8. Ecology

8.1 Introduction

8.1.1 The chapter has been prepared by Des Callaghan BSc MSc of Bureau Veritas HS&E Ltd. The aim of this chapter is to provide an assessment of the effects of the proposed development on nature conservation.

8.2 Context

Site context

8.2.1 The site (see Figure 8.1) is composed of species-poor, improved grassland used for cattle grazing, with more extensive areas of semi-natural grassland grazed by sheep in the surrounding landscape. It is not located close to any statutory designated wildlife site, but there are several non-statutory wildlife sites in the local area (within 2km of the site boundary).

Policy context

National

- Planning Policy Statement 9: Biodiversity and Geological Conservation
- Biodiversity and geological conservation – statutory obligations and their impact within the planning system (ODPM & Defra 2005)

Regional

- RSS 12: Regional Spatial Strategy for Yorkshire and the Humber to 2016 (Selective Review of RPG 12)
  - Policy N1.
- Draft Regional Spatial Strategy 12: The Yorkshire and Humber Plan
  - Policy ENV8.

Local

- Barnsley Unitary Development Plan (adopted December 2000)
  - Policies GS15, GS16, GS17, GS18, GS20, GS22 and WR13.
- Draft Barnsley Local Development Framework (unadopted)
  - Policies BIO1, BIO2 and BIO3.

Legislative context

8.2.2 The main pieces of legislation relevant to nature conservation in the present context are:

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- The Wildlife and Countryside Act 1981
- The Countryside and Rights of Way Act 2000
- The Conservation (Natural Habitats, &c.) Regulations 1994
- The Hedgerow Regulations 1997
- The Protection of Badgers Act 1992

8.3 Methodology

Sites, habitats and species of significance

8.3.1 The assessment has been focused upon sites, habitats and species of significance, which are considered to be:

- Sites: (i) non-statutory designated 'local wildlife sites'; (ii) Local Nature Reserves; (iii) National Nature Reserves; (iv) Sites of Special Scientific Interest; (v) Special Protection Areas; (vi) Special Areas of Conservation; (vii) Ramsar Sites; and (viii) sites that qualify for designation as any of the above but are as yet undesignated.
- Habitats: (i) important hedgerows (under The Hedgerow Regulations 1997); (ii) habitats listed under Section 74 of The Countryside & Rights of Way Act 2000 (which includes the priority UK Biodiversity Action Plan habitats); (iii) habitats listed as priorities for conservation in the Local Biodiversity Action Plan; (iv) habitats listed on Annex I of the Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora; and (v) habitats within statutory or non-statutory wildlife sites.
- Species: (i) badger (under The Protection of Badgers Act 1997); (ii) species listed in Schedules 2 and 4 of The Conservation (Natural Habitats, &c.) Regulations 1994 ('European protected species'); (iii) species listed in Schedules 1, 5 and 8 of the Wildlife & Countryside Act 1981 (as amended); (iv) species listed under Section 74 of The Countryside & Rights of Way Act 2000 (which includes the priority UK Biodiversity Action Plan species); (v) species listed on Appendix I or II of The Berne Convention on the Conservation of European Wildlife and Natural Habitats 1979; (vi) species listed on Appendix I or II of The Convention on the Conservation of Migratory Species of Wild Animals 1979; (vii) species listed on Annex I and II of the Council Directive 79/409/EEC on the conservation of wild birds; (viii) species listed on Annex II of the Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora; (ix) species listed as priorities for conservation in the relevant Local Biodiversity Action Plan; (x) designated species from statutory or non-statutory wildlife sites; and (xi) Red Listed Species (*i.e.* those included in Red Lists of Red Data Books or Status Reviews).

