



Chapter 9

Ornithology

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Chapter 9

Ornithology

9.1 Introduction

1. This Chapter considers the potential effects of the proposed Arcleoch Windfarm Extension (hereafter referred to as the proposed Development) on birds. It details the methods used to establish the ornithological interest within the Site and its surroundings, together with the process used to determine the Nature Conservation Importance of the species and populations present. The ways in which birds might be affected by the proposed Development are explained and the significance of the potential effects of the proposed Development are considered. The potential for cumulative effects on birds is assessed.
2. It was undertaken by Natural Research Projects (Ltd) and complements the assessment of ecological effects in **Chapter 8: Ecology**.
3. The Chapter is supported by the following Technical Appendices:
 - Technical Appendix 9.1 Birds Technical Report;
 - Technical Appendix 9.2 Birds Collision Risk Modelling; and
 - Technical Appendix 9.3 Confidential Annex.

9.2 Approach to assessment and methods

9.2.1 Legislation, policy and guidance

4. Legislation, policy and guidance relevant to this assessment is provided in **Technical Appendix 4.1**.

9.2.2 Study area

5. The field surveys adhered to current Scottish Natural Heritage (SNH) Guidance (SNH, 2014), and therefore, the following survey buffers were applied around the initial proposed turbine locations for the field surveys:

- a 500 m buffer was applied for the flight activity survey, the breeding bird survey of open ground and the winter bird survey;
- a 2 km buffer was used for most scarce breeding raptors and owls; and
- a 1.5 km buffer was applied for other scarce breeding species.

6. These buffers are indicated on **Figure 9.1a & 9.1b**.

7. It should be noted that the original study area derived in 2014 was based on different areas than are now covered by the proposed Development, therefore to ensure survey results are relevant to the proposed Development the results have been tailored (by way of presentation and assessment) to the relevant buffers of the proposed turbine layout (**Figure 9.2**).

9.2.3 Effects assessed in full

8. Potential effects are assessed in respect of species of high or moderate Nature Conservation Importance, as follows:

- Goshawk (high Nature Conservation Importance).

9.2.4 Effects scoped out

9. No effects were scoped out prior to commencement of the desk based study and field surveys. On the basis of the desk study and field survey work undertaken, the professional judgement of the ornithology team, experience from other relevant projects and taking account of policy guidance and standards, the following topic areas have been scoped out of the assessment:

- effects on internationally and nationally designated sites: the distance to the nearest SPAs and SSSIs are such that the species cited in the designations for these areas would not be affected by the proposed Development. The baseline data agree showing minimal use of the proposed Development by the SPA and SSSI qualifying species – hen harrier. There is therefore no requirement to undertake a Habitats Regulations Appraisal, as there is no possibility of an effect on the designated site;
- effects on the following bird populations: whooper swan, greylag goose and pink-footed goose; hen harrier, barn owl, merlin and peregrine; curlew, golden plover, snipe, woodcock and lapwing. Baseline field studies in 2014, 2017, 2018 and 2019 recorded very infrequent use of the area near the proposed Development Site by these species of high and moderate Nature Conservation Importance. Although these species were present, their reliance on habitats and airspace in the vicinity of the proposed Development is so low that there is no potential for an adverse effect on regional or national populations as a result of construction, operational or decommissioning activities (see **Baseline Conditions**), and
- effects on all bird species classified as of low Nature Conservation Importance.

9.2.5 Baseline determination

9.2.5.1 Data sources

10. In addition to the Guidance listed above, the following data sources have been consulted to inform the assessment:

- SNH Sitelink web pages (online information about designated sites);
- The UK Biodiversity Action Plan (BAP);
- The Birds of Conservation Concern (BoCC) (Eaton *et al.*, 2015);
- International Union for the Conservation of Nature (IUCN) Red list of threatened species (IUCN, 2017);
- Scottish Biodiversity List (Scottish Biodiversity Forum, 2013);
- Relevant ESs, associated documents and bird monitoring reports for developments included in the Cumulative Assessment (acquired from various sources); and
- Data on relevant scarce raptor species supplied by the local RSG.

9.2.5.2 Field survey

11. Baseline field surveys for the proposed Development were carried out between January and December 2014, April to August 2017 and April 2018 to March 2019. A detailed methodology for all surveys is provided in **Technical Appendix 9.1** and is briefly summarised here. Please refer to **Figure 9.1a** to **Figure 9.9** in **Volume 3** for survey buffers and results.

12. Information on bird flight activity was collected during watches from vantage points (VPs) within and surrounding the proposed Development. Data were collected for all target bird species from eight Generic VPs (GVPs) throughout the baseline survey period (split into breeding season and non-breeding season) with a minimum of 36 hours from each GVP per season. Surveys collated data over a 500 m buffer of the proposed turbine locations, and for *Target A* species recorded flight duration and the bird's flying elevation above the ground at 15 second intervals. For other species (*Target B*) flights were mapped and elevation noted but not timed. Finally for species of lower conservation importance (*Target C*) a count of individuals present each five minute period was made.

