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Guidance

Recommended bird survey methods to inform impact assessment of onshore wind farms

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SUMMARY OF KEY CHANGES SINCE LAST VERSION OF THIS GUIDANCE

This document updates guidance first published by SNH in 2005 which had a minor amendments in 2010. This update contains some key changes to the previous approach, namely:

- An increased emphasis on developers and consultants to consult informally **before** survey work commences to ensure the scope of survey is properly assessed. This will minimise the risk of further survey being required;
- A greater emphasis on the likely requirement for **up to two years of survey**, especially for larger or more sensitive developments. When survey duration of one year or less is proposed, developers and consultants must clearly demonstrate that the chosen duration is robust and appropriate to the specific proposal.
- An update of requirements for surveys of individual species and species groups. More targeted guidance for key species is presented, as well as with a reduced requirement to survey moorland, farmland and woodland passerines. The sections on land-based coastal and intertidal survey have also been rewritten.
- An update of the requirements for Vantage Point Survey, including a revised list of species and species groups for which the survey produces robust flight activity estimates to inform collision risk assessment.

1 INTRODUCTION

The purpose of this document is to define a set of standards for bird surveys at proposed wind farms on land in Scotland. Survey is usually required to inform turbine layout, species protection plans (particularly with specially protected species), and mitigation including habitat management plans. It also forms a baseline for any future monitoring. This guidance, if followed, should produce sufficient quantitative information to assess the potential effects of the development on birds

The guidance covers:

- Essential pre-survey requirements needed to define a site-specific survey programme;
- Detailed recommendations for survey methods.

This guidance replaces the original Survey Methods for Use in Assessing the Impacts of Onshore Wind farms on Bird Communities (2005) and is written for developers, ecological consultants and staff within SNH and consenting authorities. It is part of a package of ornithological guidance for renewable energy developments which is cross-referenced throughout; see http://www.snh.gov.uk/planning-and-development/renewable-energy/onshore-wind/ for a full list. Many of the survey methods and principles behind this guidance can also be applied to assessment of other types of development but this guidance is not suitable for the offshore and inshore elements of marine renewables projects.

Potential Impacts on Birds

Wind farms present three main potential risks to birds (Drewitt & Langston 2006, 2008; Band *et al.* 2007):

- **Direct habitat loss** through construction of wind farm infrastructure;
- **Displacement** (sometimes called indirect habitat loss) if birds avoid the wind farm and its surrounding area due to turbine construction and operation. Displacement may also include barrier effects in which birds are deterred from using normal routes to feeding or roosting grounds;
- Death through **collision** or interaction with turbine blades and other infrastructure.

For each of these three risks, detailed knowledge of bird distribution and flight activity is necessary in order to predict the potential effects of the wind farm on birds.

2 PRE-SURVEY

2.1 Principles

2.1.1 EIA regulations

Most wind farm and wind turbine applications fall under the Environmental Impact Assessment (Scotland) Regulations 2011, which specify thresholds for EIA screening by a local authority of more than two turbines and/or turbines or other structures are above 15m in height. We recommend that developers use the current IEEM guidelines when assessing impacts on birds arising from wind farm developments (http://www.ieem.net/data/files/Resource_Library/Technical_Guidance_Series/EcIA_Guidelines/TGSEcIA-EcIA_Guidelines-Terestrial_Freshwater_Coastal.pdf) but these are not suitable for assessing the impacts on designated sites. Box 1 also sets out information on how to deal with extensions and revised proposals rather than new applications.

Box 1 Extensions to consented developments and revision of previous proposals

Extensions to consented and/or operating wind farms should be treated in exactly the same way as new developments. There will often be a good baseline of information to build on from the original environmental statement. Where further survey is needed a suitable gap should be left between the construction of the first phase and the commencement of survey work for the extension. This will avoid bird activity and the results of the survey work for the extension being influenced by ongoing or recently completed construction work nearby. Other activities which may cause disturbance to the bird activity on the survey area should also be taken into account see section 3.3 below.

For proposals being revised, information is often available from previous EIAs, which will inform a revised or smaller proposal in the same area if it has covered the same area of ground. This information can be used for the EIA for the new proposal provided that:

- the data are reliable and not too dated (collected within the last 5 years or within 3 years if the populations of key species are known to be changing rapidly) and

- the data adequately cover the area of the new proposal (see 3.8.2.1 in relation to potential VP survey issues)

2.1.2 Designated sites

There are three types of designated site for birds in Scotland:

- Site of Special Scientific Interest (SSSI) under the Wildlife and Countryside Act 1981 (as amended);
- Special Protection Areas (SPA) under the EC Wild Birds Directive; and
- Ramsar sites under the Ramsar Convention (all Ramsar sites are either SPAs or SSSIs).

A wind farm proposal must not adversely affect the interests of these designated sites. However, the requirements relating to an SPA are much more stringent (see

http://www.snh.gov.uk/planning-and-development/environmental-assessment/habitat-regulations-appraisal/). Consequently, more comprehensive survey is likely to be required for these areas.

Note that developments outwith the boundary of a designated site may affect the interest within it. This is of particular importance in relation to SPAs. Proposed wind farm sites which are outside the boundary of a site designated for bird interests must include this interest in any assessment of potential bird impacts when the proposal lies within the regular commuting or foraging distance of that bird interest. The distances over which such effects will occur vary with the ecology and behaviour of the species concerned. There is separate guidance considering connectivity to SPAs although the basic approach is also applicable to SSSIs (http://www.snh.gov.uk/docs/A675474.pdf)

Where there is a need to assess impacts on bird species which are not a qualifying interest of an SPA or SSSI, then please refer to the SNH guidance on *Assessing Significance Of Impacts From Onshore Wind Farms On Birds Outwith Designated Areas* (2006) (http://www.snh.gov.uk/docs/C206958.pdf).

2.1.3 Use skilled and licensed observers

The reliability of the assessment is dependent on the observers used to collect the underlying information. Using appropriately skilled and experienced observers is therefore essential.

Many wind farm proposals involve survey and monitoring of a range of Schedule 1 bird species, which are specially protected under the Wildlife & Countryside Act 1981 (as amended). A licence is required from SNH to visit the nests or disturb these species during the breeding season although, in most cases, the level of survey required for wind farms does not require nests to be visited. Where the presence of breeding Schedule 1 species is known or suspected all surveyors carrying out breeding bird surveys should be suitably licensed prior to fieldwork commencing. A Schedule 1 disturbance licence is generally not needed for Vantage Point (VP) survey work as locations chosen for this type of survey should not be at a distance close enough to disturb any breeding Schedule 1 bird species.

Note that Schedules A1 (which protect nests all year round) and 1A (which prevents harassment of the species all year) of the Wildlife & Countryside Act apply in Scotland. Previously the white-tailed eagle was the only species listed (on both A1 & 1A) but, from 16 March 2013 three species have been added to these Schedules; golden eagle to both A1 & 1A and hen harrier and red kite to 1A. Schedule 1A listing will increase protection to individual birds and has particular relevance to roosting birds (note that hen harrier, red kite and white-tailed eagle regularly form communal roosts).

2.1.4 Cumulative impacts

Assessment of the cumulative impact arising from the development of multiple wind farms is **required**. Sites and species which should be included in any cumulative assessment should be identified as part of the essential preparatory work. Further guidance on the assessment of cumulative impacts is contained in our guidance document *Assessing cumulative impacts of onshore wind farm developments* (http://www.snh.gov.uk/docs/A675503.pdf).