Data gathering

8.3.2 Existing biological records from the site and a 2km buffer zone were sourced through email and telephone correspondence with:

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- Dave Pearce (Secretary, Barnsley Bird Club (BBC)). BBC provided a good response and included a list of 164 species recorded from within the search area during 1993-2004 (with notes on local status of species).
- Christina Doar (Biodiversity Coordinator, Barnsley Metropolitan Borough Council). Response provided information on non-statutory wildlife sites within the search area, confirmation that otters were active in the area and suggestions of further people/organisations to contact.
- Eric Bennett (Secretary, Barnsley Bat Group). Response provided information on bat records from the search area, which showed few records and all distant from the site.
- Monica Ward (Barnsley Representative for South Yorkshire Badger Group). Response confirmed badgers are known from the search area, in particular along Upper Whitley Edge.
- John Newton (South Yorkshire Amphibian & Reptile Group). No reply.
- Simon Pickles (North & East Yorkshire Ecological Data Centre). Response confirmed they do not hold any accurate biological records for the search area.
- Gordon Bristowe (Secretary, Barnsley Naturalist & Scientific Society). Response confirmed they do not hold any records for the search area.
- Geoffrey Wilmore (Botanical Society of the British Isles Recorder for South Yorkshire). Response provided comprehensive lists of vascular plants recorded within 1 x 1km squares across the search area. No species of conservation concern have been recorded.
- Richard Sunter (local herpetological recorder). Response confirmed he held no records for any amphibians or reptiles within the search area.
- Neil Limbert (local ornithologist). Response provided detailed information on locations of breeding Lapwing and Curlew in fields around the proposed development site.

8.3.3 Digital boundaries and citations of statutory designated wildlife sites were downloaded from the websites of Natural England (NE) (http://www.naturalengland.org.uk) and the Joint Nature Conservation Committee (JNCC) (http://www.jncc.gov.uk).

Scope of study

Approach to scoping

8.3.4 The scope of the assessment was determined through:

- *a walk-over survey of the site conducted in June 2006;*
- professional judgement, experience with other similar windfarm schemes and a knowledge of effects on wildlife and habitats that can caused by windfarm developments;
- relevant wildlife policy and legislation;

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- consideration of existing biological records and designated wildlife sites in the local area;
- best practice guidance, especially SNH (2005); and
- consultation with NE (Tim Page) and RSPB (Tim Melling).

8.3.5 NE indicated that they would seek the protection of existing habitats on site (presumably only those of conservation value), would want to explore opportunities for heathland restoration and would be concerned about possible effects on protected species (if present). RSPB explained that they either objected to schemes or declined to comment, and in this instance chose the latter.

Effects requiring further consideration

8.3.6 It was proposed in the Scoping Report to scope-out possible effects on breeding Lapwing, Curlew and Skylark, along with possible effects on bats. This was reconsidered and they were eventually included in the scope. The full scope of the assessment for nature conservation can be summarised as:

- Potential loss or degradation of habitats of significance through construction activities.
- Potential decline in a bird population of significance caused by an increase in mortality rate through collisions with turbine blades.
- Potential decline in a breeding bird population of significance caused by displacement (and hence indirect habitat loss) through noise and/or visual disturbance.
- Potential decline in a bat population of significance caused by an increase in mortality rate through collisions with turbine blades.
- Potential decline in a bat population of significance caused by displacement (and hence indirect habitat loss) through noise disturbance.

Effects not requiring further consideration

8.3.7 The following effects have been scoped-out.

- Potential degradation or loss of habitat in any statutory or non-statutory wildlife site through construction or operation of the proposed scheme. Reason: the proposed scheme will not affect land close to or within any statutory or non-statutory wildlife site (Figures 8.2 and 8.3).
- Potential killing of Great Crested Newts or destruction/degradation of their breeding ponds or terrestrial habitat through construction activities. Reason: the site supports suboptimal terrestrial habitat for GCNs (*i.e.* improved *Lolium perenne* grassland) and is distant from the nearest suitable pond for breeding (located 170m beyond the eastern site boundary) (Figure 8.1). GCNs prefer terrestrial habitat that has woody vegetation cover and avoid crossing expanses of open land. The majority of individuals do not move more than 50m from their breeding ponds and only a very small percentage venture further than 100m

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(Jehle 2000; Jehle & Arntzen 2000; Malmgren 2002; Cresswell & Whitworth 2004).