13. Bird distribution and abundance was determined in the breeding seasons of 2014, 2017 and 2018 by carrying out walkover surveys of open ground within a 500 m buffer of the proposed turbine locations, to establish the breeding bird community on open ground habitats. Four visits were completed between April and July in each year (with a gap of at least two weeks between each visit). The ground was covered to 100 m of all points and positions of birds were mapped and behaviour noted. A summary map was compiled after all visits showing the location of each identified territory centre.

14. Targeted watches and searches of key habitats were undertaken to look for breeding raptors and owls within 2 km of the proposed turbines and any checks of potential nests were made by licensed observers.

15. Checks for displaying black grouse were completed in April and May of 2014, 2017 and 2018.
16. During the non-breeding season, the bird community was surveyed by undertaking walkover surveys of the 500 m study area.

9.2.6 Consultation

17. Requests for Scoping opinions and other consultation were made with SNH and the Royal Society for the Protection of Birds (RSPB). Ornithological information for the area was requested from the local Raptor Study Group (RSG) (Table 9.1).

| Consultee | Response | Action |
|--|---|--|
| SNH – Advice. Email from P Taylor October 2014 | Advice on Vantage Point locations, survey areas and survey effort. | The advice was adhered to. |
| SNH – Advice. Email from G Walker June 2017 | Advice on Vantage Point locations survey areas and survey effort. | The advice was adhered to. |
| SNH Scoping Opinion | <i>“Glen App and Galloway Moors Special Protection Area (SPA) ...the turbines of the proposed extension would be sited approximately 3km to the East of the SPA, with the operating Arcleloch wind farm being situated in between the SPA boundary and the proposed wind farm extension”</i> | Noted. |
| | <i>“Given the separation distance between the development site and the SPA, in line with our Guidance on Assessing Connectivity with Special Protection Areas (SPAs) (June 2016) - the development would be situated out with the core foraging range for hen harrier, which is the area in which we would consider there may be connectivity between the development site and the qualifying interests of the SPA. However, we reserve full judgement until we have considered the full ornithology survey findings.”</i> | The possibility of connectivity with the SPA is discussed in the Assessment |
| | <i>“Glen App and Galloway Moors Site of Special Scientific Interest. Glen App and Galloway Moors SSSI is of national importance, shares the same boundary as the SPA and is also designated for breeding hen harrier. We also reserve full judgement on the impacts of the SSSI until we have considered the full ornithology survey results.”</i> | The possibility of connectivity with the SSSI is discussed in the Assessment |
| | <i>“Our advice with regards to breeding birds is that the following mitigation is required to minimise the impact of the development: Ground or vegetation clearance works are undertaken out-with the main bird nesting season (March-August inclusive). If this is not possible, a suitably experienced ecologist should check the development site before work commences to determine the presence of any nesting birds. If nesting birds are found, a suitably sized buffer zone should be set up around the nest and no work within this zone should commence until the young have fledged or the nest is no longer in use. This will ensure that no nests are destroyed during the site construction works and no offences are committed under the Wildlife and Countryside Act 1981 (as amended).”</i> | Protection of breeding birds is discussed as part of the Embedded Measures in the Assessment |
| RSPB Scoping opinion | <i>“Red kites are known to be present in the area and ornithological surveys should take into account this species.”</i> | Surveys covered all areas where this species might have occurred. |