2.1.5 Determining the level of survey work required

The potential risk to birds varies with the size and location of the wind farm. For many species, collision and/or displacement risk may only be a serious problem if the

wind farm is large. Larger developments will usually require a full EIA to assess potential impacts.

Smaller developments and even single turbines may also present a potential risk if placed in areas of high bird sensitivity, particularly on or near SPAs. Survey effort and assessment of the possible impacts of a proposed wind farm on birds should be in proportion to the scale of the wind farm and the bird interest in the area.

A number of small scale developments, will either not require an EIA or, if they are only just over the thresholds, require a limited environmental assessment. Typically, these very small developments (including 'domestic' turbines of 15m or less) are not considered to be a significant risk to birds, exceptions to this being proposals on or near designated sites, or where the location is very close to the nest site of a Schedule 1 bird. Assessment of existing bird data for the area may be all that is needed in many of these cases and simple mitigation such as relocating the turbine further away from a designated site or a Schedule 1 bird nest site may be sufficient to overcome any issues without the need for further survey. More detailed guidance on small scale projects not requiring an EIA is available in *Natural Heritage assessment of small scale wind energy projects which do not require formal Environmental Impact Assessment (EIA)* (http://www.snh.gov.uk/docs/C206956.pdf).

The location and scale of the proposal, and sensitivity of the bird interest present will determine the target species and the duration of the survey period.

2.2 Process

2.2.1 Essential preparatory work

Prior to commencing survey work, an initial sift of information will help to form a view on the bird populations on a site and their likely sensitivity. This is the key factor in defining the survey requirements.

This is largely a desk-based stage during which existing information is sought and collated on:

(i) birds

(ii) habitats, and thus typical bird communities; and

(iii) designated sites in the vicinity of the proposed development

The absence of data collated through these sources does NOT necessarily indicate that there is no interest which needs to be assessed.

In the absence of adequate existing information (e.g. none available, data greater than 5 years old, etc.), information must be gathered on site to ascertain the likely bird interest. For example a 'Walkover' method designed to record bird activity over large areas of ground relatively quickly can be used. The walk route should give representative coverage of all the key habitats on the study site and pay particular attention to features/habitats which may be of potential ornithological importance, e.g. water bodies, woods, crags. Periodic scanning for birds and stops to listen for calls should be incorporated. Frequency of these walks should vary depending on the site, habitat and likely bird species present, but must cover all seasons.

Having established a coarse overview of the likely bird populations on a site, their likely sensitivity and the proximity of relevant designated sites, this should form the basis of the survey programme. It will allow the selection of primary, and potentially secondary, target species (see 3.2 below) and from these the design of the survey programme should follow.

Box 2 Key Sources of Information

SNH

www.snh.gov.uk

RSPB

www.rspb.org.uk/scotland

Scottish Raptor Study Groups (SRSGs)

www.scottishraptorstudygroup.org

Scottish Raptor Monitoring Officer

Scottish Ornithologists' Club (SOC) Local Recorders

www.the-soc.org.uk

National Biodiversity Network (NBN)

www.nbn.org.uk

British Trust for Ornithology (BTO) - Bird Atlases, WeBS, BirdTrack, Non-estuary wader counts (NEWS); Winter gull survey (WINGS)

www.bto.org

Wildfowl & Wetlands Trust – goose and swan monitoring programme

www.wwt.org.uk

Local Biological Records Centres

www.brisc.org.uk/sources.php

Black grouse study groups

Capercaillie Project Officer

Joint Nature Conservancy Council (JNCC) Seabird Colony Data

www.jncc.defra.gov.uk

NB Any constraints to use of data set by data owners must be observed. There may be charges for some data.

3 SURVEY METHODS

3.1 Background

There are two main broad survey types involved.

1) Distribution and Abundance Surveys. These are surveys to record numbers and distribution of breeding, wintering and migrant birds using the site. They will allow the evaluation of a site's importance and provide information to help quantify predicted impacts from disturbance and displacement.

2) Vantage Point (VP) Surveys. These surveys comprise a series of watches from a fixed location to quantify the flight activity of birds at a proposed development site, which provides data to estimate the collision risk. See our Collision Risk Modelling guidance. http://www.snh.gov.uk/planning-and-development/renewable-energy/onshore-wind/bird-collision-risks-guidance/

This guidance document is not exhaustive and there may well be occasions where novel or different survey methods are required. Where bird survey methods differ from those outlined in this guidance, a clear rationale for using a different approach must be set out.

3.2 Target Species

In most circumstances the target species will be limited to those species which are afforded a higher level of legislative protection. Some species may also be selected as a result of their behaviour which makes them more likely to be subject to impact from wind farms. There are three important species lists from which target species may be drawn:

- Annex 1 of the EC Birds Directive;
- Schedule 1 of the Wildlife & Countryside Act 1981; and
- Red-listed Birds of Conservation Concern.

Consideration should also be given to species identified locally as of conservation concern within Local Biodiversity Action Plans. Target species should be restricted to those likely to be affected by wind farms.

Local circumstances may indicate that survey information should also be acquired on other species, especially those of regional conservation concern. Such species are termed *secondary species.* Recording of *secondary species* is subsidiary to recording of *target species.* The list of any *secondary species* should also be determined at scoping stage.

It is generally considered that passerine species are not significantly impacted by wind farms. Additionally, care should be exercised when considering Red list species for inclusion in any survey. In particular attention should be paid to the criteria used for their listing, e.g. restricted or declining wintering populations which may not be relevant for the proposed wind farm location).

Where designated sites are involved, the specific bird interest of these sites has to be assessed. This means that some species that are difficult to survey, especially by standard VP survey, may need to be assessed. See sections 2.1.2 above and 3.8.2.1 below for further information on designated sites.

The survey programme should retain flexibility to adapt to situations where one or more species (especially ones not typically chosen as a target or secondary species) unexpectedly present an issue (e.g. particularly high presence on the site).

3.3 Area of Survey Required

The survey area and design must adequately cover the entire development area, i.e. the largest possible layout, all the alternative layouts and ancillary structures and works. This includes access tracks; borrow pits, electrical substations and grid connections (both underground and overhead).

Potential collision risk, habitat loss and displacement could affect birds outwith the proposal site. Therefore, the main breeding and wintering bird survey areas should extend at least 500m beyond the development/planning application boundary. For access tracks and grid connections, the survey area should be 500m either side of the proposed limits of variation of the route. However, depending on the species using the area, there may be a need for further species or species group-specific survey to establish nest, roost or display sites up to 6km from the proposed development site (See details in Annex 1, Table 1.6).

Where there may be access issues or other land management (e.g. forestry management) and development activities that constrain the ability to survey the area properly, this should be discussed with SNH prior to any survey starting or as soon as such issues become apparent during the survey period. The same applies to other land management (e.g. forestry works) and development activities (e.g. small scale hydro scheme works) taking place on or near the survey area which are likely to affect bird activity.

Where there are adjacent or overlapping wind farm proposals being surveyed simultaneously we strongly recommend that the developers and consultants cooperate with each other over access and coordination of survey. This will minimise potential disturbance issues and prevent survey work potentially being compromised.

3.4 Timing of Survey Visits

All bird species have varied seasonal and within day activity patterns. Survey design should be based around the times when birds are likely to be most active. It is important that survey methods are followed accurately (see Section 3.7 and 3.8 below).

