achieve this. Two walkovers were carried out in 2004 (12th – 13th May and 25th June) and three in 2005 (27th – 28th April, 11th – 12th May and 28th June). The survey area in 2004 covered 6.5km², but was narrowed down to 3.5km² in 2005 when the location of the turbines had been more closely defined. All, or nearly all, of the area out to 500m from the turbine positions was covered in both years. The area within 500m of the access track was covered in 2005 only. The results are summarised in Table 4.6 below, and the distribution of territories in 2005 is shown in figure 4.11.

Table 4.6. Brown & Shepherd survey results – no. of breeding waders (pairs)

<table>
<thead>
<tr>
<th>Species</th>
<th>2004 Whole area (6.5km²)</th>
<th>2004 Within 500m of turbines</th>
<th>2005 Whole area (3.5km²)</th>
<th>2005 Within 500m of turbines</th>
<th>Combined within 500m of turbines Max no. pairs</th>
<th>Pairs per km²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lapwing</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Golden Plover</td>
<td>8</td>
<td>2</td>
<td>8</td>
<td>4</td>
<td>4</td>
<td>2.8</td>
</tr>
<tr>
<td>Dunlin</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0.7</td>
</tr>
<tr>
<td>Common Sandpiper</td>
<td>1</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Greenshank</td>
<td>2</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1.4</td>
</tr>
<tr>
<td>Curlew</td>
<td>2</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Snipe</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>0.7</td>
</tr>
</tbody>
</table>
Figure 4.11  Wader territories within 500m of development site – 2005
The Golden Plover and Dunlin territories within 500m of the turbines were situated at or very close to the turbine positions themselves, on the higher part of the plateau. The two Greenshank territories were towards the periphery of the 500m zone by water bodies either side of the plateau. The increase in Golden Plover pairs within 500m of the turbines in 2005 appeared to be a genuine difference between the two years; the increase in Greenshanks may have been partly due to the lack of a late April survey in 2004, the period when Greenshanks are most detectable. It may also be due to the inclusion of a bird calling near Loch a Mhuilinn on 27th April 2005 as a territorial bird, when it may simply have been feeding at the loch – there were no further records from the loch from any other fieldwork in 2005. The lack of any Greenshanks from the survey on 28th June 2005 indicates poor breeding success.

The density figures in Table 4 above are based on the number of territories within or overlapping the 500m zone around the turbines; for Golden Plover and Dunlin the territories were wholly within the zone, but both Greenshank territories lay at the edge of the 500m zone, thus inflating the apparent density. Extending the zone to 1km brings in both of them and an additional territory to the north; Greenshank density over this larger area (of 3.8km²) was 0.8 pairs per km² in 2005. For both Golden Plover and Greenshank the densities found are greater than the regional densities used in the selection of SSSIs in Caithness and Sutherland². These densities are 2.6 pairs per km² and 0.5 pairs per km² respectively, and are themselves 1.5 times the average density for the region.

**Impacts considered on birds**

The main potential impacts from an onshore wind farm on birds are disturbance during construction, displacement from operational turbines and collision fatalities. Collision risk workings have been carried out for all target species (other than Snow Bunting) where birds were observed in flight within 200m of the turbine positions from timed VP watches. These are summarised in Table 4.7 below. All calculations have built-in estimates for observer efficiency, tailored to each species, and have used avoidance rates which are considered to be reasonable or cautious.

Table 4.7.  *Summary of predicted collision rates for target species*
*(N.B. These figures are subject to very wide margins for error)*

<table>
<thead>
<tr>
<th>Species</th>
<th>Relevant population</th>
<th>No. of flights at risk within 200m</th>
<th>No. of birds at risk within 200m</th>
<th>Avoidance rate used in calculations</th>
<th>Predicted number of years between fatalities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greylag Goose</td>
<td>Icelandic</td>
<td>2</td>
<td>35</td>
<td>97.5%</td>
<td>0.85</td>
</tr>
<tr>
<td>Pink-footed Goose</td>
<td>Icelandic</td>
<td>2</td>
<td>25</td>
<td>97.5%</td>
<td>3.03</td>
</tr>
<tr>
<td>Golden Eagle</td>
<td>SPA birds</td>
<td>1</td>
<td>1</td>
<td>98%</td>
<td>79.84</td>
</tr>
<tr>
<td>Merlin</td>
<td>SPA birds</td>
<td>2</td>
<td>2</td>
<td>95%</td>
<td>14.22</td>
</tr>
<tr>
<td>Peregrine</td>
<td>SSSI birds?</td>
<td>1</td>
<td>1</td>
<td>95%</td>
<td>21.08</td>
</tr>
<tr>
<td>Golden Plover</td>
<td>SPA breeders</td>
<td>1</td>
<td>3</td>
<td>97.5%</td>
<td>14.89</td>
</tr>
<tr>
<td>Golden Plover</td>
<td>non-SPA breeders</td>
<td>6</td>
<td>7</td>
<td>97.5%</td>
<td>10.66</td>
</tr>
<tr>
<td>Dunlin</td>
<td>non-SPA breeders</td>
<td>5</td>
<td>5</td>
<td>97.5%</td>
<td>4.89</td>
</tr>
<tr>
<td>Greenshank</td>
<td>non-Ramsar bdrs</td>
<td>1</td>
<td>1</td>
<td>97.5%</td>
<td>29.68</td>
</tr>
<tr>
<td>Great Skua</td>
<td>non-SSSI birds?</td>
<td>4</td>
<td>4</td>
<td>97.5%</td>
<td>30.26</td>
</tr>
</tbody>
</table>

Assessment of impacts on birds

There are various factors to take into account when assessing the scale of environmental impacts relating to the nature of the impact itself (e.g. its duration, magnitude, likelihood etc) and to the population status of the affected species. For SPA qualifying interests a significant impact is one that will affect the integrity of the SPA, in terms of the numbers or distribution of the species within it. In line with the most recent guidelines from the Institute of Ecology and Environmental Management (IEEM)\(^3\), all impacts have been classed as either significant or insignificant on the affected population. This means that an impact affecting the numbers or distribution of a non-designated population might be scored as significant, but only within a local or regional frame of reference.