Table 9.1: Consultations

9.2.7 Approach to assessment of effects

18. The assessment followed the process set out in The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 and government guidance on the implementation of the EU Birds and Habitats Directives. The process of evaluating the effects of the proposed Development on birds ensures that the consenting authority (the Energy Consents Unit in this case) has sufficient information to determine whether the proposed Development (either alone or in combination with other plans or projects) is likely to have a significant effect on bird interests.
19. Effects are evaluated against the existing baseline conditions, i.e. without the proposed Development present. If any mitigation is required this is then identified, and the effects reassessed with this included.
20. Where there is a potential effect on a bird population that forms part of the qualifying interest of an internationally or nationally designated site (or where such designation is proposed)) i.e.:
- Special Protection Areas (SPAs);
 - Ramsar sites;
 - Sites of Special Scientific Interest (SSSIs); and
 - a site that would meet the criteria for international or national designation.
21. Effects are judged, so far as possible, against whether the proposed Development could significantly and adversely affect the Site's 'population' and the objectives of the Site's classification.
22. Where bird populations are not protected by such a designation as listed in paragraph 20, then judgement is made against a more general expectation that the proposed Development would not have a significant adverse effect on the species' overall population, range or distribution; and that it would not interfere significantly with the flight paths of migratory birds.
23. In assessing the effects consideration is given to the national and regional populations of species. Regional populations are those occurring within the host Natural Heritage Zone (NHZ).
- #### 9.2.7.1 Impacts assessed
24. The following potential impacts resulting from the proposed Development on birds have been assessed in full:
- habitat modification due to changes in land management and hydrology during construction and operation;
 - direct habitat loss, both temporary during the construction phase and permanent during the operation phase, due to land-take by turbine bases, access tracks and ancillary structures;
 - indirect habitat loss due to displacement of birds as a result of construction and maintenance activities or due to the presence of the operational turbines close to nesting or feeding sites or habitual flight routes;
 - collision with rotating turbine blades during the operational phase (i.e. killing or injuring birds); and
 - cumulative impacts within the regional population arising from the above potential impacts during the operational phase, taken along with those effects predicted for other windfarm developments.
- ### 9.2.8 Significance of effect
25. The assessment determines the potential impacts of the proposed Development and considers the likelihood of their occurrence. Effect is defined as change in the assemblage of bird species present as a result of the impacts accrued by the proposed Development. Change can occur either during or beyond the life of the proposed Development. Where the response of a population has varying degrees of likelihood, the probability of these differing outcomes is considered. Note effects can be adverse, neutral or beneficial.
26. In assessing whether an effect is significant or not, three factors are considered:
- the Nature Conservation Importance of the species involved;
 - the magnitude of the likely impact; and
 - the conservation status of the species.
27. The significance of potential effects is then determined by integrating the assessments of these factors in a reasoned way. The magnitude of likely impacts involves consideration of their spatial and temporal magnitudes. In making judgements on significance by this integration, consideration is given to the national and regional trends of the potentially affected species,

and how the integrated impacts may impinge on the conservation status of the species involved at these geographical levels. Further details of the process underlying the assessment and the determination of significance follow.

9.2.8.1 Nature Conservation Importance

28. The Nature Conservation Importance of each species potentially affected by the proposed Development has been defined according to **Table 9.2**.

| Importance | Definition |
|------------|--|
| High | Species listed in Annex 1 of the EU Birds Directive. Breeding species listed on Schedule 1 of the WCA. |
| Moderate | Species on the BoCC 'Red list' (Eaton <i>et al.</i> , 2015) or IUCN 'Red list – 'Near Threatened' (IUCN 2017). Regularly occurring migratory species, which are either rare or vulnerable, or warrant special consideration on account of the proximity of migration routes, or breeding, moulting, wintering or staging areas in relation to the proposed Development. Species present in regionally important numbers (>1% regional population). |
| Low | All other species not mentioned above. |

Table 9.2: Nature Conservation Importance

29. Species listed in Local BAPs (LBAPs) would be considered moderately important only if the proposed Development supported at least 1 % of the regional population.

30. All other species are considered of low Nature Conservation Importance and are not considered further in this assessment.

9.2.8.2 Magnitude of impact

31. Magnitude was determined by consideration of the spatial and temporal nature of each impact. There are five levels of spatial magnitude (**Table 9.3**) and four levels of temporal magnitude (**Table 9.4**). As this is a non-designated site, spatial magnitude was assessed in respect of regional populations within the appropriate ecological unit, in this case the Western Southern Uplands and Inner Solway Natural Heritage Zone (NHZ 19) as defined by SNH (SNH, 2001).

| Magnitude | Definition |
|------------|--|
| Very High | Total/near total loss of a bird population due to mortality or displacement. Total/near total loss of productivity in a bird population due to disturbance. Guide: > 80 % of regional population affected |
| High | Major reduction in the status or productivity of a bird population due to mortality, displacement or disturbance Guide: 21-80 % or regional population affected |
| Moderate | Partial reduction in the status or productivity of a bird population due to mortality, displacement or disturbance. Guide: 6-20 % of regional population affected. |
| Low | Small but discernible reduction in the status or productivity of a bird population due to mortality, displacement or disturbance. Guide: 1-5 % of the regional population affected. |
| Negligible | Very slight reduction in the status or productivity of a bird population due to mortality, displacement or disturbance. Reduction barely discernible, approximating to the 'no change' situation. Guide: < 1 % of regional population affected. |

Table 9.3: Levels of spatial magnitude of impact

| Magnitude | Definition |
|-------------|--|
| Permanent | Impacts continuing indefinitely beyond the span of one human generation (taken as approximately 25 years), except where there is likely to be substantial improvement after this period (e.g. the replacement of mature trees by young trees which need > 25 years to reach maturity, or restoration of ground after removal of a development). Such exceptions can be termed very long effects. |
| Long-term | Approximately 15-25 years or longer (refer to above). |
| Medium-term | Approximately 5-15 years. |
| Short-term | Up to approximately 5 years. |

Table 9.4: Levels of temporal magnitude of impact

32. The magnitude of an impact can be influenced by when it occurs. For example, operations undertaken in daylight hours may have little temporal overlap with the occupancy of birds' night-time roosts; and seasonality in a bird population's occupancy of a site may mean that impacts are unlikely during certain periods of the year.