3.5 Duration of Survey Period

Survey work should span all times of the year when the target species are present. We recommend survey for a minimum of two years to allow for variation in bird use between years. This may not need to be specifically commissioned, as other adequate site specific information collected for other purposes up to five years old may be available to be used (e.g. black grouse lek data). In recognition of the wind farm industry moving into more sensitive bird areas, including locations potentially impacting on the qualifying interests of designated sites, two years survey will be required unless it can be demonstrated by the developer that a shorter period of survey is sufficient An example of this may be where a lowland farmland site with lower bird interest or bird activity levels in potentially sensitive locations away from designated sites are much less than anticipated after one year or 18 months of survey.

Individual elements of the survey programme should not be split over different years, e.g. breeding bird surveys should cover the whole breeding season of one year.

Some birds also alternate the use of 'traditional' sites or locations for breeding or feeding between years and these factors should be considered in an assessment.

3.6 Control and Reference Sites

For proposals greater than 50MW, which require consent under the Electricity Act, post-construction monitoring is often a condition of consent. We therefore recommend that, for these developments, a comparable control or reference site is selected and surveyed at the time of the initial surveys. This should be carried out in accordance with Before–After–Control–Impacts (BACI) methods (Anderson *et al* 1999).

3.7 Distribution and Abundance Surveys

Survey techniques will vary according to species of interest, habitat and time of year. The bird interest at most proposed wind farms in Scotland will be adequately surveyed using the following techniques. Where proposed methods differ from those outlined here, the submission should explain clearly the reasons for this and demonstrate the quality of the resulting data. For other situations not covered below, please contact us.

Details on survey methods specific to species and species groups referred to below-are included in Annex 1 Table 1.6.

3.7.1 Moorland breeding birds

The survey method outlined is suitable for many moorland and open country species including, waders, skuas, gulls, red grouse and some wildfowl species. We generally do not recommend survey of moorland passerines. In previous guidance we recommended the Brown & Shepherd (1993) method but, based on recommendations set out in Calladine *et al.* (2009), we now require an adapted Brown & Shepherd method with **four** survey visits at least seven days apart. These should cover the whole breeding season between mid April and early July, and be done between 8:30 hours and 18:00 hours. They should be carried out in a wind of Beaufort force 4 or less, and in dry weather.

Timing of breeding varies between species and geographically across Scotland and this should be borne in mind when planning survey. Mistimed survey visits will fail to record many birds and will not be of an acceptable standard.

All survey visits should be undertaken in the same season; splitting survey visits between years is not acceptable (e.g. first visit in year 1, second visit in year 2).

This method is not appropriate for dotterel. More on this species can be found in Gilbert *et al.* (1998).

3.7.2 Raptors and short-eared owls

Recommended survey techniques are described in Hardey *et al*., 2009. The Area of Interest will exceed the standard 500m buffer to take account of wide ranging birds. Species-specific distances are given in Annex 1 Table 1.6.

The Scottish Raptor Monitoring Officer and/or relevant local Raptor Study Group (see Box 2) should be contacted to;

- help coordinate surveys between raptor study groups and by wind farm surveyors to minimise disturbance to breeding birds, and/or
- seek historical contextual information, e.g. alternate nest sites and changes in distribution due to fluctuating prey base.

It is also important to note that areas without breeding pairs can be used by immature and non-breeding birds. These are important in supporting the wider population as they will include birds that will breed in future. Several raptor species, especially red kite, white-tailed eagle and hen harriers, form communal roosts mostly outwith the breeding season. Any roost sites within 2km of a proposed wind farm site should be identified.

3.7.3 Breeding divers

Recommended survey methods are described in Gilbert *et al.* (1998). These species commute from their nest sites to feed on the sea or freshwater bodies and this needs to be taken into account when identifying the survey area (Annex 1; Table 1.6). They can change nest location between years and non-breed ring birds can occupy suitable breeding lochs or lochans.

Although often considered to be segregated by loch size, studies have demonstrated that there is significant overlap between the species in loch sizes used and that *both* species can commute to feed. No loch or lochan should be discounted on size alone.

3.7.4 Woodland grouse

All leks for woodland grouse species should be identified within 1.5 km of the proposed wind farm site.

The local black grouse study group or capercaillie project officer (see Box 2) should be contacted to;

- help coordinate surveys to minimise disturbance to breeding birds, and/or
- seek historical contextual information.

For black grouse, known lek sites and other areas of suitable habitat (e.g. open moorland and upland farmland adjacent to woodland or forestry, woodland edges, tracks and clearings in plantations) should be surveyed. Recommended survey techniques are described in Gilbert *et al.* 1998.

For capercaillie we have published recommended methods for this species in *Capercaillie survey methods* (www.snh.gov.uk/docs/A863292.pdf).

3.7.5 Woodland passerines

Survey of woodland passerines, especially in commercial conifer forest is generally not required. There are several Schedule 1 woodland passerine species (e.g. crested tit, redwing) which have restricted ranges within Scotland. These would only require survey if the desk study identifies that the proposal area is in a key area for the species. A reduced visit Common Bird Census type survey or, if necessary, a point count method (Gilbert *et al* 1998; Bibby et al, 2000) targeted for these would be recommended in such situations. Crossbill species are listed on Schedule 1 and may need to be taken into account for proposals in commercial forestry in relation to species protection plans but any survey required would be undertaken prior to construction after consent for the proposal.

3.7.6 Nocturnal species, especially owls

Species which are exclusively or largely nocturnal pose special problems for survey as activity and use of the site occurs mainly under conditions of restricted visibility. Nocturnal activity may pose greater hazards for birds at wind farms therefore nocturnal species should be surveyed. Breeding survey should be undertaken and

should extend out to 500m beyond the proposed site for non-owl species, and 1km for owls.

Survey methods have been published for owls (Hardey *et al*., 2009), and nightjar (Gilbert *et a*l 1998). In Scotland, nightjars are restricted as a regular breeding bird to a few areas of Dumfries & Galloway (D&G) and are unlikely to be encountered elsewhere. A radio-tracking study on nightjars in D&G showed that home range size was variable, ranging from approximately 90 to 600ha (Spray, 2007). Owls and nightjar can be surveyed by listening for calling birds around dusk at appropriate times of year: early spring from February onwards for owls, and May-July for nightjar.

For owls, late evening survey for calling juveniles in May-July can also be useful in detecting successful pairs. Adults may also be active during this time. Surveys for owls can be complemented by signs of occupation, such as moulted feathers and pellets.

3.7.7 Lowland and farmland birds

Surveys of farmland passerines especially on more intensive arable habitat are generally not required. Where wetlands and water bodies or rough grazing occur, this is likely to introduce the presence of more important species such as breeding waders. Appropriate survey methods for lowland waders are found in Gilbert *et al* (1998).

Where a range of agricultural habitats occur, information should be gathered on crop and grazing rotations on and within the vicinity of the site. Management changes over time can influence distribution and usage of species across the site.

3.7.8 Wintering and migratory waterfowl, especially geese and swans

Disturbance or displacement to wintering and migrant waterfowl can occur on both roost sites and feeding areas, so surveys for both of these should be considered.

Substantial information on these species is already held by SNH, RSPB, WWT (for geese) and BTO (for other waterfowl), through specific surveys and national monitoring such as the BTO Wetland Bird Survey (WeBS). However, these may not be up to date or may not cover all sites.