There were certain potential impacts that were considered to be of very low significance to any of the bird species. These were foraging habitat loss and disturbance due to operational site visits, due to the small scale of habitat loss and the low frequency of the site visits. These were not considered further. The impacts summarised in Table 4.8 were identified as of potential significance, and are considered in more detail below.

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Reasoning behind assessment of impacts

The overall level of each impact is not simply the sum, or a multiple, of the scores given; a considerable degree of judgement is still required. The reasons behind each of the impact assessments made in the table are explained as follows:

- **Summer construction disturbance – predicted significant effects:** the impact on divers is considered as significant since this species is sensitive to disturbance and up to two pairs of presumed SPA breeders were seen to use Loch A’ Mhuilinn at any one time. The loch is out of sight where the track is closest (within 250m or the northern tip), but is just visible at 320m where the track emerges through the scarp east of the burn, and again at a similar distance as it rises up the slope to the plateau. Diver numbers breeding on the watershed were low and a high proportion of them appear to utilise the loch as a loafing and feeding area. Significant impacts would also be expected on the breeding waders on the plateau and the breeding Merlins to the west, either preventing breeding or affecting their success. However, all of these potential impacts can be avoided by timing construction works on the plateau, and towards the burn crossing, to be outwith April to July/August.

- **Summer construction disturbance – predicted insignificant effects:** Greylag Geese nested near Loch a Mhuilinn in both 2004 and 2005; however this species is unlikely to be as prone to disturbance as the divers and an insignificant impact is predicted. Few raptors other than Merlins were observed foraging over the plateau in the summer, and eagles occurred very infrequently within 1km. The impact on foraging eagles is therefore judged to be insignificant – the site is at or beyond the very eastern edge of the territorial pair’s range, and there are wide expanses of similar habitat in the vicinity available to non-territorial birds.

- **Winter construction disturbance – predicted significant effects:** the most favoured feeding fields for the Barnacle Geese lie just below Melness House at 300m or less from the start of the access track. The activity and noise of machinery during construction of this first stretch might well deter the birds. The area of improved grassland in the general area is not particularly extensive and it is possible that the Eilean nan Ron roost could become less tenable for a season. Timing construction work at the start of the track to be outwith the period mid-October to mid-April will avoid this potential impact.
Winter construction disturbance – predicted insignificant effects: the impact on foraging eagles will be similar to that for summer construction and is expected to be insignificant.

Disturbance due to increased public access: this would be expected to affect the species breeding or resting closest to the access track and turbines. There are already tracks up to the plateau from Talmine and towards Loch A’ Mhuilinn from Melness House (this track has been signed as a public footpath since 2005). They are relatively little used. During fieldwork, four-wheel drive vehicles occasionally used the peat track from Talmine, but people were only once seen to use the paths near the loch and there was only one angler at Loch a Mhuilinn. Any new track would presumably take most of the crofters’ vehicular traffic in the future, but this is rather infrequent. The presence of the turbines as a new feature in the wider landscape might also encourage additional recreational use of existing paths, as well as the new access track, particularly among visitors in the summer – but this effect could be small if most visitors prefer unspoilt views and wildness. The scale of any impacts will depend on the access arrangements and are likely to be greater if there is open vehicular access along the track. However, the intention is to install a locked gate at the bottom of the track, so that vehicular access is only available to active crofters and for maintenance visits. A lower range of possible impacts is therefore predicted, since fewer visitors (and pets) might make it right up to the plateau.

Since the track is out of view from Loch a Mhuilinn until beyond 300m away, it is not expected to disturb Red-throated Divers. The recent signing of the path from Melness House as a footpath, together with the new track, might result in an informal circular route past the loch, but the frequency of visitors finding and using such a route would not be expected to be high.

Breeding waders (specifically Lapwings)\(^4\) have been found to suffer no reduction in breeding performance due to regular human disturbance. On the plateau, the same might be expected to hold true for Golden Plovers at least. Dunlin and Greenshank centres of activity were further from the access track and would therefore be less likely to be affected. Intermittent human presence on Blar nan Lian is not expected to significantly affect foraging Merlins.

Displacement of breeding birds: there is considerable uncertainty in the prediction of displacement by wind turbines. Various studies on upland wind farms in the UK have indicated that breeding waders tend not to be displaced from the vicinity of the turbines, at least not in the early years. However, at one site in Germany, reductions were measured within 200m of the turbines for Black-tailed Godwit and Redshank\(^5\). Being at this distance or less, it is possible that some of the breeding Golden Plovers and Dunlins would be lost from the plateau in the long term. If displacement were to occur (but it is highly uncertain) it would be counted as a significant impact on the non-SPA Golden Plover population of the area, due to the high density of birds on the plateau. The loss of a single pair of Dunlins would also be significant at a local scale. There would be no significant impact on the SPA population of Golden Plovers or Dunlins. The Greenshanks were centred further from the turbines, at over 400m and 550m, so displacement would not be expected. Similarly, the Merlins’ most regularly used nest site is 1.1km from the turbines, with other less frequent sites at 710m and 580m. Displacement would not be expected from any of these.