33. A population's behavioural sensitivity may also be considered when assessing the magnitude of effects. Behavioural sensitivity may be judged as being high, moderate or low according to the species' ecological function and behaviour. Behavioural sensitivity can differ even between similar species and, for particular species, some populations and individuals may be more sensitive than others, and sensitivity may change over time, e.g. species are often more sensitive during the breeding season.

34. Importantly, in determining behavioural sensitivity and its contribution to an impact, where such information exists from monitoring sites, data on the responses of individual birds and bird populations to windfarms and similar developments are taken into account, along with knowledge of how rapidly the population or performance of a species is likely to recover following loss or disturbance (e.g. birds being recruited from other populations elsewhere).

9.2.8.3 Conservation status

35. Where the available data allowed, the conservation status of each potentially affected population was considered within the NHZ. For these purposes, conservation status was taken to mean the sum of the influences acting on a population which may affect its long term distribution and abundance. Conservation status is considered to be favourable where:

- a species appears to be maintaining itself on a long-term basis as a viable component of its habitats;
- the natural range of the species is not being reduced, nor is likely to be reduced for the foreseeable future; and
- there is (and will probably continue to be) sufficient habitat to maintain the species' population on a long-term basis.

9.2.8.4 Determining significance of potential effects

36. Following the classification of each species' Nature Conservation Importance and consideration of the magnitude of each effect, professional judgement is used to make a reasoned assessment of the likely effect on the conservation status of each potentially affected species.

37. In accordance with the EIA Regulations, each likely effect is evaluated and classified as either significant or not significant. The significance levels of effect on bird populations are described in **Table 9.5**. Impacts resulting in detectable changes in the conservation status of regional populations of Nature Conservation Importance are automatically considered to be significant effects for the purposes of the EIA Regulations (i.e. no distinction is made between effects of "major" or "moderate" significance). Non-significant effects include all those which are likely to result in small to barely detectable (minor) or non-detectable (negligible) changes in conservation status of regional (and therefore national) populations.

| Significance level of effect | Description |
|------------------------------|--|
| Major | Detectable changes in regional populations of Nature Conservation Importance that would have a severe impact on conservation status. |
| Moderate | Detectable changes in regional populations of Nature Conservation Importance that would likely have an impact on their conservation status. |
| Minor | Small or barely discernible changes that would be unlikely to have an impact on the conservation status of regional populations of Nature Conservation Importance. |
| Negligible | No or non-detectable changes in the conservation status of regional populations of Nature Conservation Importance. |

Table 9.5 Significance levels of impacts on birds

9.2.8.5 Requirements for mitigation

38. Following the identification of the potential effects, this Chapter will then identify mitigation measures if any of the potential effects on features of Nature Conservation Importance are determined to be significant. These measures will aim to avoid, reduce, or remedy the effects where possible.

9.2.8.6 Assessment of residual effects

39. The residual effects of the proposed Development are those effects remaining after mitigation. The residual effects have been assessed following the methodology for the assessment of potential effects but taking into consideration any proposed mitigation and enhancement.

9.2.8.7 Assessment of cumulative effects

40. The assessment of cumulative effects is undertaken in a similar manner to that of the potential 'in isolation' effects for the proposed Development but takes into consideration other operational, consented or within-planning windfarm developments. Developments within scoping are not considered.

41. SNH Guidance (SNH, 2012) on assessing cumulative effects has been followed. In considering cumulative effects it is necessary to identify any effects that are minor, or greater, in isolation but that may be significant when added together.

9.2.9 Limitations to the assessment

42. There are no known information gaps or shortfalls in the data. The available information on bird populations at the NHZ level is limited and available information on the results of monitoring, mitigation and enhancement work at existing windfarm developments is sparse. Therefore, the best use is made of the available literature and professional judgement to inform the assessment.

9.3 Baseline conditions

43. This section summarises the baseline bird populations and flight activity within and surrounding the proposed Development based on surveys undertaken in the period January 2014 to March 2019. Details of methods and full results are presented in **Technical Appendix 9.1**.

44. The proposed Development Site comprises commercial plantation forestry at various stages of its lifecycle. The habitats within the ornithology 2 km buffer of the proposed Development includes plantation forestry, open moorland of rough grass and heather patches, and rough grazing.

9.3.1 Designations

45. The Site is not statutorily designated at international or national levels for ornithological interests. The nearest designated areas for birds are the Glen App and Galloway Moors Special Protection Area (SPA) (approximately 3 km south) which is designated for breeding hen harrier (*Circus cyaneus*).

9.3.2 Field survey

9.3.2.1 Wildfowl

46. Whooper swan (*Cygnus cygnus*), greylag goose (*Anser anser*) and pink-footed goose (*A. brachyrhynchus*) were recorded. All are regular winter migratory species in the UK and as such are afforded protection under the Birds Directive.