- Potential killing of reptiles through construction activities. Reason: the site supports poor quality habitat for reptiles (*i.e.* improved *Lolium perenne* grassland) and hence significant numbers are considered absent.
- Potential destruction of a bat roost through construction activities. Reason: a bat roost assessment undertaken in June 2006 found no possible locations for bat roosts within the site or a 250m buffer.
- Potential loss or degradation of otter or water vole habitat through construction activities. Reason: suitable habitat for otters or water voles is absent from the site and a 250m buffer.
- Potential reduction in the local population of Brown Hares through disturbance (and hence indirect habitat loss). Reason: disturbance likely to affect Brown Hares will be very localised and will occur only during the relatively short construction phase (noise from operational turbines is very unlikely to affect individuals).
- Potential destruction of an active badger sett through construction activities. Reason: a walk-over survey of he site in June 2006 found no possible locations for badger setts within the site or a 250m buffer.

Survey work

Phase 1 Habitat Survey

8.3.8 A Phase 1 Habitat Survey of the site and a 250m buffer was undertaken in June 2006, based upon the method described in JNCC (2004). The site was walked, habitats mapped and ecological features noted. Target Notes were collected to annotate the map and during the course of the survey attention was paid to identifying areas that could be used by significant species.

Birds

8.3.9 VP surveys were undertaken for birds following the guidance provided by SNH (2006). Focus species were all non-passerine birds of significance (see criteria above) or otherwise notable. Data on passerines was not collected since it is considered that their agile flight behaviour and relatively high productivity means they are not potentially prone to significant effects from collision mortality, though observations of any significant species were noted. During each bird passage, information recorded included species, number of individuals, minimum and maximum flight height (estimated from known heights of objects in the landscape) and flight route (plotted on a map).

8.3.10 A total of 108 hours of observation were made from a VP over-looking the site and a 250m buffer, spread across a twelve month period (see Table 8.1). Observation hours were staggered so that the full range of day-light hours was sampled adequately.

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Table 8.1 Observation effort for Vantage Point bird surveys

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Effort (hrs)
Autumn migration									X	X	X		36.00
Winter	X	X	X						X	X	X	X	66.00
Spring migration			X	X	X								36.00
Breeding			X	X	X	X	X	X					54.00
Effort (hrs)	6.00	6.00	12.00	12.00	12.00	6.00	6.00	6.00	12.00	12.00	12.00	6.00	

8.3.11 To assess the composition of the breeding bird population and determine the presence/absence of species of significance, three dawn surveys in suitable weather conditions were undertaken from mid-April to mid-June 2006/2007 across the site and a 100m buffer. Individuals apparently holding breeding territories were identified and counted, and locations of species of significance were mapped. Nocturnal and crepuscular species were surveyed using the same method but surveys were undertaken during the bat transect walks described below (*i.e.* three visits during Jul-Sep 2006). In addition, observations during the above VP surveys were used to determine locations of breeding species of significance.

Bats

8.3.12 Three bat activity surveys were conducted during Aug-Sep 2006, which began shortly before sunset and lasted for 3 hours (*i.e.* across the peak period of bat activity). Survey were conducted when temperatures were >10°C, and avoiding heavy wind and rain. The surveys included transect walks conducted by a single person equipped with a frequency division detector, walking routes around the site to incorporate landscape features that may be important for bats and with a focus on attempting to locate any possible bat roosts, flight-lines and flight-heights (the latter recorded as far as possible by naked-eye and spot-lamp). Surveys included the site and a buffer area of about 30m (the buffer zone was determined by the detectability distance of bats and land access restrictions).

Assessment and evaluation methodologies

Consultation

8.3.13 No consultation was considered necessary concerning assessment and evaluation methods.

Assessment of effects

8.3.14 Assessment of ecological effects has been undertaken by assessing changes in baseline conditions caused by the construction and operation of the proposed development. This has necessarily been undertaken by using professional judgement, based upon knowledge gained through experience and available scientific knowledge (see *e.g.* References).

