

APPENDIX 9 ORNITHOLOGY

Appendix 9.1: Ornithological Report

Executive Summary

Environment Systems Ltd was commissioned to undertake ornithological surveys to assess the importance of the site known as Garn Fach Wind Farm in Powys, for ornithological communities. The surveys included breeding bird, wintering bird and vantage points from 2017 to 2019. The turbine design layout at present includes 17 relatively uniformly distributed turbines across the site, taking advantage of higher elevation points, this excludes the southern extremity of the site which at present does not host any turbines.

Wintering bird surveys took place each month from October to March in both 17/18 and 18/19. These surveys demonstrate that the site hosts large winter flocks of golden plover, starling, fieldfare and redwing. Development plans are not anticipated to lead to the loss of important habitat features which these flocks are reliant on. Breeding bird surveys took place monthly from April to September in both 2018 and 2019 and identified multiple species to be categorised as Important Ecological Features. These included breeding red kite, probable nesting curlew and possible nesting hen harrier. No stage of the proposed development will lead to the loss of habitat features which these breeding or wintering species are reliant on meaning that the only risk posed to ornithological communities arises from the potential for collisions with turbines for certain species.

Vantage point surveys took place from eight different locations, totalling 771573 hours of survey effort and recording 1,074 flights within or in close proximity to the site. From these observations 14 species were identified as displaying flight patterns in great enough numbers which warranted further analysis for the developments potential impact on the populations as a result of collisions with turbine rotor blades. For further analysis the collision risk model (CRM) set using the Band model (2007) was used to determine that avoidance and mitigation measures are required for the current layout to accommodate for populations and movements of golden plover and birds of prey. The primary species of concern being red kite, which modelling predicts will suffer collisions with turbines blades greater than 2 per year if no mitigating action is taken. As a result several mitigation measures are recommended to avoid negatively impacting golden plover and birds of prey/raptors. These measures include sensitive siting of turbines, adjustments to the operating specifications of certain turbines, the removal of a red kite nest (outside the breeding season), pre-construction checks for active nests and adding a black or violet reflective paint to turbine blades, if permitted.

The proposed development does not represent substantial risk the majority of the ornithological assemblage at Garn Fach. Through mitigation and avoidance measures the risk to potentially vulnerable species can be reduced to an acceptable level.

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Introduction

Purpose of this document

This is a technical appendix (TA) to Chapter 9 (Ornithology) of the Garn Fach Wind Farm Environmental Impact Assessment (EIA) Report. It has been produced on behalf of Dulas Ltd (Dulas) and EDF Energy Renewables Ltd (EDF-ER) for ornithological surveys completed at the potential wind energy site located in Powys.

This document provides background information in relation to the various ornithological desk studies and field surveys completed between October 2017 and September 2019, the results of which are summarised in Chapter 9 and fully considered within the assessment.

Site Location and Description

The Garn Fach Wind Farm site is located approximately 8 km southwest of Newtown, Powys. The central grid reference for the site is SO 04417 80052. The site occupies an upland area of Waun Ddubarthog, Garn Fach, Brondre-fawr Hill with an area of lower land known as Ddullui Banc. The site area ranges in height from approximately 380 m Above Ordnance Datum (AOD) to 520 m AOD and covers approximately 830 ha, meaning the majority of the land can be defined as upland.

The up-to-date habitat survey (TA: 8:2 Desk Study and Extended Phase 1 Habitat Survey) confirms that there are a range of habitats present in the area which are representative of typical upland farmland in mid-Wales. A mosaic of habitats can be found in the more unimproved upland area to the north of the site. Habitats include:Blanket bog

- Acid dry heath
 - Wet modified bog
 - Acid flush
 - Standing water (ponds)
 - Running water (streams)
 - Marshy grassland
 - Improved grassland
 - Unimproved grassland
 - Dense scrub
 - Continuous bracken
 - Broad-leaved woodland
 - Semi-improved acid grassland
 - Plantation coniferous woodland
- The availability of various habitat types combined with the rolling topography provides suitable nesting, foraging and hunting opportunities for several protected and priority species such as red kite, kestrel and curlew.