47. One flight by a flock of 13 whooper swans passed over the 500 m buffer of the proposed turbine locations. A total duration of 1414 seconds (23.57 minutes) of flight activity was recorded; however none of this duration was spent at collision risk height, i.e. between 50 - 200 m in height.

48. Two flights by greylag goose, involving a total of three birds, flew within the 500 m buffer of the proposed turbines, one individual was at collision risk height, and one flock of 200 unidentified goose species flew over the 500 m buffer but not at a height that would put them at risk of collision.

49. The low recorded use of airspace by wildfowl in the vicinity of the proposed Development is clear and the resulting risk to all regional populations as a result of collision is deemed to be so low as to not require further consideration within this assessment.

9.3.2.2 Scarce raptors and owls

50. Barn owl (*Tyto alba*), goshawk (*Accipiter gentilis*), hen harrier, merlin (*Falco columbarius*) and peregrine (*F. peregrinus*) were recorded. Only goshawk bred within the buffer of the proposed turbines. All these species except goshawk are listed on Annex 1 of the Birds Directive and all are listed on Schedule 1 of the WCA. Hen harrier is a Red-listed Bird of Conservation Concern.

51. Goshawk nested successfully during 2017 and 2018 within the 1 km buffer of the proposed turbines. None of the other species nested within the survey buffers. Seven flights by goshawk were recorded within the 500 m buffer of the proposed turbines; just over half of flight durations were spent at collision risk height, i.e. between 50 - 200 m in height. One flight by hen harrier and one by peregrine were recorded within the 500 m buffer of the proposed turbines.

52. In view of the apparent low use of the proposed Development and its surrounds by hen harrier, barn owl, merlin and peregrine, along with no nesting occurring in the survey years, these species are not considered further within this assessment. Due to the successful nesting by goshawk they will be considered further in the assessment.

9.3.2.3 Black grouse and nightjar

53. No records were made of either of these species, and anecdotal evidence suggests that they have not been present in the vicinity in recent years. Due to neither species being present in the area these species are not considered further in this assessment.

9.3.2.4 Waders

54. Curlew (*Numenius arquata*), golden plover (*Pluvialis apricaria*), lapwing (*Vanellus vanellus*), snipe (*Gallinago gallinago*) and woodcock (*Scolopax rusticola*) were recorded. No species of wader bred within the 500 m buffer of the turbines. Four flights by a total of 65 golden plover passed over the 500 m buffer of the proposed turbines, two flocks with at least part of their flight duration at collision risk height. Two flights by a total of three curlew all with at least part of their flight duration at collision risk height. However as the recorded use of the airspace in the vicinity of the proposed Development by these species is low, and there are no substantial indications of overwintering, migration or breeding by either of these species they will not be considered further within this assessment.

9.3.2.5 Other species

55. Selected species of interest include: buzzard (*Buteo buteo*), kestrel (*Falco tinnunculus*) and sparrowhawk (*Accipiter nisus*). A great grey shrike (*Lanius excubitor*) was present for some of the winter months 2018/2019. Crossbills (*Loxia curvirostra*) were present along with other more common passerines. However, as these species are either of low Nature Conservation Importance or present in such low numbers that effects on regional populations are considered implausible; hence none are considered further in this assessment.

9.4 Assessment of effects

9.4.1 Potential construction effects

9.4.1.1 Embedded measures

56. The assessment has been undertaken under the assumption that a Bird Protection Plan (BPP), devised in consultation with South Ayrshire Council and SNH, would be in place prior to the onset of construction activities. The BPP will describe survey methods for the identification of sites used by protected birds and will detail protocols for the prevention, or minimisation, of disturbance to birds as a result of activities associated with the proposed Development. The BPP would be overseen by the Ecological Clerk of Works.

57. The BPP will include a description of surveys to locate the nests or other key sites (e.g. roosts) of birds listed in Schedules 1 and 1A of the Wildlife and Countryside Act, 1981, in advance of construction works progressing within the Site of the Project. In the event that an active nest or roost of a Schedule 1 or Schedule 1A species is discovered within distances given by Ruddock & Whitfield (2007) (or within a 500 m radius of the nest for Schedule 1 species not listed), a disturbance risk assessment will be prepared under the BPP and any measures considered necessary to safeguard the breeding attempt or roost (e.g. exclusion zones or restrictions on timing of works), would be submitted to SNH for agreement before recommencing work. If felling is required near to or including any nest locations this would be carried out during the non-breeding period.

58. Should the nest of any other wild bird not listed on Schedule 1 be located, construction activities within 50 m of the nest site should be halted and the Ecological Clerk of Works (EcoW) informed immediately. A disturbance risk assessment should be undertaken and any measures considered necessary to prevent disturbance to the nest site be implemented. For some species breeding in some locations, no actions may be necessary but for others, buffers may be required around the nesting attempt to prevent unnecessary disturbance until the nest is no longer active.