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Assessment of significance

8.3.15 Attention is focused upon effects on sites, habitats and species of significance (see above). The significance of effects was necessarily determined through professional judgement, taking into consideration available guidance (IEEM 2006) and the significance of the site, habitat or species.

8.4 Description of baseline conditions

On-site

Habitats

8.4.1 Grassland (improved). The site is comprised entirely of this habitat (Figure 8.1) and is used primarily for cattle grazing. It is species-poor and dominated by Perennial Rye-grass. A number of the fields adjoining the site are also of this grassland type.

8.4.2 Grassland (semi-improved). Grazed mainly by sheep, this habitat comprises rough pastures of acid grassland typical of the semi-uplands, dominated by grasses such as Red Fescue, Mat-grass and Common Bent. The habitat does not occur within the proposed development site but is located within many of the surrounding fields (Figure 8.1).

8.4.3 Grassland (species-rich). Patches of species-rich grassland have developed along banks within the disused quarry adjacent to the south-east section of the proposed development, including species such as Crested Dog's-tail, Sweet Vernal Grass, Yorkshire Fog, Tufted Hair-grass and Red Fescue. These are not mapped in Figure 8.1 owing to their small area.

8.4.4 Standing water. The is no standing water within the proposed development, only the remains of a former pond that is now a fry depression near the northern boundary of the site (Figure 8.1). A poor-quality pond used by livestock and waterfowl is located 160m from the site boundary, across Whitley Rd in a nearby field. A pool in better ecological condition has been formed at the base of a quarry adjacent to the site, located 170m from the boundary of the proposed development site. This pool is relatively undisturbed and has good water clarity, though growth of aquatic plants is limited (indicating nutrient-poor conditions).

8.4.5 Tree-lines. Three lengths of defunct hedgerow within the site are now lines of scattered, mature Hawthorn (labelled 'tree-lines' in Figure 8.1). In addition, a planted strip of semi-mature trees (commonest species being Sycamore, Beech, Common Birch, Rowan and Field Maple) is located along the south boundary of the site adjacent to Whitley Rd.

8.4.6 Woodland copses. There are two small copses of semi-mature broad-leaved trees located 280m and 360m from the site boundary (Figure 8.1).

8.4.7 Dry-stone walls. Most of the field boundaries within and around the site are bounded by dry-stone walls (Figure 8.1), the remainder being post-and-wire fencing and very occasional hedgerows.

8.4.8 The species-rich grassland, quarry pool and woodland copses are considered to be of significance.

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Birds

8.4.9 Breeding bird species and the number of territories apparently being held during each survey visit are shown in Table 8.2. Stable territories of significant species are shown in Figure 8.4, which is supplemented with information on Lapwings and Curlews provided by a local ornithologist (Neil Limbert).

Table 8.2 Results of breeding bird surveys (cross-reference with Figure 8.4)

	N° apparent territories		
Species	**26/06/06**	**26/04/07**	**10/05/07**
Blue Tit	0	1	0
Chaffinch	3	4	3
Curlew	1	1	1
Dunnock	1	1	0
Goldfinch	0	1	0
Grey Partridge	0	2	0
Lapwing	1	1	2
Linnet	1	0	1
Meadow Pipit	6	5	1
Pied Wagtail	3	0	0
Reed Bunting	0	1	0
Skylark	7	8	4
Starling	1	0	0
Wheatear	0	3	1
Whitethroat	1	0	0
Willow Warbler	0	1	0
Woodpigeon	4	0	0
Totals	**24**	**28**	**12**

8.4.10 Densities of breeding birds within the site were very low, while the semi-natural grassland around the site supported moderate densities of bird species typical of semi-upland agricultural landscapes.

8.4.11 Nocturnal birds surveys recorded a single Barn Owl, which flew eastwards from the central hawthorn tree-line within the site at a height of 10m on 31st Aug 2006. This may have been a dispersing individual or could possibly belong to a pair that bred in the local area.