Collision fatalities: the impact of collision fatalities depends on the level of collision risk and the population-level effect that such a risk represents. For species where there were no individuals observed flying at risk height within 200m of the turbine positions, or where the predicted fatality interval is more than 20 years, it is considered very unlikely that any fatalities will occur, and an insignificant effect is assessed. Where a fatality interval of 10 to 20 years is predicted, one or two fatalities might occur, but would not be expected to have any population-level effect – an insignificant impact is therefore expected.

Only the non-SPA breeding Dunlins, and the passage Greylag and Pink-footed Geese had higher levels of predicted fatalities. Although the geese have the highest expected collision rates at 1.25 Greylags and 0.3 Pink-feet per year, these are not considered significant in relation to the large populations of these species (around 100,000 for Greylag Geese and over 300,000 for Pink-footed Geese). The collision risk to Greylags arises from the passage of Icelandic breeding birds, and does not therefore affect the native breeders under the Ramsar designation. In practice geese may show higher

avoidance rates than 97.5%, since several extensive reviews of the international literature on wind turbine/bird collisions mention only 3 goose fatalities between them\textsuperscript{5,6,7}.

The somewhat lower risk to the breeding Dunlins on the plateau (1 fatality every 4.9 years) is more likely to result in a significant impact on this local non-SPA population, due to the much smaller number of individuals involved. However, the uncertainty over any collision rate predictions is high, since the various assumptions within the workings have a very high effect on the outcome. It is quite likely that the 97.5% avoidance rate used is too low for an agile wading bird; it is also probable that the very frequent flight activity observed from just one close-up VP watch has resulted in exaggerated extrapolations of overall flight activity, particularly given the overall low detection rates for this species which has been factored into the calculations.

**Residual impacts on birds**

After suggested mitigation there are no significant residual impacts predicted for any SPA qualifying interest. The only impacts that might still be significant, in a localised geographical context, relate to the breeding Golden Plovers and Dunlins on the Blar nan Lian plateau. There is the possibility of displacement of breeding birds due to the presence of the turbines, and perhaps of significant collision risk to Dunlins, but both effects are highly uncertain and would tend to be mutually exclusive.

Neither of these species is of national importance on the site; the evaluation of the Golden Plovers on Blar nan Lian in geographical terms is at regional level, due to the above average density of pairs (up to four pairs within 500m of the turbines). The Dunlins are of local value, since their density (one pair within 500m of the turbines) is well below the regional average.

**Cumulative impacts**

There are no other wind farms likely to affect the North Sutherland Coastal Islands SPA, and the residual impact from Melness is considered to be effectively nil. There are various other proposed windfarm developments in Caithness and Sutherland that could potentially affect the Caithness and Sutherland Peatlands SPA e.g. Stroupster, Lybster, Camster, Dunbeath,


Strathy, Bettyhill. In broad terms any effects will be related to proximity to the SPA boundary and the size of the development. Some of these sites are likely to be considerably closer to the boundary than at Melness and most are larger developments. On its own there are no significant impacts on the SPA predicted at Melness; in terms of size, Melness would be expected to contribute in only a small way to the overall impacts.
### Table 4.8. Summary of impact assessment on birds.

<table>
<thead>
<tr>
<th>Impact</th>
<th>Nature of impact:</th>
<th>Species and population potentially impacted</th>
<th>Assessment of impact prior to mitigation</th>
<th>Possible mitigation</th>
<th>Assessment of impact after mitigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction disturbance (summer)</td>
<td>2</td>
<td>SPA Red-throated Divers (resting)</td>
<td><strong>Significant</strong></td>
<td>Construction across burn and on plateau to avoid Apr – Aug</td>
<td>Insignificant</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SPA Golden Eagles (foraging)</td>
<td>Insignificant</td>
<td>No construction on plateau Apr– Jul</td>
<td>Insignificant</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SPA Merlins (breeding &amp; foraging)</td>
<td><strong>Significant</strong></td>
<td>) No construction on plateau</td>
<td>Insignificant</td>
</tr>
<tr>
<td></td>
<td></td>
<td>non-Ramsar Greylags (breeding)</td>
<td><strong>Significant</strong></td>
<td>) Apr- July</td>
<td>Insignificant</td>
</tr>
<tr>
<td></td>
<td></td>
<td>non-SPA Golden Plovers (breeding)</td>
<td>** Significant**</td>
<td></td>
<td>Insignificant</td>
</tr>
<tr>
<td></td>
<td></td>
<td>non-SPA Dunlins (breeding)</td>
<td>** Significant**</td>
<td></td>
<td>Insignificant</td>
</tr>
<tr>
<td></td>
<td></td>
<td>non-SPA Greenshanks (breeding)</td>
<td>** Significant**</td>
<td></td>
<td>Insignificant</td>
</tr>
<tr>
<td>Construction disturbance (winter)</td>
<td>2</td>
<td>SPA Barnacle Geese (foraging)</td>
<td>** Significant**</td>
<td>Construction at start of track to avoid mid-Oct to mid-April</td>
<td>Insignificant</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SPA Golden Eagles (foraging)</td>
<td>Insignificant</td>
<td></td>
<td>Insignificant</td>
</tr>
<tr>
<td>Operational disturbance (increased public access)</td>
<td>5</td>
<td>SPA Red-throated Divers (resting)</td>
<td>Insignificant</td>
<td></td>
<td>Insignificant</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SPA Merlins (foraging)</td>
<td>Insignificant</td>
<td></td>
<td>Insignificant</td>
</tr>
<tr>
<td></td>
<td></td>
<td>non-SPA Golden Plovers (breeding)</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>non-SPA Dunlins (breeding)</td>
<td>Insignificant</td>
<td></td>
<td>Insignificant</td>
</tr>
<tr>
<td></td>
<td></td>
<td>non-SPA Greenshanks (breeding)</td>
<td>Insignificant</td>
<td></td>
<td>Insignificant</td>
</tr>
<tr>
<td>Displacement (breeding birds)</td>
<td>4</td>
<td>SPA Merlins</td>
<td>Insignificant</td>
<td>)Monitor breeding pairs</td>
<td>Undetermined</td>
</tr>
<tr>
<td></td>
<td></td>
<td>non-SPA Golden Plovers (breeding)</td>
<td>** Significant**</td>
<td>)to gauge effect</td>
<td>Undetermined</td>
</tr>
<tr>
<td></td>
<td></td>
<td>non-SPA Dunlins (breeding)</td>
<td>** Significant**</td>
<td></td>
<td>Undetermined</td>
</tr>
<tr>
<td></td>
<td></td>
<td>non-SPA Greenshanks (breeding)</td>
<td>** Significant**</td>
<td></td>
<td>Undetermined</td>
</tr>
</tbody>
</table>
Table 4.8. *Summary of impact assessment on birds.*