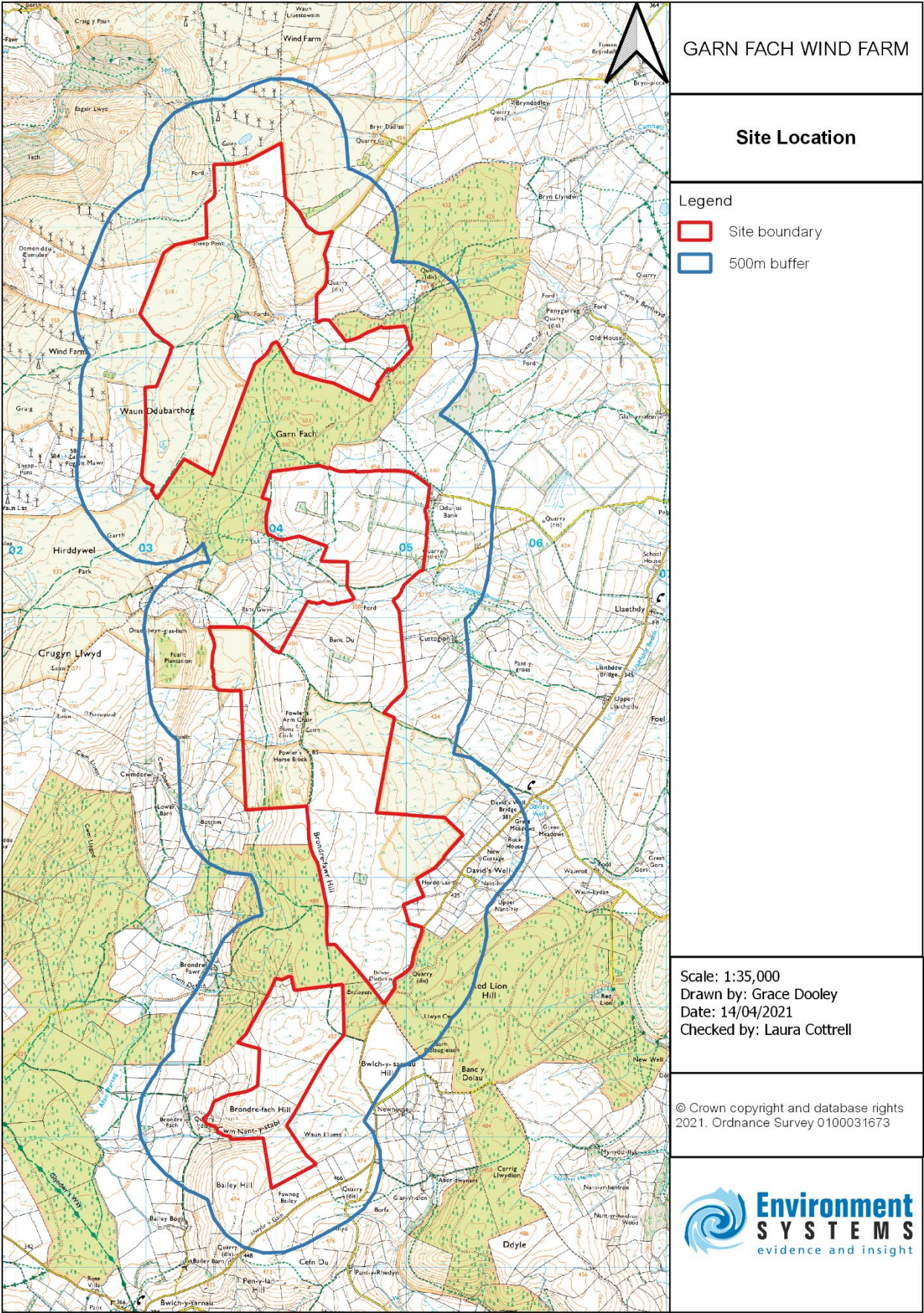


Figure 1: Site location including 500m buffer

Background

The study follows on from previous survey work undertaken in 2008 and 2014 for the proposed wind farm.

A set of surveys was completed in order to systematically assess the use of all habitats within the Garn Fach Wind Farm (the ‘Proposed Development’) study area by breeding and non-breeding birds, with a particular focus on species of UK conservation concern and species/groups that are potentially sensitive to wind farm development. All surveys were completed by suitably experienced surveyors following well-established survey methods, largely based on Scottish Natural Heritage (SNH) guidance for surveys of proposed onshore wind farm sites current at the time (SNH, 2017).

The existing Penrhyddlan-Llidiartywaun (P&L) wind farm is located to the north and west of the site, approximately between 200-300m separate the site boundaries at their nearest points. The P&L wind farm currently contains 103 turbines which were installed in 1992. The turbines will be decommissioned from 2022 (it is estimated this will take place over 3 years) and there is an ongoing proposal to repower the site, installing 34 turbines, with much larger specifications than the original 103 turbines.

Policy and Legislation

Policy for birds and their associated habitats in Wales is implemented through a series of areas and species designated under legislation from an international to local level. In relation to the majority of significant bird species, key legislation and policy relevant to the protection, conservation and enhancement of bird interest associated with the ornithological study area is outlined in Table 1.

Table 1: Legislation and Policy Context Summary

Legislation/ Policy	Description
EC Birds Directive (2009/147/EC)	Annex 1 of the EC Birds Directive lists rare and vulnerable species of wild birds that are subject to special conservation measures. The Directive also provides for the designation of SPAs, which form part of the Natura 2000 network of sites protected by European wildlife legislation.
The Wildlife and Countryside Act 1981 (as amended)	This legislation effectively prevents any kind of activity occurring that might have a detrimental effect on nesting birds. Schedule 1 of the Act also lists a number of species which are protected by special penalties at all times. Nesting periods vary between species, from year to year and in relation to latitude and altitude, however as a general rule, the breeding season for most species occurs between March and the end of July.
The Countryside and Rights of Way (CROW) Act 2000	This legislation strengthens the provisions of the 1981 Wildlife and Countryside Act, both in respect to statutory sites such as Sites of Special Scientific Interest (SSSI's) and protected species. It also places a statutory obligation on Local Authorities and other public bodies to further the conservation of biodiversity in the exercise of their functions, thus providing a statutory basis to the Biodiversity Action Plan (BAP) process which began in 1994. Section 74 of the Act lists the habitat types and species of principal importance in England.
Environment (Wales) Act 2016	This act makes provision in respect of biodiversity, pesticides harmful to wildlife, protection of birds and invasive non-native species in Wales. Section 7 of this act includes a duty on public bodies to have regard to the purpose of conserving biodiversity in the exercise of their functions. The list of species included in Section 7 defines the birds that are of principal importance in Wales and should be considered when public bodies exercise their duty.
RSPB Birds of Conservation Concern (BoCC)	‘Red’ and ‘Amber’ lists for Wales have been prepared by the RSPB of species populations and their known breeding population. Red List species are those whose breeding population or range is rapidly declining (50% or more in the last 25 years), recently or historically, and those of global conservation concern. Amber List species are those whose breeding population is in moderate decline (25 – 49% in the last 25 years), rare breeders, internationally important and localised