8.4.12 Results of the Vantage Point survey are shown in Table 8.3. During the 108 hrs of survey effort passage rate of birds was generally low, with a total of 6,684

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individual passes of significant or notable non-passerine birds recorded, of which 82% were at turbine height. Lapwing and Golden Plover were by far the most frequent recorded. Curlew, Golden Plover, Grey Partridge, Lapwing, Peregrine Falcon, Redshank and Short-eared Owl are considered to be of significance.

Table 8.3 Total individual passes of significant or notable non-passerine birds across the study area during 108 hrs of Vantage Point surveys

Species	Below turbine height	At turbine height	Total
Common Buzzard	0	5	5
Curlew	80	22	102
Golden Plover	27	2022	2049
Grey Heron	0	1	1
Grey Partridge	8	0	8
Greylag Goose	0	15	15
Kestrel	21	15	36
Lapwing	1071	3384	4455
Oystercatcher	1	6	7
Peregrine Falcon	2	0	2
Redshank	0	2	2
Short-eared Owl	1	0	1
Sparrowhawk	1	0	1
Total	**1212**	**5472**	**6684**

Bats

8.4.13 Results of the bat activity survey are shown in Table 8.4 and Figure 8.5. Bats were recorded on the first and third visits, but none were recorded during the second visit. Three common species were found at the site in small numbers (Common and Soprano Pipistrelles and Noctule). Activity was concentrated along hedgerows and tree-lines (*i.e.* where flying insects congregate), and flight heights ranged from 3 to 10 m.

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Table 8.4 Results of bat activity surveys (cross-reference Location with Figure 8.5)

Species	Date	Number of bats	Time	Height	Location[1]	Notes
Common Pipistrelle	14/08/06	1	21:45	5 m	4	Flying SE along hedgeline
Common Pipistrelle	14/08/06	?	22:28	Unseen	7	Detected along N boundary
Common Pipistrelle	28/09/06	1	19:20	7 m	13	Flying from hedgeline SW across field
Common Pipistrelle	28/09/06	?	19:35	Unseen	14	Briefly detected along N boundary
Common Pipistrelle	28/09/06	1	19:40-19:44	3 - 10 m	15	Up and down hedgeline and SW into fields
Common Pipistrelle	28/09/06	?	20:41	Unseen	24	Along drystone wall at site boundary
Common Pipistrelle	28/09/06	?	21:02	Unseen	25	Briefly detected along hedgeline
Noctule	28/09/06	?	20:00	Unseen	19	Detected near corner of field
Noctule	28/09/06	1	20:06	10 m	20	Flew NE along hedgeline and over site boundary into fields to N
Noctule	28/09/06	?	20:10	Unseen	21	Detected near corner of field
Soprano Pipistrelle	14/08/06	1	21:35	10 m	1	Flew from tree line separating fields within site to treeline along N boundary
Soprano Pipistrelle	14/08/06	1	21:53	7 m	5	Flying along tree line towards N boundary
Soprano Pipistrelle	14/08/06	?	22:32	Unseen	8	Detected along tree line separating fields within site
Soprano Pipistrelle	14/08/06	1	22:35	10 m	9	Flying up and down within-site tree line
Soprano Pipistrelle	14/08/06	?	22:42	Unseen	10	Detected along tree line separating fields within site
Soprano Pipistrelle	14/08/06	?	22:44	Unseen	11	Detected along tree line separating fields within site
Soprano Pipistrelle	14/08/06	1	22:50	5 m	12	Flying up and down within-site tree line
Soprano Pipistrelle	28/09/06	1	19:50	8 m	16	Flying up and down hedgeline and into fields to N of site
Soprano Pipistrelle	28/09/06	?	19:53	Unseen	17	Along line of Hawthorn
Soprano Pipistrelle	28/09/06	1	19:55-19:57	5 m	18	Flying up and down hedgeline
Soprano Pipistrelle	28/09/06	2	20:18	5 m	22	NE along hedgeline then N across field
Soprano Pipistrelle	28/09/06	2	20:30-20:38	3-10 m	23	Feeding between trees along Whitley Road and narrow field
Soprano Pipistrelle	28/09/06	1	21:12	7 m	27	SW along hedgeline then NE along hedgeline
Unidentified Pipistrelle	14/08/06	?	21:40	Unseen	2	Briefly detected along N boundary