(continued)

<table>
<thead>
<tr>
<th>Impact</th>
<th>Nature of impact:</th>
<th>Species and population potentially impacted</th>
<th>Assessment of impact prior to mitigation</th>
<th>Possible mitigation</th>
<th>Assessment of impact after mitigation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>short term (1) or permanent (5)</td>
<td>very local (1) to widespread (5)</td>
<td>very unlikely (1) to certain (5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Collision fatalities</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>Insignificant</td>
<td>Monitor breeding pairs to gauge effect</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>SPA Barnacle Geese</td>
<td>SPA Red-throated Divers</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>SPA Golden Eagles</td>
<td>SPA Golden Eagles</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>SPA Merlins</td>
<td>SPA Golden Plovers</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>SPA Golden Plovers</td>
<td>SSSI Peregrines</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>SPA Golden Plovers</td>
<td>non-SPA Golden Plovers</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>non-SPA Dunlins</td>
<td>non-SPA Greenshanks</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>passage Whooper Swans</td>
<td>passage Greylags (non-Ramsar)</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>4</td>
<td>3</td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td>passage Pink-footed Geese</td>
<td>passage Great Skuas</td>
<td></td>
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<td>3</td>
<td>2</td>
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<tr>
<td></td>
<td></td>
<td>passage Snow Buntings</td>
<td></td>
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</table>

OSE/2525
4.3 **Potential disturbance to archaeology**

A series of walkover surveys of the site and the route of the track were conducted by the project archaeologist, Section 5. The objectives were to identify and describe any known sites and to anticipate the potential for unknown sites within the immediate environs of Melness, to assess the potential impacts of the developments, and to identify measures to mitigate any adverse impacts. The following information resources were used:

- the National Monuments Record of Scotland (NMRS), compiled by the Royal Commission of Ancient and Historical Monuments of Scotland (RCAHMS), and accessed through the on-line CANMORE database ([www.rcahms.gov.uk](http://www.rcahms.gov.uk))
- the PASTMAP on-line database of sites and monuments with statutory protection, also compiled by RCAHMS and accessed at ([www.rcahms.gov.uk](http://www.rcahms.gov.uk))
- the Highland Council Archaeology Unit Sites and Monument Record (SMR), a computerised database accessed at Highland Council offices in Inverness
- the RCAHMS and Highland Council Archaeology Unit collections of aerial photographic surveys; and
- maps, with particular emphasis on the Ordnance Survey 1:10,560 County Series first edition of 1878 (accessed at [www.old-maps.co.uk](http://www.old-maps.co.uk)), and the current OS 1:25000 Explorer series map of the area (no. 447, *Ben Hope, Ben Loyal & Kyle of Tongue*, issued 2003).

Three walkover surveys of the development area and the immediate surroundings were made in July 2004 and June & September 2005. This series of visits reflected the iterative design process, with the results of the earlier visits influencing subsequent design permutations, as well as allowing a growing familiarity with the area and its ground conditions and examination under varying light conditions and degrees of vegetation cover during natural growth cycles. Any archaeological features which were encountered were located in relation to the site plan and their locations confirmed by hand-held GPS, and recorded by written description and digital photography.

There are four archaeological or historic sites in the Kyle which have been given a designated protection; Talmine Corn Mill is in the immediate vicinity of the proposed development and has Scheduled Ancient Monument protection. The research ahead of the walkover visit showed that the lack of archaeological recognition for the Kyle was misleading in relation to the quantity of sites recorded and to the historic information available for the area. A wealth of minor sites suggests that many more may exist, awaiting systematic discovery if the area is
fully surveyed or chance discovery in the disturbance of modern development and construction. Visual impact assessment for the remaining formally designated local sites and buildings give no significant concerns.