9.4.1.2 Direct habitat loss

59. Land-take as a result of construction of the proposed Development would amount to up to 28.84 ha of permanent loss., There will be loss (ca. 135 ha) relating to felling of plantation forestry habitat of which there is an abundance within the study area and its environs, and the majority of which will be subsequently replanted resulting in a permanent loss of 60.1 ha.

9.4.1.2.1 Goshawk

60. Goshawks are tree nesting raptors which occupy their home range all year, and hunt over both open areas and within woodland taking a large and varied range of prey species (Kenward, 1996). They may breed in the same locality for a number of years (Hardey *et al.*, 2013). The current nest location (utilised in 2017 & 2018 and most probably occupied in 2019) is approximately 100 m from one proposed turbine location.

61. Goshawk is a species of high Nature Conservation Importance by virtue of their Schedule 1 WCA status. Their current Conservation Status is considered to be favourable in Scotland, with the population increasing. Goshawk have been perceived as a species dependent on continuous mature forestry cover (Kenward, 1996) with European birds achieving relatively high densities in mosaics of farmland and woodland (Kenward, 1996; Beier & Drennan, 1997). The NHZ 19 population of goshawk was assessed in 2013 to be at a minimum 31 pairs, however this estimate is suspected to be highly conservative) (Wilson *et al.*, 2015).

62. If the current nest location is still in use when construction commences the trees in that coupe would be felled as part of the buffer around the proposed turbine, as they form part of the turbine 'keyhole' and the felling requirement to make a wind firm edge. As a consequence of this felling that nest location would be lost, and part of that coupe would no longer be of use to the birds seeking to nest there. However, there are a number of other areas within the nearby forest which have trees of a similar age (approximately 900 ha). Goshawk are known to be able to move up to 2.5 km to another nest site if disturbed (Petty & Anderson 1996), there is therefore the strong possibility that the pair from this territory could establish another nest elsewhere in the forest.

63. Even if they were unable to move nest location and this territory was temporarily lost to the regional population, the effect of this habitat loss would be assessed at worst case as medium-term and of low spatial magnitude. Similar to nests lost during harvesting in forests undergoing normal crop rotation regimes, suitable goshawk nesting habitats would return as tree coupes mature elsewhere in the forest plantation. Hence, there would be no change in the conservation status of goshawk as a result of habitat loss and the adverse effects of direct habitat loss on them are deemed negligible and therefore not significant under the EIA Regulations.

9.4.1.3 Displacement

64. The construction activities of the proposed Development, including the felling of the forest areas, construction of the Site access tracks, turbine hard-standings and erection of the turbines is expected to last a total of 18 months. The number of bird breeding seasons potentially disrupted by construction activities would depend on the month in which construction works begin and the components of the proposed Development. For the purposes of this assessment a worst case scenario is assumed: i.e. that construction work would start during a bird breeding season and, for any given species, breeding would be potentially affected for up to two seasons. Breeding could also be affected along the main access route used by construction traffic accessing the area of the turbine array.

65. The impacts on birds most likely to occur during the construction phase are those of indirect habitat loss due to displacement of birds through disturbance by activity of people and machines in the vicinity of the proposed Development. It is likely that noise and visual disturbance associated with construction activities could temporarily displace some of the breeding and foraging birds present, dependent on their behavioural sensitivity to human activities. Birds that are disturbed at breeding sites are vulnerable to a variety of potential effects on breeding performance, including the chilling or predation of exposed eggs/chicks, damage to or loss of eggs/chicks caused by panicked adults and the premature fledging of the young. Birds disturbed when foraging during the breeding season may also feed less efficiently and thereby breed less successfully. These impacts may lead to a short-term reduction in the productivity of bird populations.

66. Disturbance effects on breeding birds would be confined to areas in the locality of the turbine layout and associated infrastructure, with different species varying in their sensitivity. Larger bird species, those higher up the food chain e.g. most raptors, or those that feed in flocks in the open tend to be more susceptible to disturbance than small birds living in structurally complex or closed habitats (e.g. woodlands) (Hill *et al.*, 1997).

9.4.1.3.1 Goshawk

67. The current nest location is in a forest coupe scheduled for felling between 2027 and 2031. As discussed in Section 9.4.1.2, the nest location is close to a proposed turbine location. If the nest trees are not felled as part of the construction or the birds relocate within the forest and thus birds remain in this territory, then these birds may be susceptible to disturbance during

breeding. However, any nesting attempts by goshawk would be safeguarded under the BPP, in compliance with legislative requirements to avoid disturbance to the sites of specially protected birds.