Feeding distribution surveys for geese and swans: For greylag geese and pink-footed geese such surveys need only be undertaken when the survey area lies within known goose feeding areas (see Mitchell, 2012). For whooper swan, Greenland white-fronted geese, bean geese and barnacle geese feeding distribution surveys should be undertaken in areas of suitable habitat when the survey area lies within the core foraging distance of SPAs for these species or other major roosts unless it can be established from existing data that the area is not utilised for feeding. Table 2 in the SNH SPA Connectivity Guidance ((http://www.snh.gov.uk/docs/A675474.pdf) details the species specific wildfowl foraging ranges. SNH also hold some feeding distribution data for these species at a number of sites.

Feeding distribution surveys of geese and swans should be carried out on a fortnightly basis where species are likely to be wintering, or on a weekly basis for sites where birds are likely to be present in the migration period only. The survey area should extend to 500m from the proposed development site. Feeding distribution surveys can be undertaken by road transects where the road network is suitable or by observations from vantage points. In either case it is necessary to ensure that all potential feeding habitat can be surveyed. Depending on topography this may require walking into fields to check blind areas.

In addition, searching the survey area for signs of wildfowl presence (counts of droppings) can help determine if feeding birds are using the wind farm site by night or on days previous to survey visits.

Roost site surveys: It is known that geese are particularly sensitive to disturbance on roost sites. As such any known roost sites within 1km of the proposed wind farm should be surveyed fortnightly. Methodology should follow Gilbert *et al* (1998). It should be noted that roost sites may not be restricted to permanent water bodies, but may include temporary standing water, intertidal areas and other wetland habitat.

Where significant levels of goose flight activity are anticipated from vantage point surveys, survey of roost sites beyond 1km from the proposed wind farm site may also be necessary to provide contextual information on local population levels for assessing predicted collision risk from VP work.

3.7.9 Coastal species (also includes inland breeding gulls and terns)

During the breeding season, coastal environments may host aggregations of breeding birds such as seabirds and seaduck, which may be vulnerable to habitat loss and collision with operational turbines. Surveys should focus on identifying such aggregations, especially those within 2km of any proposed development. It should be noted that seabirds may use inland, coastal and inshore habitats for feeding and other behaviours. Similarly breeding aggregations of other species such as coastal waterfowl should also be considered, especially where they are known to fly between breeding, feeding and resting areas, and may pass through the survey area

During the non-breeding period, assemblages of wintering waders and waterfowl as well as coastal gull and tern roosts may occur in areas where wind farms are proposed. Surveys should focus on identifying such assemblages, especially those within 2km of any development. Wintering water birds (waders, waterfowl and gulls) may show regular flight routes to and from nocturnal roosts, as well as movements associated with tidal cycles, and these must be factored into survey design if they are likely to use or pass through the survey area.

3.8 VANTAGE POINT SURVEY

3.8.1 Background

VP survey is designed to quantify the level of flight activity and its distribution over the survey area. Its primary purpose is to provide input data for the Collision Risk Model (Band *et al*. 2007), which predicts mortalities from collision with turbines. Data can also be used to provide an overview of bird usage of the site, which may help to inform an overview of potential disturbance and displacement. However, the data gathered on target species other than those for Collision Risk Modelling may be biased (see section 3.8.2.1). Where new above-ground grid connections are planned, the proposed connection route should be covered by VP observations to assess potential collision risk.

VP survey must not take place simultaneously with any other fieldwork on the site, that may cause disturbance and invalidate the VP survey results.

3.8.2 Vantage Point Survey and Detectability

3.8.2.1 Distance

Detectability of birds to human observers declines with distance. This is particularly noticeable with smaller species, but can also occur due to the species' typical flight behaviour (e.g. merlin, some smaller breeding waders). Even larger species such as

divers show declines in detectability at less than 2km distance. Selection of target and secondary species for VP survey draws from the lists in section 3.2 but potential detectability issues should be borne in mind when selecting VP locations to ensure they are as appropriate as possible for the species to be surveyed (see section 3.8.4 for more information on VP selection).

In some situations corrections using distance sampling methods can be applied or other methods used, e.g. point counts of wader flocks which can be converted to flux and used in the collision risk modelling. Where survey sites are small with very good VP coverage, and/or flight activity of target species is low and backed up by results of the distribution and abundance surveys, there is unlikely to be a need to undertake corrections

Additionally where designated sites, especially SPAs, are involved there is a requirement to assess impacts on their qualifying interests. Whilst robust collision risk data may not be able to be collected for all qualifying species, any flight activity of qualifying species should be recorded. This will provide information to help inform the assessment (e.g. regular flight lines to/from the designated site may be detected). Note, however, that in some cases specific VPs may need to be established to assess whether there is connectivity to designated sites.

Annex 1, Tables 1.1-1.5, provides additional species and species group specific information for vantage point survey.

3.8.2.2 Terrain

Some areas may be hidden from view due to terrain and/or vegetation. Observers should re-use the exact VP location in successive watches as small changes in VP location can produce significantly different visible areas. Changing the VP location complicates collision risk analysis and assumptions cannot be made that viewshed (the view visible from the VP location) areas will be the same. It is therefore critical that the spatial coordinates of VP positions are measured to the highest level of accuracy possible using a GPS.

Birds are often visible when the ground they are flying over is not. Thus birds can sometimes be seen flying or soaring over hidden valleys and watersheds. Where the key purpose is to estimate the risk of collision with turbines, it is the visibility of the airspace to be occupied by the turbine rotors (the collision risk volume) that is of prime importance. Therefore it is recommended that visibility be calculated using the least visible part of this airspace, i.e. an imaginary layer suspended at the lowermost height passed through by the rotor blade tips (typically about 20-30m above ground level). Predicting visibility at this level is a simple task using GIS. Being able to view all or most of the site to ground level can be helpful in gauging overall bird activity and usage of the site, but is not as important as being able to view the collision risk volume.

3.8.3 Area of Flight Activity Survey

Information is collected during timed watches from strategic vantage points (VPs). This should cover the defined survey area encompassing the proposed turbine envelope if known, or the maximum extent of potential turbine layouts. This should extend to 500m beyond the outermost proposed turbines to deal with inaccuracies of position for flight line observations. This will also reduce the risk of failing to record birds that use the wind farm area only occasionally.

3.8.4 Vantage Point Watch Selection

When selecting VPs, the aim should be to cover all of the flight activity survey area such that no point is greater than 2 km from a VP. Any exceptions should be agreed with SNH. It is very important that VPs are chosen to achieve maximum visibility with the minimum number of points. As detection of flight activity will decrease with distance, VPs should be located as close to the survey area as possible.

It is important to minimise the observer's effect on bird behaviour. For this reason VPs are best located outside the survey area where possible. In order to minimise disturbance, VPs should not be located near to sensitive sites for target species, i.e. nest, roost or lek sites. Observers should try to position themselves inconspicuously so as to minimise their effects on bird movements. Care also needs to be taken not to locate observation points in locations that may lie directly between the site and a roost or nest site of a key target species, as this can seriously influence the behaviour of birds to be surveyed

Where VPs are located within the survey area, they should not be used simultaneously with other VP locations which overlook them as the presence of an observer either sitting at or moving to/from the VP will probably affect bird behaviour.

We recommend scanning an arc of up to 180^{o} from each VP. Larger arcs cannot be scanned efficiently. With proposals for up to three turbines it may be possible to observe the entire survey area from a single VP. In most cases, however, two or more VPs will be required. For example an upland site in Scotland measuring around $10km^2$ typically requires three or four VPs.