For the majority of the terrain encountered, the thin and degraded topsoil cover suggests a low possibility of encountering sub-surface archaeological deposits, though their presence can not be ruled out entirely. Three specific zones, however, cause a greater level of uncertainty, with a higher but poorly defined potential for archaeological discoveries:

- at the start of the access track close to where it leaves the Melness road where a subsurface feature of uncertain form and origin has been identified
- the Loch A’Mhuilinn outlet burn and valley where the confusing topography may conceal archaeological remains in the vicinity of the stream and two mill sites
- the Blar nan Lian plateau, where blanket peat may conceal prehistoric features.

These zones have the highest potential to disrupt the construction progress on archaeological grounds. However, there is no evidence to suggest that they definitely contain archaeological features, and provided exclusion zones are adopted for the identified features within the Loch A’Mhuilinn outlet burn and valley and the isolated probable hut circle on the hillslope, there is no specific concern about the development footprint constituting a definite physical risk to identifiable archaeological deposits or features.

A small number of previously unrecorded archaeological sites has been found; these are of local importance only and most lie outside the development footprint so will not be physically affected by the proposals. The terrain of the development footprint suggests a low overall possibility of encountering sub-surface archaeological deposits, though their presence can not be ruled out entirely. The three zones detail above cause a greater level of uncertainty, accordingly, a series of recommendations are made for groundbreaking work

**Summary of archaeological recommendations**

- An archaeological watching brief will be necessary throughout any groundbreaking work for the turbine sites, the access track, cable trenching, and the substation.
- A mound of uncertain origin, which lies on the off-site access track route should be investigated ahead of any development to establish whether it has any significance.
- Two exclusion zones will be required to protect some newly discovered archaeological features.
4.4 **Impact upon Geological and Hydrogeological features**

An assessment of the geology and the hydrogeological features of the area was conducted with reference to maps produced by the British Geological Survey, Section 6. This survey identified various layers – artificial, landslip, superficial and bedrock geology. This part of Sutherland has no artificial or landslip aspects to the land, however the assessment did indicate the extent of peat deposits in the area. Thin deposits extend over much of the development site, extending from the summit of hills to the west of Melness, over the Blar nan Lian plateau and on to the fringes of the Melness communities. The bedrock in this part of Sutherland is relatively homogenous and is mainly metamorphic at the development site, with small areas of conglomerate at West Strathan and igneous intrusions at the coastal fringes, Figure 4.12.

![Figure 4.12 – Geological map based on extract from British Geological Survey](image-url)
The turbines have been positioned upon areas of Lewisian gneiss, a hard metamorphic rock. This type of rock provide solid bases for the foundations. The main hydrological features in the area are Loch A Mhuillin, located 600m south of T3, and Melness Burn 800m north of T1. The small seasonal pond next to T2 is a recent man-made feature resulting from peat extraction and poor drainage. The access track travels from the main road, past the substation building, with a new bridge constructed to cross the Allt a Mhuillin, the small burn that exits from Loch A Mhuilinn, Section 8. The area around the loch is part of the Melness Geological Conservation Review site (Section 4, Ecology, Appendix VII) and is interesting for the comparison between Lewisian basement inlier and later intrusions.

The archaeology and ecology surveys revealed that the peat on the plateau has largely been extracted, with this area historically being the main source of fuel for the Melness community. A thin, degraded layer exists in places, up to a maximum of 0.5m in depth, and with the turbines located along the watershed of a largely flat plateau, peat slip is not predicted to be an important issue at the turbine sites. The access track to the site has been aligned to ensure the track does not cut across the slope, and the construction process will ensure that water does not drain into the peat/rock interface, again to minimise the potential risk of peat slide.

4.5 Environmental impact during construction

A major part of the project will be the construction of the road and foundations, with risk of disturbance to peat based soils. A carbon balance calculation was therefore completed as part of the Roads and Transportation assessment, Section 8.

The maximum volume of topsoil that could be disturbed is approximately 3500 m$^3$, consisting of the new access track and hard standing areas, a total area of 10,000 m$^2$ at an average depth of 0.35m. The carbon content of peaty soils has been discussed by Chapman et al and assuming that the soils at Melness have 0.069 tonnes of carbon per cubic metre of peat, the carbon content of this volume of peat is estimated to be 240 tonnes. The carbon emission factor of grid electricity is 0.117 T/MWh (Carbon Trust) therefore three wind turbines at Melness provides a positive carbon balance of 2.7 T per day; 3 months of generation are required to compensate for the potential carbon released from the peat.

The foundation manufacture will require approximately 600m$^3$ of concrete. It is recognised that the production of concrete is responsible for the emission of CO$_2$, from both the energy required and from the calcining of limestone when producing cement; 600 m$^3$ of concrete requires 270T of cement, and assuming 1.25T of CO$_2$ per tonne, IPCC Working Group II, p661, 337 T
of CO$_2$ would be emitted. Using a CO$_2$ avoidance factor of 0.43T CO$_2$/MWh, the wind turbines provide a positive CO$_2$ balance of 10 T per day; one month of generation is required to compensate for the carbon dioxide released during concrete manufacture.