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Table 8.4 (continued) **Results of bat activity surveys (cross-reference Location with Figure 8.5)**

Species	Date	Number of bats	Time	Height	Location[1]	Notes
Unidentified Pipistrelle	14/08/06	?	21:43	Unseen	3	Briefly detected along N boundary
Unidentified Pipistrelle	14/08/06	?	21:58	Unseen	6	Briefly detected near N boundary
Unidentified Pipistrelle	28/09/06	?	21:07	Unseen	26	Very brief detection

[1]See Figure 8.5.

Off-site

8.4.14 A Phase 1 Habitat Survey of the proposed underground grid connection route is shown in Figure 8.6. The route is alongside existing roads and tracks with adjacent areas of (predominantly) semi-improved grassland. No statutory or non-statutory designated wildlife sites are located along the route or within a 100m buffer. Significant nature conservation features within a 100m buffer of the route are: (i) an area of species-rich grassland at Upper Wood Royd, located on the north side of Wood Royd Hill Lane; (ii) a small semi-mature deciduous woodland copse at the junction between Brown's Edge Road and Lower Maythorn Lane; and (iii) two sections of hedgerow (300m and 85m) located between the Brown's Edge Road/Lower Maythorn Lane junction and Upper Maythorn Farm (Figure 8.6).

Predicted future baseline without the proposed development

8.4.15 The future baseline conditions are not expected to change significantly if the development were not to proceed, nor is the sensitivity/importance of the species, habitats and sites.

Information gaps

8.4.16 There are no significant gaps in information regarding the presence and distribution of sites, habitats and species of significance that may be affected by the proposed development.

Sensitive receptors

8.4.17 Sensitive receptors are considered to be sites, habitats and species of significance and which may be affected by the proposed development, including:

- Habitats
  - Species-rich grassland located at Upper Wood Royd
- Species
  - Birds: Barn Owl, Curlew, Golden Plover, Grey Partridge, Lapwing, Linnet, Peregrine Falcon and Skylark
  - Bats: Common Pipistrelle, Soprano Pipistrelle and Noctule

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8.5 Mitigation, offsetting and enhancement measures incorporated into the proposed development

On-site

8.5.1 Positioning of the turbines, access tracks, control building and associated infrastructure within the site have not been limited by ecological constraints since the land is all intensively managed pasture of no significant ecological value.

8.5.2 The land within the proposed development area will continue to be management as presently (*i.e.* for intensive agricultural production), thus limiting the potential for ecological enhancement. However, new species-rich hedgerows will be planted along the field boundaries within the site that are presently demarcated by post-and-wire fences only and along appropriate lengths of the new access tracks, providing a total length of about 800m of new species-rich hedgerow (see Figure 8.6).

Off-site

8.5.3 A small area of species-rich grassland located at Upper Wood Royd (Figure 8.7) could be affected by the positioning of the underground grid connection route if this is laid along the north side of the lane. Routing along the south side of the lane will be preferred, but if this is not reasonably possible appropriate mitigation (involving turf stripping and replacement) will be undertaken to ensure no significant damage to the species-rich sward.

8.5.4 In addition, a total of £5,000 will be donated to the local 'Coalfield Heathland Project', which involves English Nature, the Environment Agency, Sheffield Wildlife Trust, South Yorkshire Forest Partnership and the five local authorities in Barnsley, Kirklees, Rotherham, Sheffield and Wakefield. The project is restoring 300ha of heaths, creating new heaths on derelict aggregate sites, and improving access and education. Lowland heathland is a priority habitat for conservation, both locally and nationally.

8.6 Assessment of potential effects

Habitats (off-site)

Species-rich grassland

8.6.1 Mitigation measures will ensure that effects on species-rich grassland located at Upper Wood Royd from the underground grid connection route will be insignificant.