68. The potential impact of construction on goshawk hunting is unknown. Goshawks nest and hunt in some cities in continental Europe, where they are able to tolerate high levels of disturbance. Within the UK, goshawks tend to occur in relatively rural/remote areas implying that they are more sensitive to disturbance and they suffer human persecution more in some parts of the UK than in continental Europe. Recently used nest sites within the Arcleoch territory have been within 300 m of a current windfarm track and around 650 m from the closest existing wind turbine. They have also recently returned to a nest site despite ongoing forestry operations including felling and timber-truck movements within 1 km. Thus it would seem the birds occupying this territory are probably relatively tolerant of disturbance and less likely to be affected by construction activities.

69. Foraging goshawks could be displaced from habitat in the vicinity of construction activities and, in theory this could lower foraging efficiency, leading to short-term adverse effects on breeding productivity or survival. However goshawk hunting ranges are large with respect to the area occupied by the proposed Development, with ranges recorded up to 6 km (Cramp & Simmons, 1980), and there are plenty of relatively undisturbed potential foraging habitats elsewhere in the likely home range, which would compensate for the short-term loss of the area within the proposed Development during construction.

70. In summary, a worst case scenario is that the goshawks are displaced to hunt elsewhere for the short time period during construction. With goshawk nesting attempts being safeguarded through the BPP and foraging efficiency by breeding birds unlikely to be affected by construction activities, the short-term adverse impact of construction on breeding goshawk would be spatially negligible and impacts on the regional breeding population are deemed to be negligible and not significant under the EIA regulations.

9.4.1.4 Proposed mitigation

71. There is no requirement for mitigation as there are no effects predicted to be significant.

9.4.1.5 Residual construction effects

72. The effects of construction on birds are at worst long term low spatial magnitude for direct habitat loss and short-term negligible for displacement on goshawk and are therefore still not significant under the EIA regulations.

9.4.2 Potential operational effects

73. The impacts on birds most likely to occur during the operational phase are those of:

- any long term habitat modification created by construction or later land management;
- direct habitat loss due to the creation of tracks, turbine bases and other infrastructure elements;
- indirect habitat loss due to displacement of birds by the presence of operating turbines and maintenance personnel; and
- mortality through collision with rotating turbine blades, guy-lines and fencing.

74. Operational displacement impacts are less concentrated in time and in intensity than construction impacts. Indirect habitat loss through displacement can be evident by a decline in the breeding productivity or (in extreme cases) the number of breeding territories in the vicinity of the turbines (although a movement of the affected breeding pairs or territories away from the proposed Development source of disturbance may result). Displacement from areas used for feeding may also be manifest as an alteration of the flight patterns of birds which fly over the area, and this in turn, may influence survival rates and/or (for breeding birds) reproductive output through a reduction in available foraging habitat. Collision with turbine blades and other structures would be shown by the loss of birds from the population though increased mortality rates.

9.4.2.1 Embedded measures

75. There are no embedded measures for operational impacts.

9.4.2.2 Habitat modification and direct habitat loss

76. Permanent habitat modification is restricted to the maintenance of the open areas surrounding the turbines within the forest plantation. The total land take for this is approximately 60 ha.

9.4.2.2.1 Goshawk

77. A long-term study in European forests did not find any difference in the breeding success of goshawks in logged and unlogged stands, provided the original stand structure was altered by less than 30 % (Penteriani & Faivre, 2001). In the long term the creation of age diversity within the forest as a whole means that when areas are mature and harvested, other areas of younger forest, not yet ready for felling, would be available for goshawks to move into.

78. The land take is of negligible effect spatially in the context of the larger home range of this species. They would be able to make use of the altering forest structure during the normal life span of the forest rotation. The permanent adverse impacts of operational Habitat Modification and Direct Habitat Loss on goshawk would be spatially negligible and impacts on the regional breeding population are deemed to be negligible and not significant under the EIA regulations.

9.4.2.3 Displacement

79. The presence and operation of wind turbines could potentially displace birds from nesting and foraging areas. Existing information (e.g. de Lucas *et al.*, 2007; Douglas *et al.*, 2011; Haworth & Fielding, 2012) and reviews of effects (e.g. Madders & Whitfield, 2006; Hötter *et al.*, 2006; Gove *et al.*, 2013) suggest that most birds are affected only slightly, if at all, although these effects require further study. For example, breeding birds have not been found to be completely displaced at distances greater than 300 m from a turbine (e.g. Gill *et al.*, 1996; Percival, 1998; Hötter *et al.*, 2006) although other studies suggest partial displacement effects at greater distances (Pearce-Higgins *et al.*, 2009). However, wind turbines might displace birds from much larger areas if they act as a barrier to bird movements, or if availability of suitable habitat is restricted. In addition, displacement effects may vary over time, as birds habituate to the operation of turbines or site-faithful individuals are lost from the population.

80. The evidence suggests that impacts vary between species and sites (see discussion for raptors; Madders & Whitfield, 2006). There is potential for some disruption of feeding and nesting due to increased human activity for maintenance purposes. However, this would be relatively infrequent, involve low levels of disturbance and would be restricted to areas of the Site accessible by tracks. Therefore, the overriding source of disturbance and displacement of birds during the operational period is considered to be the turbines operating (Pearce-Higgins *et al.*, 2009).