Legislation/ Policy	Description
	species and those of unfavourable conservation status in Europe. Species included on a third, “Green” list are not considered threatened or to be in significant decline. These lists confer no legal status; however, they are useful when assessing the significance of predicted impacts and determining the level of mitigation that may be required when birds are affected by development or any other activity
Planning Policy Wales, Chapter 5	Planning Policy Wales (PPW) details measures to conserve landscape and biodiversity in the planning system. This national policy guidance details the features including statutory and non-statutory sites, protected species and trees and woodland and how they should be considered when making planning decisions.
Future Wales: The National Plan 2040	This development plan recognises the necessity for resilient ecosystems within Wales within policy 9 of the document. Developments should enhance biodiversity whilst maximising the provision of green infrastructure.
Technical Advice Note 5	Technical Advice Note 5 (TAN5) outlines how the land use planning system in Wales should contribute to protecting and enhancing biodiversity and geological conservation. TAN5 details that when considering polices and proposals in planning applications at a local level the principles and material considerations are taken into account.
Powys Local Development Plan	The Powys Local Development Plan (LDP) includes Policy DM02 – The Natural Environment which require development proposals to demonstrate how they protect, positively manage and enhance biodiversity and geodiversity interests including improving the resilience of biodiversity through the enhanced connectivity of habitats within, and beyond the site.
Powys Local Biodiversity Action Plan	The national strategy for biodiversity is delivered at local level via Local Biodiversity Action Plans (LBAPs). The study area is covered by the Powys LBAP. It is understood the LBAP is currently in review and a new Powys Nature Recovery Action Plan (PNRAP) will focus on managing ecosystems to support wild flora and fauna with a list of species of Local Importance which will aid the assessment of species of local conservation concern. At present, species listed in the LBAP as of concern include curlew, nightjar, red kite and tree sparrow.

Rationale

The following objectives were set to provide baseline data to inform the impact assessment:

- To undertake year-round vantage point surveys;
- To undertake winter walkover surveys;
- To undertake breeding bird surveys, including nightjar, peregrine and barn owl surveys;
- To prepare a database for use with a Collision Risk Model (Band *et al.*, 2001);
- To identify the risks associated with a wind farm development at the Site.

Method

Study Area & Surveyors

The bird survey area was chosen to include all areas within the potential zone of ornithological influence of the wind turbines including a 500m buffer for breeding bird surveys, wintering bird walkovers and VP surveys. The 2017-19 bird surveys were focused on the potential wind turbine areas as defined at that time, which was a larger potential development than what is now proposed. Subsequently the wind turbine area has been reduced in extent in response to the emerging engineering and environmental constraints.

The surveys were undertaken by:

- Neil Parker MCIEEM CEnv who has over 15 years of experience in surveying for birds at windfarms.
- Adam Murphy BSc (Hons) MSc is a highly experienced bird surveyor with over 5 years of experience in ecology and conservation.
- Anthony Cross, a well-respected ornithologist within Wales with decades of experience.
- Chris Mellenchip, who has decades of experience working in ornithological surveying and conservation.

Desk Study

An initial desk study was undertaken prior to the start of field work in 2017. The purpose of the initial study was to ensure that all relevant species that could potentially be present in the study area, based on their known breeding or wintering ranges and the broad habitats present, were taken into consideration in survey planning.

Information on designated sites (local, regional, national and international) that have ornithological interest was also collated during the initial desk study. In addition to this, following SNH guidance on SPA bird populations and potential connectivity to habitats affected by onshore wind farm development, any potentially relevant SPAs up to 20km from the site were also considered (SNH., 2017).

Information was gathered from the following sources:

- Ordnance survey maps (1:10,000 & 1:50,000);
- Special Protected Areas (SPA's), Special Areas of Conservation (SAC's) and Ramsars were obtained from the Joint Nature Conservation Committee (JNCC) website;
- Sites of Special Scientific Interest (SSSI) maps and citations were obtained from the Natural Resource Wales website;
- The Multi-Agency Geographic Information for the Countryside (MAGIC) website was consulted to confirm the location of designated sites of nature conservation interest;
- Aerial photographs;
- The Environment (Wales) Act 2016 Section 7 Priority Species
- Biodiversity Action Plans – The UKBAP and the LBAP were consulted in respect to notable habitats and species; and
- The Powys Local Development Plan was consulted to obtain any information regarding non-statutory designated sites of nature conservation and local policies regarding nature conservation.