Lowland heathland

8.6.2 A £5,000 donation to the 'Coalfield Heathland Project' will ensure a positive effect on this priority habitat in the local region.

Habitats (on-site)

Species-rich hedgerows

8.6.3 The short-term effect of the proposed development on species-rich hedgerows will be a significant positive effect, with the creation of about 800m of new hedgerow

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and no damage to existing hedgerows. When the windfarm is decommissioned there is potential for damage to some sections of species-rich hedgerow, for which appropriate mitigation or compensation could be developed easily at that point in time.

Species

Birds

8.6.4 Stewart *et al.* (2007) undertook a very comprehensive and independent systematic review of available data to test the hypothesis that windfarms reduce the abundance of birds in their vicinity. Scientifically robust data was available for fourteen windfarms (onshore and offshore), located in Europe and North America. A significant decline in overall bird abundance was evident at only two (14%), both offshore, located in Holland (18 turbines) and Sweden (220 turbines). In addition, only waterfowl and waders were significantly affected, with no apparent significant affect on other groups of birds, such as birds of prey and songbirds. Similarly, a recent review of research on the displacement of birds of prey at windfarms, which primarily involved foraging birds, concluded that most studies indicate that displacement appears to be negligible (Madders & Whitfield 2006).

8.6.5 However, studies of displacement of breeding birds owing to road noise (*e.g.* Reijnen *et al.* 1995, 1997; Rheindt 2003) suggest changes in noise levels caused by the proposed turbines (see Noise chapter) will cause minor displacement of some species of significance within and around the present site. Reijnen *et al.* (1995) estimated that traffic noise caused a 13% reduction in breeding bird densities between major roads (60,000 cars per day) and 250m distance away (where traffic noise was about 45 dB) in woodland habitat. However, species varied greatly in their response, with some species showing higher densities closer to roads and some much lower. Rheindt (2003) has suggested subsequently that this may be related to the frequency of a species' calls and songs, with those that have a frequency similar to the road noise being affected most.

8.6.6 The 45 dB contour of noise from the proposed turbines operating at 8 m/s and locations of stable territories of significant bird species are shown in Figure 8.4. It cannot be said with any certainty which species may be affected by the increased noise in this zone, but some territories will move and a rough estimate based on the results of Reijnen *et al.* (1995) is that about one territory will be lost within the 45 dB zone (*i.e.* 13% of those territories that overlap to some extent with the 45 dB zone).

8.6.7 The species' shown in Figure 8.4 are considered to be of conservation concern (and hence significant in the present context) because they have undergone significant declines in the UK in recent decades, other than Curlew (which is considered significant because it is a designated feature of the nearby Whitley Edge NHS). Most of these species are not declining presently and all retain large national population sizes, remaining frequent or common over large parts of the UK (Gibbons *et al.* 1993; Baillie *et al.* 2005; Brown & Grice 2005). Hence, the predicted minor displacement effect caused by noise from the proposed turbines is considered insignificant.

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8.6.8 Nocturnal bird surveys produced a record of a single Barn Owl. There are no possible breeding localities for this species within the site or a 250m buffer, and it is not know whether this individual was a dispersing non-breeder or belonged to a breeding pair further afield. The species rarely flies >19m (*i.e.* the lower height of turbine blades) and hence is not at significant risk from collision mortality, thus the proposed development will have a neutral effect on this species.

8.6.9 Significant bird species whose size and flight behaviour means they are potentially prone to collision mortality and which were recorded as passing across the site and a 250m buffer during VP observations include Curlew, Golden Plover, Grey Partridge, Lapwing, Peregrine Falcon, Redshank and Short-eared Owl. The degree of mortality caused will be dependent on: (i) the rate at which birds pass at turbine height ('rotor-height passage rate'); (ii) the rate at which birds taking action to avoid rotor blades ('avoidance rate'); and (iii) the likelihood of a bird being hit when flying through the rotor blades ('collision rate').

8.6.10 The following species can be omitted from further consideration because their rotor-height passage rate is either extremely low or zero: Grey Partridge, Peregrine Falcon, Redshank and Short-eared Owl.