The number of observers required to undertake watches will vary depending on the levels of target bird activity. If activity is predicted to be high and involves several target species, judgement should be exercised as to whether more than one observer may be required, in order that all activity of target species can be recorded.

3.8.5 Vantage Point Watch Timings

Watches should be tailored to the ecology of the target bird species involved. This should provide a spread over the full daylight period available (from official local sunrise to sunset times) which will vary depending on the time of year. Watches should be spread across all calendar months when the species is present or likely to be so. The watches should be stratified according to the ecology of the target species present and should give a representative sample of site use.

Migration watches should take account of key periods for the target species to be surveyed, and reference should be made to known peaks in their migration and weather patterns that can produce larger scale movements.

Watches should be taken under conditions of good ground visibility (>2km) and can be undertaken on showery days providing showers are not too frequent or prolonged. The cloud base should be high enough to allow observation of the collision risk volume. Ideally such observations should be made in a range of wind conditions This is particularly important in the case of soaring birds when wind direction and strength is likely to have a large effect on ranging behaviour. Some bird species will fly in poorer weather conditions (e.g. persistent rain/mist, very strong winds) but useful observation in such conditions is often difficult and is not recommended, however the likelihood of such activity should be borne in mind during the assessment.

3.8.6 Vantage Point Watch Hours

The longer the overall survey period of VP survey, the more accurate and precise the sample of flight behaviour.

We recommend a **minimum of 72 hours per VP location divided between seasons (36 hours breeding and 36 hours non-breeding) per year**, as a standard for species where vantage point survey is required. We would expect that VP survey effort would be greater than this if the site is particularly sensitive. Where a high level of migration movements are considered likely, or are known, to occur, sampling within this period should be stratified to ensure adequate data collection across the spring and autumn periods. Additional survey is **not always necessary** but may be required to cover this adequately in large areas or areas of high activity. Note that some areas may be more heavily used in either spring or autumn (e.g. the West Water SPA pink-footed goose roost is much more heavily used in autumn and early winter than other periods) and this must be taken into account when designing the VP work. Where proposed effort is less than 72 hours, this should be fully justified and agreed with SNH prior to the survey commencing.

Within each season, each part of the wind farm should be watched for at least 36 hours. If half of the proposed wind farm area has been watched for 36 hours, for example, and the other half has been watched for 36 hours **with no overlap in visibility areas**, then the proposed wind farm area has been watched for 36 hours (the time spent observing each part of the proposed wind farm), and **not** 72 hours (the total time spent in observation).

Observation time during a distribution survey does not count towards observation time conducted under VP watches: the two methods are not consistent in design or objectives.

3.8.7 Vantage Point Watch Durations

We recommend that VP watches are conducted as a series of watches each of not more than 3 hours continuous duration at a time. They are designed to form a representative sample of bird flight activity and a sample of, for example 12 x 3 hour watches is better than fewer longer watches. There should be suitable breaks of at least 30 minutes between watches to minimise observer fatigue. Watches can be suspended and then resumed to take account of changes in visibility, e.g. fluctuations in the cloud base, passing rain shower or for the observer to rest. A combination of more than 9 hours VP watches should not be carried out by the same observer(s) over the course of a single 24 hour period.

The time taken to move between VP locations must be factored into the survey schedule so that there is sufficient time for surveyors to move around the site without risking disturbance impacts on birds or if a small team of surveyors is involved to other VPs being watched. Similarly, there should be a short ‘settling in’ period of approximately 10 minutes at each VP, before watches start to allow surveyor familiarisation and ensure any disturbance from observers moving around the site has passed.

3.8.8 Vantage Point Watch Recording

During each watch, two recording methods are used to record data: focal bird sampling for *target species*; and activity summaries for *secondary* species (See Sections 3.2 and 3.8.2.1). These are as follows:

a. Focal Bird Sampling. The area in view is scanned until a *target species* is detected at which point it is followed until it ceases flying or is lost from view. The time the target bird was detected and the flight duration are recorded. The route followed is plotted in the field onto OS 1:25 000 scale maps (enlarged OS 1:25 000 scale may be useful in some cases). The bird's flight height is estimated at the time of detection and then at 15 second intervals thereafter, using, for example, a count-down timer with an audible alarm. A 15 second interval is recommended as a practical compromise that aims to minimise dependency within data while maximising the sample of observations.

   Flight heights should be classified into height bands, i.e. below the rotor- swept area, the rotor-swept area and above the rotor-swept area, allowing for observer error. Where there is doubt over the size of turbines to be used, further height bands to reflect the possible turbine sizes can be included. It should be noted however that lots of narrow height bands within the rotor-swept area (10m or 20m increments) are difficult to assess accurately and are likely to increase potential observer error. If conditions allow a finer resolution of height bands (e.g. presence of topographical or structural features of known height), more detailed observations of flight height should be made. Use of a clinometer and range finder provides one means of determining flight height accurately. Observations of target species take priority over completion of activity summaries.

b. Activity Summaries. Each watch should be sub-divided into 5 minute periods, at the end of which the number and activity of all *secondary species* observed should be recorded (target and secondary species to be targeted would usually be agreed with SNH at scoping stage prior to survey commencing). If a *target species* is being tracked at the end of a 5 minute period, then the activity summary for that period should be abandoned and a new one started once observations of the target species have ended. Observation of target species takes priority over recording of secondary species. Note that the number of birds recorded should be the minimum number of individuals that could account for the activity observed.

   Static and flying birds should be recorded separately. Observers should record perched birds and birds on water bodies once only on arrival at the VP, and the area or site used marked on a map. Thereafter only flying birds and newly noticed perching/swimming birds should be included in the activity summaries. This allows greater time for focal bird sampling, rather than repeated observations of the same static birds. Changes in weather should be recorded as frequently as necessary.

3.8.9 Vantage Point Watch Observational Error and Flight Height Estimation

Observers must be trained in the recording of different heights from a distance, and a period of training and familiarisation should be conducted at a site prior to formal observations starting. Comparing observer estimates of the heights of objects against their known heights can be used in training and post-training in the estimation of error.

3.8.10 Recording

We recommend that data for target species are recorded on the forms in Annex 2 and mapped on 1:25 000 map(s). This must be completed for each VP watch, regardless of whether target species were recorded or not. Use different forms for

different watches (i.e. do not combine data from different watches onto one form or map). Maps should clearly identify and cross-reference to the form information on:

- the location of the VP used;
- flight lines of *target species* and indicate direction of flight. Use different colours and symbols for each species, including a key on the form; and
- reference number of each flight line corresponding to that on the form.

Use additional map(s) as appropriate to prevent confusion between overlapping flight lines.

4 ALTERNATIVE METHODS

For species which are active at dawn and dusk or at night, other methods of recording or assessing activity need to be employed. Night vision/infra-red equipment and survey on moonlit nights can establish presence of nocturnal species or presence and direction of feeding/migration movements both by calls and by sight (although we accept following birds beyond short distances is almost impossible, and that for most species nocturnal activity is likely to be underestimated in any attempted survey).

Use of automated sensing techniques, such as radar, have been used particularly in relation to offshore renewables and can be useful in assessing activity. Low-powered surveillance radar as used in conventional marine navigation systems offers the simplest means of tracking bird movements in two dimensions, to provide an overview of the location and number of bird flight trajectories out to several kilometres (Desholm *et al*., 2006). This can provide useful supporting information on the volume and location of bird movements.