A further desk study process was completed during the wind farm design phase. This involved contacting a range of organisations that hold bird records and requesting any relevant data they may hold for the study area. Requests for data were placed with the following organisations:

- British Trust for Ornithology (BTO);
- Royal Society for the Protection of Birds (RSPB);
- Mid Wales Raptor Study Group.

It is important to note that due to the remote nature of the site many receptor species considered in the assessment have generally not been monitored in detail by these organisations. Therefore, the absence of records for any species should not be treated as evidence that the species is absent in a particular area. Where there is suitable habitat, and the site is within the distributional range of the species, a precautionary approach is followed in relation to any judgements made on site importance or the need for surveys based on the desk study data alone.

The information gathered from the desk studies and field surveys was used to inform the wind farm design process in addition to carrying out collision risk modelling (CRM) and territory analysis that assist in predicting the effects of the development on ornithological receptors.

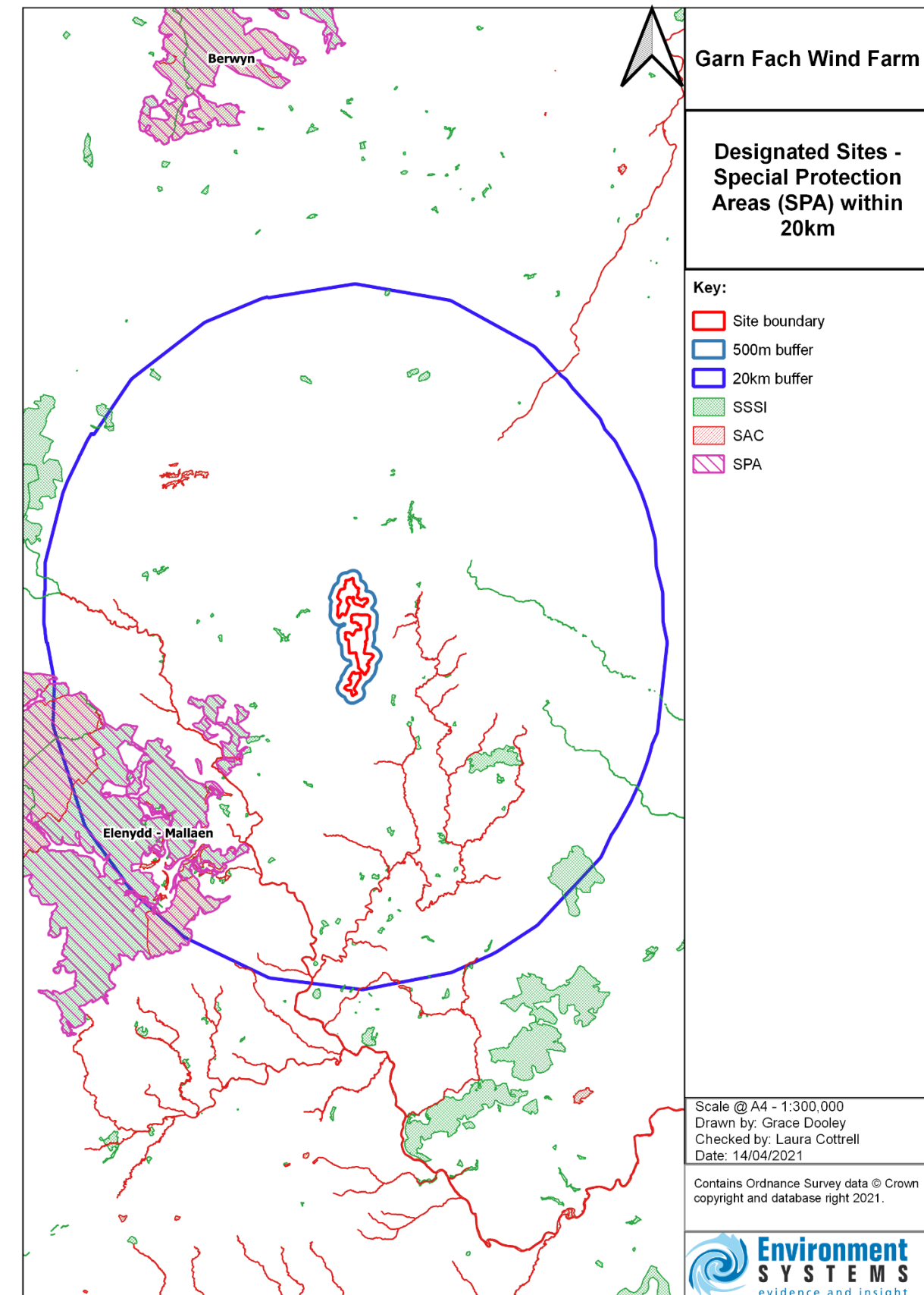


Figure 2: Designated sites and in particular SPAs within 20km

Potential Receptor Species

The surveys focused on populations of bird species that are known to be sensitive to effects from the construction and / or operation of onshore wind farms. Particular consideration has been given in this assessment to those species whose populations are also of conservation concern in the UK and / or Europe. These include:

- Species listed on Annex I of the European Council Directive 2009/147/EC on the Conservation of Wild Birds (i.e. 'Annex I' species);
- Species listed on Schedule 1 to the Wildlife and Countryside Act 1981, as amended (i.e. 'Schedule 1' species);
- Species of national conservation concern, not included within the above categories but that are present within the study area in nationally or regionally important numbers.