There will be an increase in traffic levels during construction and upgrading of the access track, and during mobilisation and installation of the turbines. This will however only occur over a short period of time. 15 loads of turbine components will be transported to site, with up to 3 loads of components for a 300T telescopic crane. A total of approximately 2.2km of new or upgraded access track is to be constructed, all to be 4 m wide. Around 3500 m$^3$ of stone will be required for the track and hard standing construction. It is expected that some stone will be recovered during the road and foundation manufacture, with the remainder coming from identified quarries in Caithness and Sutherland.

4.6 Pollution impact during construction and maintenance

It is acknowledged that the Kyle of Tongue is designated under the Shellfish Waters Directive (79/923/EEC), figure 2.4, and accordingly the project has been designed to ensure that any pollution from the project cannot enter the designated waters.

The construction activities during mobilisation and installation of the turbines represent the greatest risk of pollution. This may be through operational discharges or as the result of an unplanned or accidental event. Measures will be taken to protect against the release of any material with the potential to leach into the soil or water courses. All temporary welfare facilities will be located away from the site, within the substation location. Details of proposed pollution prevention measures are included in Part 5, below.

4.7 Potential disturbance from noise

Section 7 of this report is the Environmental Health Impact Assessment, which addresses potential noise and shadow flicker impact. Noise is generated by the turbine blades passing through the air as the hub rotates, along with mechanical noise from the gearbox and generator. Noise from the turbine blades is reduced by good design, particularly of the blade tip. Noise is measured in decibels (dB) and is a measure of the sound pressure level; a 1dB change in noise level is just perceptible, a 3dB change in noise level is clearly perceptible and a 10dB change in noise level is heard as a doubling or halving of the perceived level. Environmental noise measurement is made in dB(A) which more fully represents sounds
heard by the human ear. Background noise levels naturally increase with windspeed, PAN 56, and it should be considered that noise levels from the turbines will decrease further due to ground affects and barrier attenuation. Table 4.9 shows the predicted impact at the neighbours to the Melness project along with other indicative noise levels.

Table 4.9 – Indicative noise levels in the environment

<table>
<thead>
<tr>
<th>Source/Activity</th>
<th>Indicative noise level dB (A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Threshold of hearing</td>
<td>0</td>
</tr>
<tr>
<td>Rural night-time background</td>
<td>20-40</td>
</tr>
<tr>
<td>Melness wind farm</td>
<td>27-32</td>
</tr>
<tr>
<td>Quiet bedroom</td>
<td>35</td>
</tr>
<tr>
<td>Busy road at 5km</td>
<td>35-45</td>
</tr>
<tr>
<td>Car at 65 km/h at 100m</td>
<td>55</td>
</tr>
<tr>
<td>Busy general office</td>
<td>60</td>
</tr>
<tr>
<td>Conversation</td>
<td>60</td>
</tr>
<tr>
<td>Truck at 50kmh at 100m</td>
<td>65</td>
</tr>
<tr>
<td>City traffic</td>
<td>90</td>
</tr>
<tr>
<td>Pneumatic drill at 7m</td>
<td>95</td>
</tr>
<tr>
<td>Jet aircraft at 250m</td>
<td>105</td>
</tr>
<tr>
<td>Threshold of pain</td>
<td>140</td>
</tr>
</tbody>
</table>

The Planning Advice Note on Renewable Energy Technologies, PAN 45 provides information on noise from wind turbines. Paragraph 65 states: "Well designed wind turbines are generally quiet in operation". The document goes on to discuss the sources of noise and the effects of increasing wind speed on wind turbine noise and background noise. It notes that the report “The Assessment and Rating of Noise from Wind Farms” ETSU-R-97, describes a framework for the measurement of wind farm noise and gives indicative noise levels thought to offer a reasonable degree of protection to windfarm neighbours, without placing unreasonable restrictions on wind farm development or adding unduly to the costs and administrative burdens on wind farm developers or planning authorities.

The impact of noise from the wind turbines is not expected to be significant. The noise levels from the Vestas V52 is adjustable, and can be set at a range of levels from 100 dB(A) to 104
dB(A). This value decreases with distance from the turbine and with atmospheric absorption. When considering the impact from a windfarm, the noise levels from individual wind turbines must be combined. Figure 4.13 shows the predicted noise levels at neighbouring properties, and it should be noted that these are worst case figures, with all three wind turbines operating at maximum speed and power.

The nearest neighbour is Dalvraid, approximately 1.1km from the nearest wind turbine, accordingly it is suggested that measurement of background noise levels is not required and that a simplified assessment is sufficient. Impact has been assessed using a system produced for the Swedish Environmental Protection Agency by Lundmark Acoustic and Vibration; Section 7 of the report contains the full assessment. The predicted sound levels are well below the simplified ETSU-R-97 limit of 35 dB $L_{A90}$ at all residential locations and these noise levels are well below the recommended amenity hours noise limits. Accordingly it is predicted that there will be no significant impact to neighbours.

Figure 4.13 – Predicted sound levels at neighbours
4.8 **Potential disturbance from shadow flicker**

Under certain combinations of geographical position, time of day and time of year, the sun may pass behind the rotor of a wind turbine and cast a shadow over neighbouring properties. This would normally occur in late evening or early morning when the sun is at low elevations. When the wind turbine blades rotate the shadow appears to flick on and off, creating an effect known as shadow flicker, and is noticeable only in buildings when viewed through narrow window openings.