Such systems cannot discriminate between species of similar size and weight (e.g. common gull and golden plover produce similar echoes), therefore some observations in daylight are required to enable recorded echoes to be assigned to the relevant bird species. In addition, they can be used in conjunction with vertically mounted radar to detect flight heights. **SNH recommends that radar is only used to assess sites where there is likely to be high nocturnal activity of important species, especially if an SPA qualifying species is potentially affected.**

In Scotland, radar has been used in onshore cases in relation to assessing nocturnal movements of geese and golden plover. For some species it may be possible to estimate levels of nocturnal activity based on studies on these species. It has been estimated for geese species that adding on 28% extra activity to observed VP data should account for regular nocturnal feeding activity movements based on a study in Kintyre of Greenland white-fronted geese (Walls *et al*., 2006)

Playback techniques may be helpful in stimulating call responses during nocturnal survey and for other more difficult to detect species. Care should be taken to avoid excessive disturbance to the species, using short bursts (15-30 seconds) of calls several times during a period of 15-20 minutes at any one location. Playback should only be used where suitable habitat for the species is present, and on calm nights. Note that not all birds will respond to playback and that for Schedule 1 species a licence would be required to carry out this type of survey.

Various types of tagging (radio, GPS and satellite) are increasingly being used to investigate a range of bird behaviours. These methods are continuing to reveal important information on migration, foraging and ranging behaviour. Many ongoing tagging projects are publicly available via various websites and can provide useful information, e.g. actual routes of migrating geese and swans, movements of dispersing young raptors, etc. Although there have been few applications of these technologies directly associated with wind farms to date, they clearly have potential uses in both pre- and post-construction surveys.

Such tagging needs careful planning and can be logistically difficult, depending on the species involved. It requires competent, experienced ringers/fieldworkers to trap and mark birds, with such tagging requiring approval from the BTO Ringing Unit's Unconventional Marking Panel. A Schedule 1 licence may also be required, and a proposal will need further assessment if it involves an SPA or SPA qualifying species. Anyone considering undertaking such projects should first contact SNH.

For breeding golden eagles, whole range use can be estimated using the PAT (Predicting Aquila Territory) model in a GIS (McLeod *et al.,* 2002a, b). While actual observations of range use are always preferable, and may identify prey hotspots exploited by golden eagles which the model would not predict, the PAT model can be useful in providing an indication of the potential importance of a proposed wind farm site to breeding golden eagles at a very early stage of the assessment process. The PAT model can also examine potential changes in range use for all known alternative nest sites within a range, something which may take many years of observations to document. It can be used to help assess ranges which are vacant at the time of survey in case they are reoccupied in future and can act as a useful cross-reference to the observed flight data in an occupied range. The use of the PAT model is recommended as an element of assessment.

In some instances, assessing habitat quality, prey abundance and availability can be important in assessing impacts on raptors and can provide important context for survey results, e.g. low hen harrier activity correlated with low vole and/or pipit densities. Whilst some prey species and habitat quality are likely to be covered by other bird and habitat survey work for the proposal, assessing mammal abundance (voles, rabbit/hares, deer/sheep carrion etc.) usually requires additional survey. SNH recommends that such surveys are undertaken where there is likely to be high activity of raptor species, or where SPA-qualifying raptor species are potentially affected.

5 RECORDING, REPORTING AND PRESENTATION OF DATA

This section shows what data should be reported to allow the potential impacts to be assessed, in order to minimise requests from SNH or consenting authorities for further information. Full presentation of results also facilitates their use by other parties, for example within the context of cumulative assessments. The following elements are **required**:

- ES or EIA reports must not be submitted for determination including only partial survey or assessment whilst planned survey is still ongoing as information material to the application's determination will still be being collected and assessed. All survey and assessment must be completed before formal submission of the proposal into the planning system.
- Information must be provided on the experience for bird observation of the staff employed on the field survey team.
- Details must be provided in tabular form for all forms of survey work conducted, including dates, times, observer(s), and weather. An appendix to the environmental statement containing a summary of all the VP survey watches and their results and worked examples of collision risk calculations must be provided to allow collision risk estimates to be independently checked. Examples of VP survey watch and survey visit summary tables are given in Annex 2.
- A summary table containing just the flight line data used in the collision risk modelling must be presented where there is a large amount of flight data involved.
- Flight line activity must be presented in relation to the proposed turbine(s) and application boundary location. Figures should not be too cluttered to allow easy assessment (i.e. not too many species or flights on one figure).
- The location of VP watch points and the area of visibility from each VP must be presented as a map or maps which show the arc (viewshed) in which the observations were conducted. Such viewshed figures should include details of altitudinal cut–off levels to allow assessment of coverage and whether any lower level flight activity may have been missed. The map should also show the location of the proposed wind farm including turbine locations and its proximity to any designated sites where relevant.
- Maps showing the locations of all survey records of birds/nest distribution must be clearly presented in map and tabular form. Agreements on the distribution, publicity and retention of data owned and supplied by external parties must be respected.
- Details of the assessment of impacts should be presented for each target or secondary species where impacts have been identified, even if the impact is deemed to be minor. Where SPA qualifying interest species are involved, the bar for what constitutes a 'minor impact' is much higher. The level of impacts often considered minor in non-SPA related cases may not be acceptable in SPA-related cases. Such estimates will require to be checked by SNH and the consenting authority, and may be invaluable for future cumulative assessments: hence they should be readily available.

5.1 Confidential Annexes

SNH has produced specific guidance on *Environmental Statements and Anenxes of Environmentally Sensitive Bird Information* (www.snh.gov.uk/docs/A285693.pdf). Key points include:

- that the information included should be limited to Schedule 1 species and their breeding and/or communal roost locations;
- confidential annexes should not be used to keep non-sensitive information from the public; and
- environmentally sensitive confidential data should be in a separate annex from any other commercial in-confidence data which developers may share with SNH or consenting authorities.

SNH and consenting authorities are subject to the Freedom of Information (Scotland) Act 2002 and the Environmental Information (Scotland) Regulations 2004. Both of these have a presumption that any information held will be released to any member of the public who seeks it, except in certain circumstances. Such circumstances enable the restriction of information whose release might lead to harm to the species. It is therefore important that confidential annexes include only that information which it is necessary to keep confidential.

6 ACKNOWLEDGEMENTS

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7 FURTHER READING

An exhaustive discussion of the philosophy and principles that should be followed when assessing the impact of a potential or existing wind farm has already been produced (Anderson *et al*., 1999). Updated information relating to this can be found on the website of the National Wind Coordinating Committee (NWCC) as the Comprehensive Guide to Studying Wind Energy/Wildlife Interactions. http://www.nationalwind.org//publications/comprehensiveguide.aspx

Other useful documents on methodologies, that are also available at the NWCC's website, include Gauthreaux (1996), Erickson *et al*. (2000) and Morrison & Pollock (2000). Erickson *et al*. (2000) reviews studies in the USA of the effects of wind farms on birds and provides comparisons of wind turbine collision mortality with other forms of collision mortality.