Table 2 provides a list of key species, based on the above criteria, which were identified through the initial desk study process as potentially present within the study area and relevant to the assessment. Following completion of the baseline surveys, and emergence of the design for the Proposed Development, a more focused list of ornithological receptors for the assessment was determined.

Table 2: Initial Target Species based on the results of the Desk Study.

Common Name	Scientific Name	Sch.1	Annex 1	UK BoCC	Section 7 Env (Wales) Act 2016
Hen harrier	<i>Circus cyaneus</i>	✓	✓	Red	✓
Red kite	<i>Milvus milvus</i>	✓	✓		
Peregrine	<i>Falco peregrinus</i>	✓	✓		
Goshawk	<i>Accipiter gentilis</i>	✓	✓		
Merlin	<i>Falco columbarius</i>	✓	✓		
Kestrel	<i>Falco tinnuculus</i>				✓
Osprey	<i>Pandion haliaetus</i>	✓	✓	Amber	
Hobby	<i>Falco Subbuteo</i>	✓			
Short-eared owl	<i>Asio flammeus</i>		✓		
Long-eared owl	<i>Asio otus</i>				
Barn Owl	<i>Tyto alba</i>	✓			
Golden plover	<i>Pluvialis apricaria</i>		✓		✓
Snipe	<i>Gallinago gallinago</i>			Amber	
Curlew	<i>Numenius arquata</i>			Red	✓
Lapwing	<i>Vanellus vanellus</i>			Red	✓
Red Grouse	<i>Lagopus lagopus</i>				✓
Nightjar	<i>Caprimulgus europaeus</i>		✓		✓
Greenland white-fronted goose	<i>Anser albifrons subsp. Flavirostris</i>				✓
Brent goose	<i>Branta bernicula</i>				✓
Teal	<i>Anas crecca</i>				
Whooper Swan	<i>Cygnus cygnus</i>	✓	✓		
Black-headed gull	<i>Chroicocephalus ridibundus</i>			Amber	✓
Great black backed gull	<i>Larus marinus</i>			Amber	
Herring gull	<i>Larus argentatus</i>			Red	

Vantage Point Survey Method

Setting Vantage Point Locations

Vantage Points (VP) were identified and viewshed coverage was calculated using the following two-step process.

1. Ground truthing of all potential VP locations to assess visibility and recording of the locations via a Global Positing System (GPS), ±5m, using a Trimble Juno SB Personal Digital Assistant (PDA) with ArcPAD 8 software. Each location was visited on foot and any obstacles or ground conditions assessed to provide suitable viewpoints with minimal visibility from above (hill top locations were avoided and suitable cover was determined).
2. Subsequent to the ground truthing exercise, viewshed analysis was performed using ArcGIS 10 (Spatial Analyst) based on the VP locations recorded in step one and a 50 m Ordnance Survey Digital Terrain Model (DTM).

Six VPs were initially selected to give coverage of the initial site boundary. Four of these were monitored throughout the duration of the survey period (2017-2019) whilst two were dropped as site boundaries were adjusted over the course of the survey period.

Undertaking Vantage Point Watches

Each VP was monitored for two periods of 3 hours each month, over two years. Observations were stratified across different parts of the day to provide an accurate image of bird activity throughout the day. This included surveys to be undertaken around dawn and dusk to capture movements of crepuscular species and birds moving between roosts and feeding areas. See Appendix for all survey details.

Table 3: Summary of total hours valid survey per VP in each season.

Period	VP C	VP D	VP E	VP F
2017/2018 non-breeding season	36	36	36	36
2018 breeding season	33	36	36	36
2018/2019 non-breeding season	36	36	36	36
2019 breeding season	36	36	36	36

During each survey a 180° arc view was scanned extending up to two kilometres from the observer until a target species was detected: at which point it was followed until it ceased to fly, or was lost from view. The following data was recorded:

- The time the target bird was detected;
- Species;
- The duration of the section of flight observed for as long as possible;
- The route followed by the bird is plotted in the filed onto field maps;
- The bird’s flying height is estimated at the point of detection and then at 15 second time intervals thereafter, using a count-down timer with an audible alarm;
- Behaviour (hunting, feeding, roosting etc.); and
- The number of birds.

Flight heights were classified as <10m, 10-100m and >100m above ground level.

When target species are not active, non-target birds were recorded at minimum five-minute intervals, including the species, behaviour and number. A target species list has been derived from knowledge of the local area (i.e. historic survey effort) combined with those species protected by law and/or known to be of conservation concern. It is acknowledged that a number of these species are migrants and will only be observed in passage (spring and autumn) or only during the breeding season (spring to summer) or overwintering. The target species list is indicative and all species observed that are likely to be of concern in relation to wind farm development were recorded

Winter Walkover

Walkover surveys were undertaken between and including October and March in both 2017/18 and 2018/19 (non-breeding season). One survey per month was carried out and followed guidance published by Gilbert *et al.*, (1998). The survey included covering the survey area on foot, using high powered optical equipment to scan open areas and to see into inaccessible parts of the survey area, to make field counts of bird species encountered both by sight and sound. These surveys involved following a route that optimised ground coverage, such that observers walked within 250m of every part of the site. Surveyors periodically stopped at appropriate viewing and listening points along the route and longer vantage point watches were included within the walkover to allow potentially important areas to be monitored in greater detail Following the latest guidance from SNH (2017) the survey area was extended up to 500m of the development boundary using open access land and public access routes surrounding the site.