Planning advice note PAN45 recommends 10 rotor diameter separation between the wind turbines and the nearby dwellings to avoid shadow nuisance. The Melness project achieves this recommendation by a large margin; 10 rotor diameters is 520m and all properties are over 1100m from any wind turbine. Nevertheless the potential for shadow effects was checked for a selection of neighbouring properties around the site using the WINDFARM software tool, regardless of the distance, with full results and graphs shown in Section 7. Figure 4.14 shows the properties around the site selected for the study and the distances involved to the nearest turbine, along with the theoretical time in hours over the full year when shadows could cross the buildings. It has been presumed that windows face directly towards the turbines to produce worst case examples. As expected the nearest property has the greatest potential for shadow impact, with a total of 15.8 hours over the full year and a maximum 16 minutes on any given day, provided the sun is shining. This level of impact is not significant.

![Figure 4.14 – Distances from nearest properties and potential for shadow impact](image-url)
4.9 Potential radiocommunications interference

When a wind turbine is positioned near to a radar, radio, television, or microwave transmitter system, it may reflect some of the electromagnetic radiation in such a way that a reflected signal interferes with the original signal as it arrives at the receiver; this can cause the received signal to become distorted and lead to interference. The extent of any electromagnetic interference caused by a wind turbine, beyond positioning, depends mainly on the blade materials and the surface shape of the tower. Electromagnetic interference may also occur if a wind turbine is close to a radio communications service. Consultation with the Ministry of Defence, the Civil Aviation Authority, and National Air Traffic Services indicated that there will be no impact upon military and civil radar systems, and accordingly no objection was raised from these agencies.

Consultation with the Scottish Executive indicated that there was no risk of interference to emergency radio systems and microwave links. The Radiocommunications Agency, now OFCOM, indicated that British Telecom have a commercial microwave link traversing the Melness estate, figure 2.3, above, and the link should have a 200m wide exclusion corridor to avoid interference. British Telecom were consulted and agreed to a revised layout which has the turbine positions adjusted to ensure adequate clearance. The gap between turbines is 330m, and even allowing for a possible longer blade length of 31m, the required clearance has been achieved by a large margin.

The only other transmitter in the area is located on the summit of the hill to the north of the site, next to vantage point A on Figure 4.4. The transmission path is aligned towards Ben Tongue and this link avoids the windfarm by over 1km.

The potential for interference with television systems has also been considered, using a service provided by the BBC, http://windfarms.kw.bbc.co.uk/rd/projects/windfarms/. This indicated that the main transmitter of terrestrial television channels in the area is located on the summit of Ben Tongue, and with the turbines located on Blar nan Lian there will be no disruption of television services to any property in the Melness and Tongue communities.
5 Environmental management and proposed mitigation

This report has described a proposal to erect a small wind farm in Melness, north-west Sutherland, together with an assessment of the related activities. This part of the report describes proposed environmental practices and mitigative measures.

5.1 Visual impact mitigation

To manage the visual impact of the development, the project landscape architect recommended that turbines be located off the higher part of the estate to reduce overall visual impact and that landscaping of the foundations be considered to hide the lower part of the turbines. It was also recommended that the access track should be designed to present a simple feature in the landscape, running along the contours of the land and following the line of existing tracks where possible. Similarly it was recommended that the project switchgear building be located off the hill and should be designed to fit in with the surroundings, in this case to match the cluster of buildings at Midtown.

The planning advice note on Renewable Energy Technologies, PAN 45, states “Turbines in wind farms are likely to be tall, frequently located in open land, and therefore likely to be highly visible” and “It will normally be unrealistic to seek to conceal them. Developers should seek to ensure that through good siting and design, landscape and visual impacts are limited and appropriate to the location”, and “Although wind farms may be complex, they should not appear confusing in relation to the character of the landscape. Ideally they should be separate from surrounding features to create a simple image”.

It is believed that Melness achieves these recommendations by ensuring that the turbines are a linear, balanced feature in the landscape, positioned away from the highest ground. The only additional infrastructure will include a small building, located at some distance from the turbine site and hidden by a fold in the terrain.

5.2 Ecological impact mitigation

Impact avoidance has already occurred within the project development to date, in the selection of Blar nan Lian as the potential site (distant from the SPA, on degraded bog and away from topographical features attractive to birds) and also in the choice of access route (one of three looked at in some detail).
The main potential impacts from construction on the selected site relate to disturbance to birds during construction, habitat loss and possible displacement and collision risk for breeding waders on the plateau. There is also the possibility of disturbance to Water Voles at the burn crossing point.

Of these, the significant impacts on birds arising from disturbance during construction can be successfully avoided by careful planning of the timing of construction work at different points of the development.

Detailed routing of the tracks, and construction practices that re-deploy excavated peat and vegetation on the degraded blanket bog vegetation could go some way to avoiding or offsetting losses of habitat. The transplanting of scarce and declining plant species from the start of the track will also reduce the impact.

Bird displacement is less easy to avoid, although it is possible that improvements to the blanket bog vegetation on the plateau might increase its attractiveness to breeding waders. Such an effect would not be expected to pull in extra birds, since the Golden Plovers, at least, are probably already at capacity, but it might act to retain those already present. Collision risk would not therefore be increased above that calculated.

If Water Voles are found to be present at the crossing point prior to construction, it should be possible to apply for a licence from SNH and to agree a method to exclude voles.

In addition to these specific on-site measures, further action is proposed off-site to make a positive environmental gain away from the immediate proximity of the development. This is to fence off the cliffs beside the Strath Melness Burn, between Cnoc Eilig and Dalvraid, to allow natural regeneration of woodland remnants. This should benefit native woodland vegetation and invertebrates.