8.6.11 Passage rates of Curlew, Golden Plover and Lapwing at turbine height were more frequent, and hence it is necessary to consider likely avoidance and collision rates for these species. Avoidance rates for birds at windfarms are uncertain (Chamberlain *et al.* 2006). However, a major radar study (of waterfowl movements at a large off-shore windfarm) showed that some bird species often considered susceptible to collision mortality are highly successful at avoiding the danger zones of rotating turbine blades (Desholm & Kahlert 2005), while Scottish National Heritage suggest for geese that a conservative avoidance rate of 95% is used, noting that 99% may be more realistic (R. McMichael pers. comm. 2007). Avoidance rates for geese will almost certainly be lower than the more agile Curlew, Golden Plover and Lapwing, suggesting that >99% of individuals of these species approaching turbines blades will take avoiding action. Meanwhile, modelling of collision rates for Pink-footed Geese has estimated that 9.1% of birds flying through turbine blades will be hit (Callaghan 2007). Hence, collision rates for the smaller Curlew, Golden Plover and Lapwing would be <9%.

8.6.12 Therefore, it is reasonable to conclude based on current information that >99% of Curlew, Golden Plover and Lapwing flying towards rotor blades would take avoiding action and of those that didn't <9% would be hit by a blade. In other words, <1 fatality would likely result from every 1000 flights towards the wind-swept area of a turbine blade. Bearing in mind that <20% of the flight passes noted at turbine height within Table 8.3 would actually be towards the wind-swept area of turbine blades, it is concluded that detailed modelling of this effect on these species is not needed since increases in mortality will clearly be very small and are extremely unlikely to have any significant effect on local population sizes of these birds.

Bats

8.6.13 Thermal imaging has shown that some bats forage around and in the rotor-swept zone of the turbine blades, strongly suggesting that displacement by turbines is not a potential effect (Arnett 2005). Mortality data of bats at windfarms are highly

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variable between sites, but it does seem that windfarms on forested ridges and/or along the paths of long-distant migratory bats can cause significant problems (Arnett 2005; Johnson *et al.* 2004). Collision mortality of local, resident bat populations, as within the present study area, are unclear, with some studies showing no significant effect even where large windfarms are close to large bat breeding populations (*e.g.* Johnson *et al.* 2004) and others studies from forested ridges suggesting an effect (*e.g.* Arnett 2005).

8.6.14 The three species of bat recorded in the present site are widespread in the UK with stable or increasing populations; Common Pipistrelle and Soprano Pipistrelle are especially numerous (Battersby 2005). There are no bat roosts within or close to the site, and the small number of individuals recorded during activity surveys suggests significant effects on any bat species from possible collision mortality are extremely unlikely.

8.7 Summary of significance evaluation

8.7.1 A summary of the significance evaluation for the nature conservation assessment is provided in Table 8.5. There are no significant negative effects and an overall positive effect on nature conservation is predicted, through a £5,000 contribution to the conservation of lowland heathland in the local area and the planting of about 800m of species-rich hedgerows on-site.

Table 8.5 Summary of significance of effects

Receptor and summary of predicted effects	Type of effect[1]	Significance[2]
Species-rich hedgerows	+ve	S
Species-rich grassland	N	NS
Lowland heathland	+ve	S
Barn Owl	N	NS
Curlew	N or –ve	NS
Golden Plover	N or –ve	NS
Grey Partridge	N	NS
Lapwing	N or –ve	NS
Linnet	N	NS
Peregrine Falcon	N	NS
Skylark	N or -ve	NS
Common Pipistrelle	N or –ve	NS
Soprano Pipistrelle	N or –ve	NS
Noctule	N or -ve	NS
Key/footnotes:		

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Table 8.5 (continued) Summary of significance of effects

Receptor and summary of predicted effects		Type of effect[1]		Significance[2]
1.Type of effect	-ve = negative +ve = positive N = Neutral ? = unknown	2.	S or NS	Significant Not-significant

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