The Bern Convention (Convention on the Conservation of European Wildlife and Natural Habitats 2003) has also produced a useful review, which includes several principles which should be followed when undertaking environmental assessments that involve wind farms and birds. In 2010 the European Commission also produced the important document Wind Energy Development and Natura 2000 (http//:ec.europa.eu)

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ANNEX 1 – SPECIFIC VP SURVEY for BREEDING, WINTERING and MIGRATION SURVEY

Abbreviations used in Tables: B – breeding season; NB – non-breeding season; M – Migration; and N/A – Not Applicable

Table 1.1 Divers

VP SUMMARY TABLE					
Species	**Recommended Minimum hours per VP per season**			**Temporal spread of VP hours required**	**Notes**
	B	NB	M		
Divers - General	36	36	N/A	Between sunrise and sunset	Surveys should be conducted during the breeding season (late April to August inclusive) for two breeding seasons. Observations should be collected between official sunrise and official sunset time. Great care should be taken not to disturb nesting divers when selecting VP locations and visiting VPs, especially when setting up observations around dawn. In both diver species' populations there are non-breeding and prospecting birds that visit lochs in suitable breeding habitat. Impacts on these elements of the population should be considered and observers should distinguish these birds from breeding birds. Flight activity can peak early and late in the day and also during June-August.
Red-throated diver	36	36	N/A	Between sunrise and sunset	In addition to the daytime watches outlined above for divers 'Focal breeding loch' watches should also be conducted from VPs overlooking each occupied nesting lochan within 1 km of the proposed development site. Incoming and outgoing flights should be recorded during the incubation and chick-rearing periods. For proposed development sites that lie on potential flight routes between the sea/feeding loch and a designated site for red-throated divers, 'focal breeding loch' watches may be required at nesting lochans at more than 1km. Observations should be sufficient to record a total of 20-30 incoming and outgoing flights. The latter are more useful for determining flight routes as the birds can usually be followed for longer before being lost to view than with incoming flights. (we acknowledge that this may be hampered by pairs failing and activity changing). In some cases fewer flights may be enough to identify regular flight routes. If the area has a high density of divers in the vicinity further advice from SNH may be required.
Black-throated diver	36	36	N/A	Between sunrise and sunset	Note that in some parts of N&W Scotland black-throated divers can breed on small lochs and regularly feed away from the breeding site like red-throated divers. Additional 'focal breeding loch' VP watches to map flight lines should be carried out as per red-throated diver above where it has been identified that this behaviour occurs.

Table 1.2 Raptors and Owls

VP SUMMARY TABLE					
Species	**Recommended Minimum hours per VP per season**			**Temporal spread of VP hours required**	**Notes**
	B	NB	M		
Raptors - general	36	36	N/A	Between sunrise and sunset	Unless it has been otherwise agreed VP watches should be conducted for two breeding seasons, non-breeding seasons or years, depending on whether the species of interest occurs in the breeding or non-breeding periods or year-round respectively. Breeding season is April-July inclusive unless otherwise stated below.
Golden eagle	36	36	N/A	Between sunrise and sunset	Soaring and display often peaks during the warmer part of the day but can occur throughout the day. Hunting flights also occur throughout the day and territorial birds can forage several kilometres from nest sites. There are seasonal variations in activity levels, e.g. late winter/early spring period has increased territorial behaviour and nest building prior to breeding Immatures and non-breeding birds can visit breeding territories. Breeding season is defined as February-August inclusive.
White-tailed eagle	36	36	N/A	Between sunrise and sunset	Soaring and display often peaks during the warmer part of the day but can occur throughout the day. Hunting flights also occur throughout the day and territorial birds can forage several kilometres from nest sites. There are seasonal variations in activity levels, e.g. late winter/early spring period has increased territorial behaviour and nest building prior to breeding Immatures and non-breeding birds can visit breeding territories. Breeding season is defined as February-August inclusive.
Osprey	36		N/A	Between sunrise and sunset	Note birds can forage up to 10km from nest sites regularly and some rich feeding locations (which can be coastal) are used by birds from several territories as well as non-breeding birds. Breeding season is defined as April-August inclusive.
Red kite	36	36	N/A	Between sunrise and sunset	Activity varies across the year, with some habitat specific activity, e.g. seasonal foraging around lambing areas and foraging over farmland during silage cutting and harvesting. Such foraging can also be communal with flocks gathering in good feeding areas.
Hen harrier	36	36	N/A	Between sunrise and sunset	Whilst much flight activity is at a relatively low height (less than 15m) birds do fly at greater heights especially during display or when commuting longer distances. Breeding season defined as April-August inclusive

Goshawk	36	36	N/A	Between sunrise and sunset	Whilst this can be a species which is difficult to detect on VP survey primarily due to much flight activity being at low level and in and around forest/woodland cover, the flight activity above the canopy can be surveyed. Given that mature commercial forestry and other woodland often have trees 20-30m high this above canopy flight will be relevant to the potential collision risk area for turbines.
Peregrine	36	36	N/A	Between sunrise and sunset	Birds often on territory year round. Breeding season is defined as March-August.
Merlin	36	36	N/A	Between sunrise and sunset	This species is very difficult to detect on VP survey and is generally significantly under recorded. While much flight activity is at a relatively low height (less than 15m) birds do fly at greater heights especially during display or when commuting longer distances.
Short-eared owl	36	36	N/A	Between sunrise and sunset	Diurnal activity peaks early and late in the day, although in some areas peak is very much in evening. Note daytime activity may not be representative of nocturnal activity (Calladine & Morrison 2013) and is tied to vole activity patterns. While much flight activity is at a relatively low height (less than 15m) birds do fly at greater heights especially during display or when commuting longer distances. Breeding season is defined as April-August

Table 1.3 Geese and other waterfowl

VP SUMMARY TABLE					
Species	**Recommended Minimum hours/VP/season**			**Temporal spread of VP hours required**	**Notes**
	B	NB	M		
Waterfowl - general	36	36	See 3.8.6	Between and including dawn and dusk	The spring migration, period is defined as March – mid-May but this will vary depending on species and location. The autumn migration period is defined as September – November but again varies with species. Additional watches during migration periods may be required in some cases - see section 3.8.6, Migratory activity is often weather-related and so an element of targeting a proportion of observations to periods when the weather is likely to result in movements of target birds occurs may be more effective than simply accruing additional observation hours over an autumn or spring.
Geese & swan spp.	36	36	See 3.8.6	Between and including dawn and dusk	Breeding season relates to the British resident population of greylag goose and due to the growth and range expansion of the resident population it may not be possible in many locations to differentiate between these birds and wintering Icelandic birds outwith the breeding season. Wintering birds can feed at night, and nocturnal flights that should be taken into account when calculating collision risk (see section 3.8). For sites which may potentially affect birds flying to and from roost sites, observations should be conducted one hour before dawn to one hour after dawn (or until the roost is vacated if necessary), and one hour before dusk to one hour after dusk. For sites which are close to feeding sites or may intercept flights between feeding sites, and away from roosts observations should be conducted throughout the day.