Monitoring work could include ongoing surveys the breeding wader population on the plateau (the most uncertain impact) and monitoring of the blanket bog reinstatement measures.

After suggested mitigation, and work off-site, there are no significant residual impacts predicted for any vegetation types, European Protected Species (mammals) or SPA qualifying interest (birds). The only impacts that might be significant, in a localised geographical context, relate to the breeding Golden Plovers and Dunlin on the Blar nan Lian plateau.
5.3 **Pollution avoidance**

The construction of the access track and the areas of hardstanding have the highest likelihood of pollution, and SEPA’s Pollution Prevention Guidelines PPG1, PPG5, PPG6, PPG8 and PPG21 have been adopted by the project. To combat the potential risk of run-off from these areas, it is proposed that some of the mechanisms used to construct Sustainable Urban Drainage systems be adopted, using of a permeable surface on the access track to allow water to pass through the upper layer, along with a filter strip of vegetated land to providing filtering and flow attenuation of water run-off.

The construction of the bridge and the foundations of the wind turbines involves pouring fresh concrete. The nearest watercourse is around 500m from a turbine location, reducing the risk of pollution run-off and it is proposed that all concrete be brought onto site as a dry mix to minimise the risk of spills.

The construction of the bridge crossing at Allt A Mhuilinn has the greatest risk of pollution impact, and accordingly will require a watching brief by the site geo-environmental engineer to ensure that concrete does not enter the watercourse. The main structure of the bridge consists of a set of precast concrete beams laid between the supports, with a reinforced cast-in-place slab. Accordingly, the shuttering and gaps between the beams will be completely sealed to avoid risk of pollution impact upon the burn during the concrete pour. Cleaning of shutters and the washing of equipment will only be done away from the site.

To minimise risk of pollution from oils and fuels during project construction, all work will be to COSHH regulations and any machinery, equipment or construction material will be located on areas of hardstanding away from water courses. Any waste will be transported away from the work area and disposed of using standard waste handling procedures. Refuelling activities for construction vehicles and equipment will be restricted to a contained area of hard standing at a fuel storage area adjacent to the substation location to restrict the potential for contamination of land; any spills would be contained during fuel transfer, and a store of absorbent material will be provided.
5.4 Mitigation of noise disturbance and shadow flicker nuisance

The site has been designed to ensure that all neighbours are 1100m or more from the wind turbine; at this distance the noise from the wind turbines will be reduced to levels less than the minimum recommended by PAN45 and ETSU-R-97.

The risk of shadow flicker has been calculated for neighbouring properties and in the worst case there is the possibility of 8.5 hours of impact spread across the full year. However, the site has been designed to ensure that all turbines are positioned much more than ten rotor diameters from neighbours, and accordingly the project achieves the recommendations of PAN45 by a large margin.

5.5 Construction and Transportation impact mitigation

There will be construction noise during the road and foundation manufacture, mainly from lorries delivering stone and concrete over a 12 to 20 week period, however no blasting of rock is expected. The community and authorities will be consulted about suitable times for lorry movement and a construction schedule will be published.

Before any wind turbine components are transported to site, the project owner and designers will consult with Highland Council Roads Department and the Police to ensure acceptability of the route to site. Existing public road culverts, bridges, verges and street furniture will be surveyed by the project developers in conjunction with the Roads Department. A schedule of loads and a timetable will be prepared and circulated prior to delivery.

Road warning signs and lights will be located at all areas of road works and any items such as fence posts and road signs that have been temporarily removed will be re-erected following transportation. The local community and all affected neighbours will be notified in advance of transportation.
6 Conclusions

This study has described a project to install a small wind farm on a remote plateau at Melness, in north-west Sutherland. The environmental impact of the project has been considered, with emphasis on visual impact, impact upon habitats, potential disturbance to birds, pollution control and potential nuisance impact upon neighbours. Life-cycle analysis of the development has considered the location, the sustainability of the project, the type and size of wind turbines to be installed, and the installation, operations and eventual decommissioning of the site. The study has further addressed the environmental and socio-economic benefits of the project.

The visual impact upon the landscape has been considered and the project has evolved into a simple linear layout of three machines. Although any wind energy project involving modern wind turbines will be seen from the surrounding area, the installation of wind turbines at this location would only have visual impact on the immediate surroundings, mainly the scattered housing surrounding the Blar Nan Lian plateau, and upon the Tongue community to the east. Over greater distances the wind turbines are largely hidden by topography.

Impact upon the ecology of the area will be minimal; the general area for the development was selected to maximise distances to the Caithness and Sutherland Peatlands cSAC/SPA components, and the turbines have been located in an area of extensive peat cutting. The overall potential impact upon habitats and bird species is predicted to be minor. Impact upon neighbours has been controlled by ensuring that any wind turbine is at least 1100m away from dwellings, reducing the noise impact to background levels, and restricting and controlling any shadow flicker impact; PAN45 planning guidelines have been achieved.

This project has been designed to provide a commercially viable wind energy development, with strong local economic benefits. The local community will own the development and will ensure, as far as possible, that most if not all the project revenue is retained within the area.

The Melness project has been designed to respect the environment, while minimising impacts on the local community. Constructing the Melness Community Wind Energy Project will give a positive message on the importance of renewable energy to this part of Sutherland, demonstrating the benefits of community ownership, while at the same time allowing diversification and a more viable and sustainable use of the land.
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