All sightings of birds and their behaviour were recorded using standard British Trust for Ornithology (BTO) notation (Marchant, 1983; Gilbert et al., 1998) on to a 1:25,000 scale map for each month of survey.

On completion of each survey, data was entered into a vector (point) GIS dataset using QGIS software. The attribute fields included in the dataset are detailed in Table 3 in addition to the date, surveyor name, and the species' legal and BoCC status. The results were added each consecutive month to identify areas of winter roosting (distribution), the relative diversity of the site for over-wintering and migrating species and estimated non-breeding abundance.

Breeding Birds Survey Method

Census methods

In areas of open ground, walkover surveys were completed following an adapted Brown and Shepherd (1993) method using the outcomes of Callendine *et al.*, (2009) and Pearce-Higgins *et al.*, (2012). This was combined with the latest SNH guidance (2017) which recommends surveys up to 500m from the development boundary. Given the outcomes of Pearce-Higgins it was prudent therefore to survey up to 800m using this technique to target curlew territories.

The survey was completed in each month between April and July with the surveyor approaching, in a practical manner, to within 100m of all areas within the landowner agreed access and using open access land and public access routes up to 500m beyond the site boundary. The location and behaviour of the birds were recorded in the field on a 1:25,000 scale map for each month of survey. Surveys were extended into August and September following previous professional experience in searching for late and second broods as required by Natural Resources Wales in similar wind farm schemes in the region.

Behaviour was categorised as per the methodology detailed in the European Breeding Bird Atlas 2 (EBBA2) shown in Table 2. The EBBA2 can be considered to advance over the Brown and Shepherd method by differentiating between possible breeding, probable breeding and confirmed breeding.

On completion of each survey, data was entered into a vector (point) GIS dataset using QGIS software. The results were added each consecutive month to enable the creation of probable territory maps for each species.

Within visits, duplicate records of birds separated by less than a threshold distance of 500m for waders were subjectively considered to correspond to birds of the same pair, while those separated by more than this threshold distance were considered to be from different pairs. Exception to this was applied when surveyors recorded birds seen within this threshold distance of each other, and as such represents different pairs and vice versa. Estimates of the number of territories or pairs was calculated at the end of the July survey period by comparing mapped visit data. Professional judgement was used to derive territory boundaries of other species, based on knowledge of breeding behaviour of each species.

Table 4 Description of breeding status of birds

Breeding Status	Evidence of breeding
Non-Breeding (NB)	A species observed but suspected to be still on migration or to be summering non-breeder.
Possible Breeding (PO)	- Species observed in breeding season in possible nesting habitat - Singing male(s) present (or breeding calls heard) in breeding season
Probable Breeding (PR)	- Pair observed in suitable nesting habitat in breeding season - Permanent territory presumed through registration of territorial behaviour (song, etc.) on at least two different days a week or more apart at the same place - Courtship and display - Visiting a probable nest site - Agitated behaviour or anxiety calls from adults - Brood patch on adult examined in the hand - Nest building or excavating nest-hole
Confirmed Breeding (CB)	- Distraction-display or injury feigning - Used nest or eggshells found (occupied or laid within period of survey) - Recently fledged young (nidicolous species) or downy young (nidifugous species) - Adults entering or leaving nest-site in circumstances indicating occupied nest (including high nest or nest-holes, the contents of which cannot be seen) or adult seen incubating - Adult carrying faecal sac or food for young - Nest containing eggs - Nest with young seen or heard

Barn owl

Barn owls *Tyto alba* are afforded protection as a Schedule 1 species under the Wildlife & Countryside Act. Despite currently being Green listed under BoCC, the species is thought to currently be declining in the UK due to a loss of habitat. The population in upland areas of mid-Wales is thought to be relatively low, making any potential breeding pairs in the area of additional importance.

Barn owls are difficult to detect using the standard census methodology of breeding bird surveys and also have specific nesting requirements, usually a large hollow in a tree or undisturbed and well sheltered buildings. Features within the site boundary and a buffer area extending to 800m beyond the boundary were identified using OS maps and satellite imagery. These features were then visited during the 2018 and 2019 breeding seasons (March – August) by a surveyor and assessed for their ability to provide either a roost or nesting site for barn owl in the area, as well as searched for any signs (moulted feathers, pellets) that they may already be being used by the species. The surveys followed methodology outlined in Gilbert *et al.*, (1998), as mentioned in SNH Guidance (SNH, 2017).

Peregrine

Peregrine *Falco peregrinus* are a diurnal raptor species which is protected under Annex 1 of the Directive 2009/147/EC on the conservation of wild bird and as a Schedule 1 species in the Wildlife and Countryside Act. Peregrine are currently Green listed on by BoCC in both Wales and the entire UK, following a continuing recovery from low population lows in the 1960's. The Welsh uplands are considered a stronghold for the species within the UK and any developments should take peregrines into account.