9.4.2.3.1 Goshawk

81. Similar to operational Direct Habitat Loss, if displacement of goshawk due to the presence of the turbines was to occur this would most probably result in loss of a small area of the overall potential nesting and foraging habitat for this species. New nesting areas elsewhere in the forest are likely to be available and would also mature through the normal forest rotation. Foraging habitats currently exist all around and within the forest, and only a small amount would be lost to the turbines and other infrastructure. Currently one pair nests successfully within 300 m of an existing windfarm track and 650 m of a turbine, therefore they are presumably tolerant of the low level of disturbance which already exists due to the turbines and the maintenance activities associated with them. This pair is also presumably tolerant of the disturbance which occurs in the forest due to the regular forestry works. The likely outcome is that the pair which currently nests in the forest would continue to do so.

82. If this pair is displaced and cannot relocate to a new nest location the adverse impact on the regional goshawk population would be at worst medium-term and spatially low, therefore operational Displacement would be deemed to be negligible and not significant under the EIA regulations.

9.4.2.4 Collision mortality

83. Birds that are not displaced would be potentially vulnerable to collision with the turbines. The level of collision with wind turbines is presumed to be dependent on the level of flight activity over the proposed Development and the ability of birds to detect and manoeuvre around rotating turbine blades. Birds that collide with a turbine are likely to be killed or fatally injured. This may in turn affect the maintenance of bird populations.

84. An increasing body of evidence suggests that birds' capacity to avoid collision with wind turbines is very high (SNH, 2017). The indications from studies are that collisions are rare events and occur mainly at sites where there are unusual concentrations of birds and turbines, or where the behaviour of the birds concerned leads to high-risk situations (eg Gill *et al.*, 1996; Percival, 1998; de Lucas *et al.*, 2007). Examples include migration flyways, and where the food resource, and therefore level of bird activity, is exceptional.

85. Collision Risk is calculated for goshawk flight activity which occurred within the 500 m buffer of the proposed turbines (see **Technical Appendix 9.3: Collision Risk Assessment** for further detail.

9.4.2.4.1 Goshawk

86. The speed used in the collision risk calculations was 9.9 m/second for goshawks. Collision risks have been calculated assuming 98 % avoidance.

87. On the basis of applying an accepted avoidance rate of 98 % for goshawk, this equates to one bird colliding with a turbine approximately every 182 years.

88. The goshawk population numbers a minimum of 31 breeding pairs in the NHZ and this species is thought to be experiencing a phase of expansion (Wilson *et al.*, 2015). The potential loss of one goshawk every 182 years is of negligible magnitude and the overall adverse effect at the scale of the NHZ would be negligible. This effect is considered not significant in terms of the EIA Regulations and the population would maintain favourable conservation status.

89. In order to allow for possible future small alterations to hub height and rotor length, the Collision Risk Modelling was also completed for hub height 120m with blade length 70m and hub height 130m and blade length 80m (all other parameters remained the same). The resulting mortality estimates were very similar (one bird killed every 201 and 166 years respectively) and thus if these alterations came about, there would be no change to the predicted effect which would continue to be negligible, and thus no alteration to the assessment of not significant for collision risk.

9.4.2.5 Proposed mitigation

90. There is no requirement for mitigation as there are no effects predicted to be significant.

9.4.2.6 Residual operational effects

91. The effects of operation of the proposed Development on birds are permanent and negligible for goshawk and are therefore still not significant under the EIA regulations.

9.4.3 Potential cumulative effects

92. The EIA Regulations require the cumulative effects of the proposed Development with other relevant projects or plans to be assessed. SNH guidance (SNH, 2012) on assessing cumulative effects has been followed. In considering cumulative effects, it is necessary to identify any effects that are minor (or greater) in isolation (**Table 9.5**) but that may be major cumulatively.

93. "Target" species were taken to be those species of high Nature Conservation Importance (see **Table 9.2 & Section 9.3.2**) for which there was some indication of a potential effect as a result of the operation of the proposed Development, which may be exacerbated cumulatively. However, no significant effects of the proposed Development in the operational phase were identified, and all effects in the operational phase were assessed as negligible. As such, the predicted in-isolation effects of the proposed Development are considered to have no potential to contribute to cumulative effects and are therefore negligible across all species.

94. In conclusion, for all bird species, the cumulative effects of the proposed Development in-combination with other projects in the NHZ are likely to be negligible and deemed to be not significant under the terms of the EIA Regulations.

9.5 Summary and statement of significance

95. The likely effects of the proposed Development have been evaluated in accordance with the methods described in the methodology section of this Chapter. It is concluded, overall, that the likely effects of the proposed Development on all bird species are not significant under the terms of the EIA Regulations.

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