Table 1.4 Upland and lowland waders

VP SUMMARY TABLE					
Species	**Recommended Minimum hours/VP/season**			**Temporal spread of VP hours required**	**Notes**
	B	NB	M		
Waders general	36	36	See 3.8.6	Between sunrise and sunset	Inclusion wader species will depend on proximity to designated sites and levels of activity expected to be encountered. Display tends to peak earlier in the breeding season, with intensity varying during the day, often showing peaking in early morning or the evening. Some species commute to and from feeding areas away from the breeding location. .Additional watches during migration periods may be required in some cases - see section 3.8.6,
Dunlin	36	N/A	N/A	Between sunrise and sunset	Dunlin is very difficult to detect with standard VP survey and unlikely to be meaningfully recorded without species specific bespoke VPs. Most flight activity of breeding dunlin is at low heights (below 20m), although some display and commuting flights can be higher.
Golden plover	36	36	See 3.8.6	Between sunrise and sunset	Display and some commuting flight activity can be at collision risk heights. In many areas of Scotland commuting flights from breeding to feeding sites on pasture regularly occur. Inland wintering and migration stopover sites occur on grassy moorland and upland pasture in Scotland, as well as on lowland farmland.
Greenshank	36	N/A	N/A	Between sunrise and sunset	Display and some commuting flight activity can be at collision risk heights. Birds can display over a fairly large area and display is primarily in the earlier part of the breeding season and often very early in the day.
Common snipe	36	N/A	N/A	Between sunrise and sunset	Snipe are very difficult to detect on standard VP watches (a significant proportion of display and other flight activity is crepuscular or is in weather of reduced visibility) and are unlikely to be meaningfully recorded. Some display flight activity will be at collision risk height.
Whimbrel	36	N/A	N/A	Between sunrise and sunset	Mainly restricted to Shetland as a breeder in Scotland with very small populations in Orkney, Caithness and Sutherland and the Outer Hebrides. Display and some commuting flight activity can be at collision risk heights.
Curlew	36	36	See 3.8.6	Between sunrise and sunset	Display and some commuting flight activity can be at collision risk heights Display can be over a relatively large area. Inland wintering and passage stopovers can occur on upland habitats in Scotland.

Table 1.5 Coastal species

VP SUMMARY TABLE					
Species	**Recommended Minimum hours/VP/season**			**Temporal spread of VP hours required**	**Specific Guidance Notes**
	B	NB	M		
Coastal species - general	36	36	See 3.8.6	Between sunrise and sunset	Allow at least 36 hours of observation at each VP for the breeding season (mid-March to August) and 36 hours at each VP for the non-breeding season (September to mid-March), appropriately timed for any migratory interest that may use or overfly the wind farm site. Additional watches during migration periods may be required in some cases – see section 3.8.6.. Migratory activity is often weather-related and so an element of targeting a proportion of observations to periods when the weather is likely to result in movements of target birds may be more effective than simply accruing additional observation hours over an autumn or spring. Where intertidal habitats holding migrant and wintering waders are present survey should cover movements of birds to/from roosts and feeding areas. These watches should be spread over the full range of tidal conditions to cover variation in wader activity. Note that many wader species can feed nocturnally as well as diurnally.
Skuas	36		N/A	Between sunrise and sunset	Skuas can show distinct commuting flight lines from inland breeding sites to the coast and watches should seek to identify any such flight lines. Great skuas in particular will mob intruders and any VP survey close to colonies will need to account for this.
Gulls & terns	36	36 (gulls only)	See 3.8.6	Between sunrise and sunset	Gulls and terns can often have regular commuting flight lines at both inland and coastal colonies to feeding areas, and watches should seek to identify any such flight lines. Gulls are more likely to be selected for VP survey where concentrations of birds could be affected by the proposal - e.g. breeding colonies, roosts and feeding areas such as landfills. Gulls and terns will mob intruders so VP survey close to breeding colonies will need to account for this.

Table 1.6 Non VP survey summary for most regularly encountered species or species groups

BREEDING, WINTERING and MIGRATION SURVEY SUMMARY TABLE			
Species	**Survey Period**	**Distance outwith proposal site within which data should be collected**	**Notes**
Red-throated diver	Breeding	Within 1km radius	Occupied water bodies. Use of lochans 15m long. Assess non-breeding birds present. Two years' survey is required unless shorter survey period has been justified.
Black-throated diver	Breeding	Within 1km radius	Occupied water bodies. Use of lochs 100m long. Assess non-breeding birds present. Two years' survey is required unless shorter survey period has been justified.
Golden eagle	Breeding	Within 6km radius	Breeding territories. Two years' survey is required unless shorter survey period has been justified.
White-tailed eagle	All year	Within 6km radius	Breeding territories & communal roosts. Two years' survey is required unless shorter survey period has been justified.
Peregrine	Breeding	Within 2km radius	Breeding territories. Two years' survey is required unless shorter survey period has been justified.
Merlin	Breeding	Within 2km radius	Breeding territories. Two years' survey is required unless shorter survey period has been justified.
Hen harrier	All year	Within 2km radius	Breeding territories & communal roosts. Two years' survey is required unless shorter survey period has been justified.
Red kite	All year	Within 2km radius	Breeding territories & communal roosts. Two years' survey is required unless shorter survey period has been justified.
Osprey	Breeding	Within 2km radius	Breeding territories. Two years' survey is required unless shorter survey period has been justified.
Goshawk	Breeding	Within 1km radius	Breeding territories. Two years' survey is required unless shorter survey period has been justified.

Short-eared owl	All year	Within 2km radius	Breeding territories & communal roosts. Two years' survey is required unless shorter survey period has been justified.
Other owls	Breeding	Within 1km radius	Breeding territories. Two years' survey is required unless shorter survey period has been justified.
Black grouse	Breeding	Within 1.5km radius	All leks. Note that single males often do not have a fixed lek site and can be harder to detect. Two years' survey is required unless shorter survey period has been justified.
Capercaillie	Breeding	Within 1.5km radius	All leks. Two years' survey is required unless shorter survey period has been justified. See Capercaillie survey guidance link in section 3.7.4 for more detailed methods.
Upland waders	Breeding		Breeding pairs survey using transects with 4 visits during mid April-early July. Two years' survey is required unless shorter survey period has been justified.
Lowland waders	Breeding		Breeding pairs survey using transects with 3 visits during mid April-early July. Two years' survey is required unless shorter survey period has been justified.
Non-breeding waders	Autumn-Spring		Count birds monthly between July-May at roosts and with through the tide counts, the latter if required, Two years' survey is required unless shorter survey period has been justified.
Non-breeding wildfowl (esp. geese & swans)	Autumn-Spring		Count birds as required twice per month at roosts and/or feeding areas depending on site between August-May. Two years' survey is required unless shorter survey period has been justified.

ANNEX 2 – EXAMPLES OF VP SURVEY RESULTS AND SURVEY VISIT SUMMARY TABLES

Vantage Point Survey Watch Summary Table						
Date	Observer	VP	Start	Finish	Length of VP watch (hrs)	Weather
12/6/13	A. Watcher	1	12:00	15:00	3	Sunny intervals, wind SW F4-5, Visibility good
13/6/13	A. Watcher	2	9:00	11:00	2	Overcast then heavy rain curtailing watch, wind S F1-2
14/6/13	A. Watcher	1	06:00	09:00	3	Dry, sunny, wind F1

Vantage Point Survey Results Summary Table						
Species	Date	VP	No of Birds	Flight behaviour/ Age of bird	Time at risk height for flight in secs	Total time at risk height (multiplied where more than one bird involved in the flight)
Curlew	12/3/13	1	1	Display	30	30
Curlew	14/4/13	2	30	Heading north west to farmland off site	15	450
Golden Eagle	15/4/13	1	1	Adult displaying	25	25

NB: Can be split by season where relevant. Watch data should be recorded and presented in date order to allow ease of assessment

Breeding Bird Survey Visit Summary Table			
Date	**Observer**	**Start & finish time**	**Weather**
14/4/13	A. Watcher	0:8:30-12:00	Dry, overcast, stopped due to rain, wind F3.
15/5/13	A. Watcher	10:00-14:00	Sunny, wind F2