As with barn owl traditional BBS methods will under report the presence of peregrines as they can often go unnoticed, it is therefore necessary to undertake dedicated surveys to identify suitable features that the species may use for breeding. Peregrine falcons require a well-protected and relatively flat ledge on a steep cliff for a nesting site, alternatively some buildings and quarries can also provide a suitable ledge. Potentially suitable features within the site boundary and a buffer area extending to 2km beyond the boundary were identified using OS maps and satellite imagery. Potential nest sites were visited and checked for evidence of occupation, sites checked included crags and steep banks identified from OS maps and searches of the survey area. Surveyors checked for signs of occupation (e.g. faecal splash, fresh plucked prey); Surveys were conducted between March and August in 2018 and 2019.

Nightjar

The nightjar *Caprimulgus europaeus* is a crepuscular species known to favour heathland, open areas of woodland, clear felled conifer plantations and scrubby vegetation, particularly in Wales, immature conifer plantation. Nightjar are protected under Annex 1 of the Directive 2009/147/EC on the conservation of wild birds (the Birds Directive) and recognised by the Welsh Government as a ‘Species of Principle Importance’ under Section 7 of the Environment (Wales) Act 2016. The species is currently listed as a BoCC Amber species within the UK, it was previously Red listed, which suggests that conservation efforts are succeeding. The population of nightjar in Wales has been increasing since at least the early 1980’s, with increased felling of mature forest plantations being regarded as the potential reason, providing much younger and more suitable habitat for the species.

Two areas were identified as providing potential breeding habitat for nightjar. The main plantation at Garn Fach mostly consists of spruce trees of varying maturity and with some areas providing more open habitat which is favoured by nightjar. The small Fualt plantation, though more mature than is ideal for nightjar, provides lots of open areas for foraging and nesting habitat.

Following guidelines published in Gilbert *et al.*, (1998), the marked transect was visited on two occasions between mid-June and mid-July in 2019 by surveyors. Research indicates that the most productive time to hear nightjar churring is usually the two hours following dusk and two hours preceding dawn. Therefore, survey effort was targeted for approximately two hours between 21:30 and 00:00. Surveys were undertaken by surveyors using the following methods:

- Listening for churring nightjar from a fixed-point location;
- Methodically walking transects on forestry tracks through or adjacent to clear fell.

As the survey aim was to determine presence or likely absence, no attempt was made to locate exact positions of nightjar nests

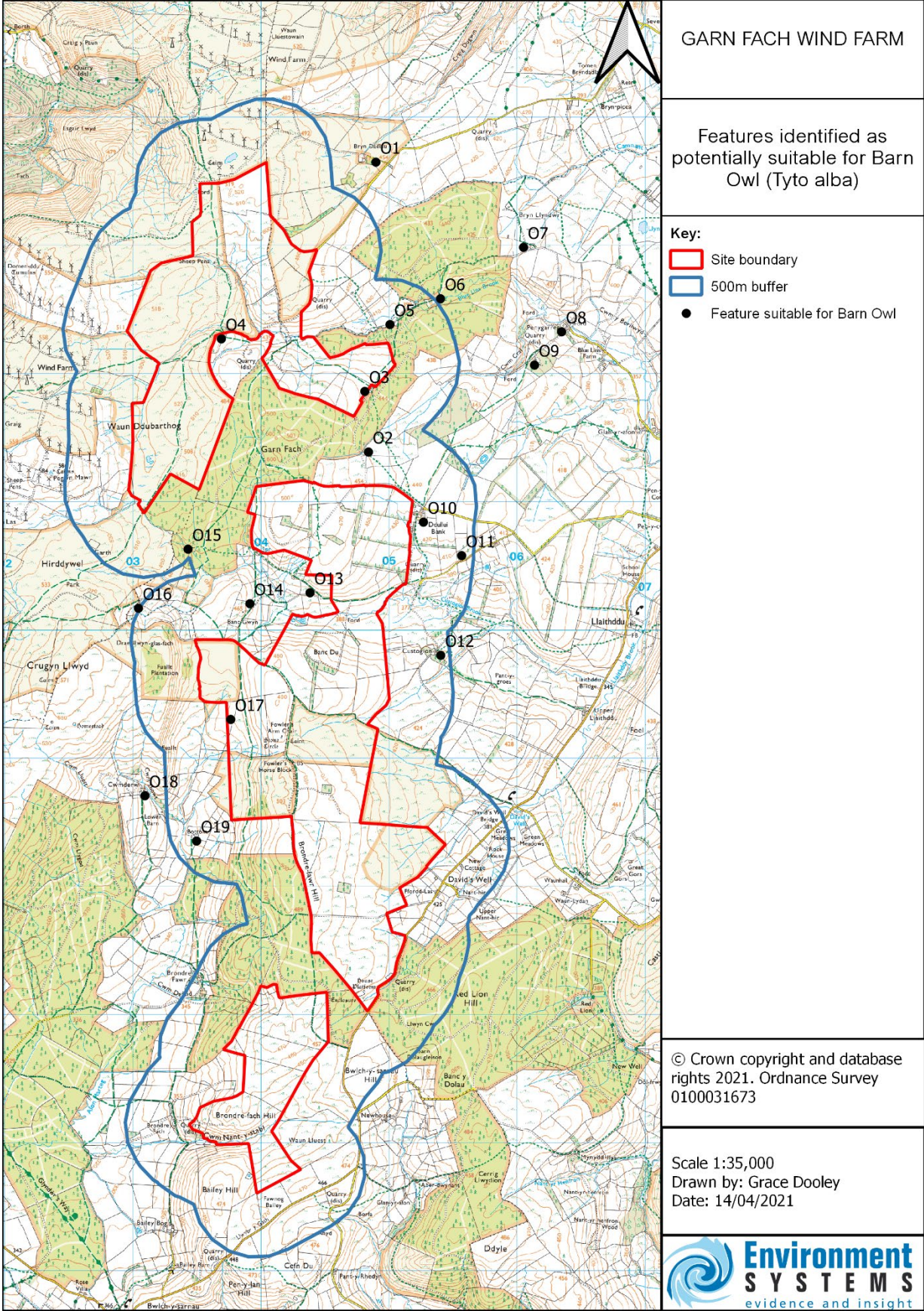


Figure 3 Features identified as potentially suitable for barn owl

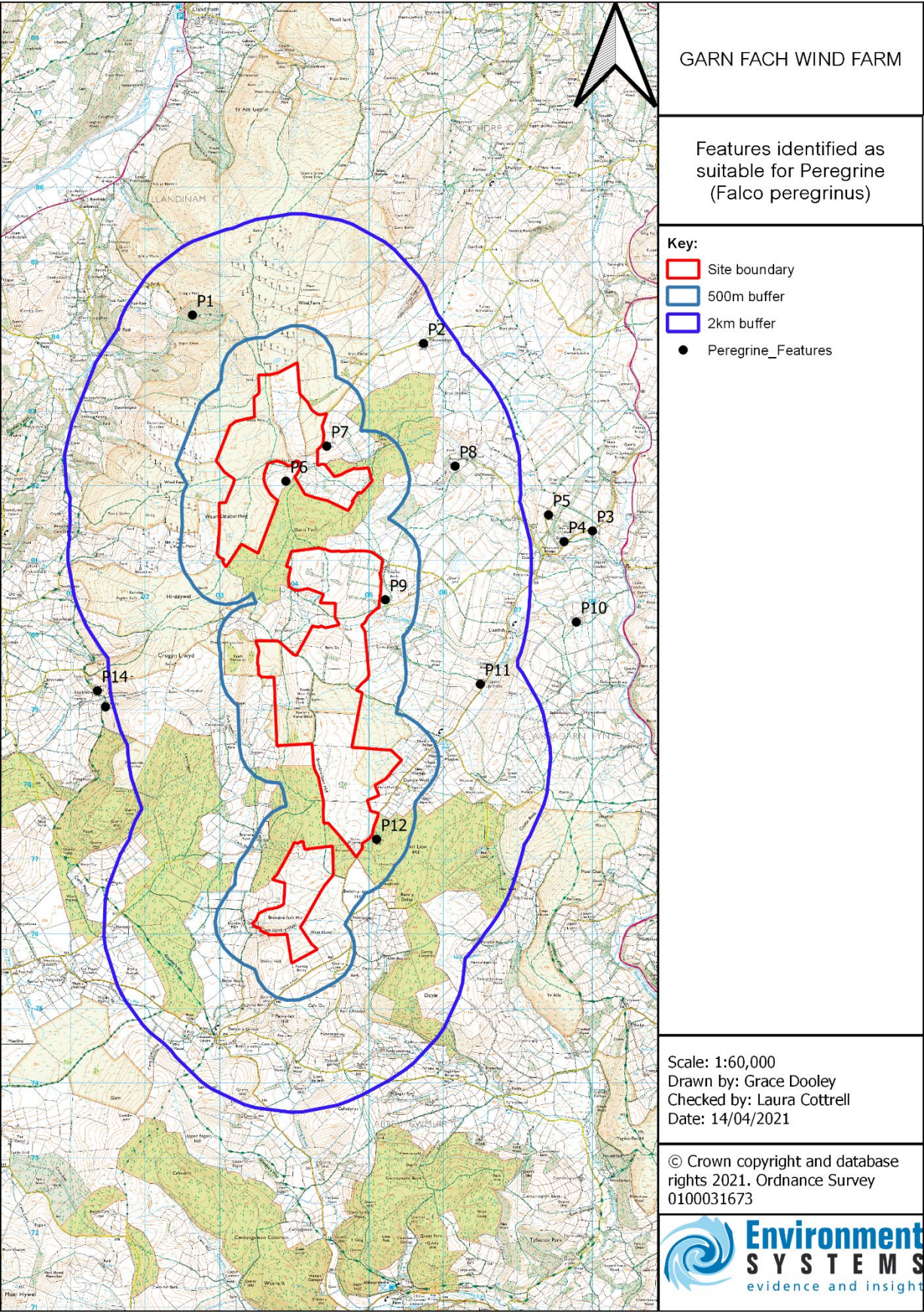


Figure 4 Features identified as suitable for peregrine within the site, a 500m and 2km buffer

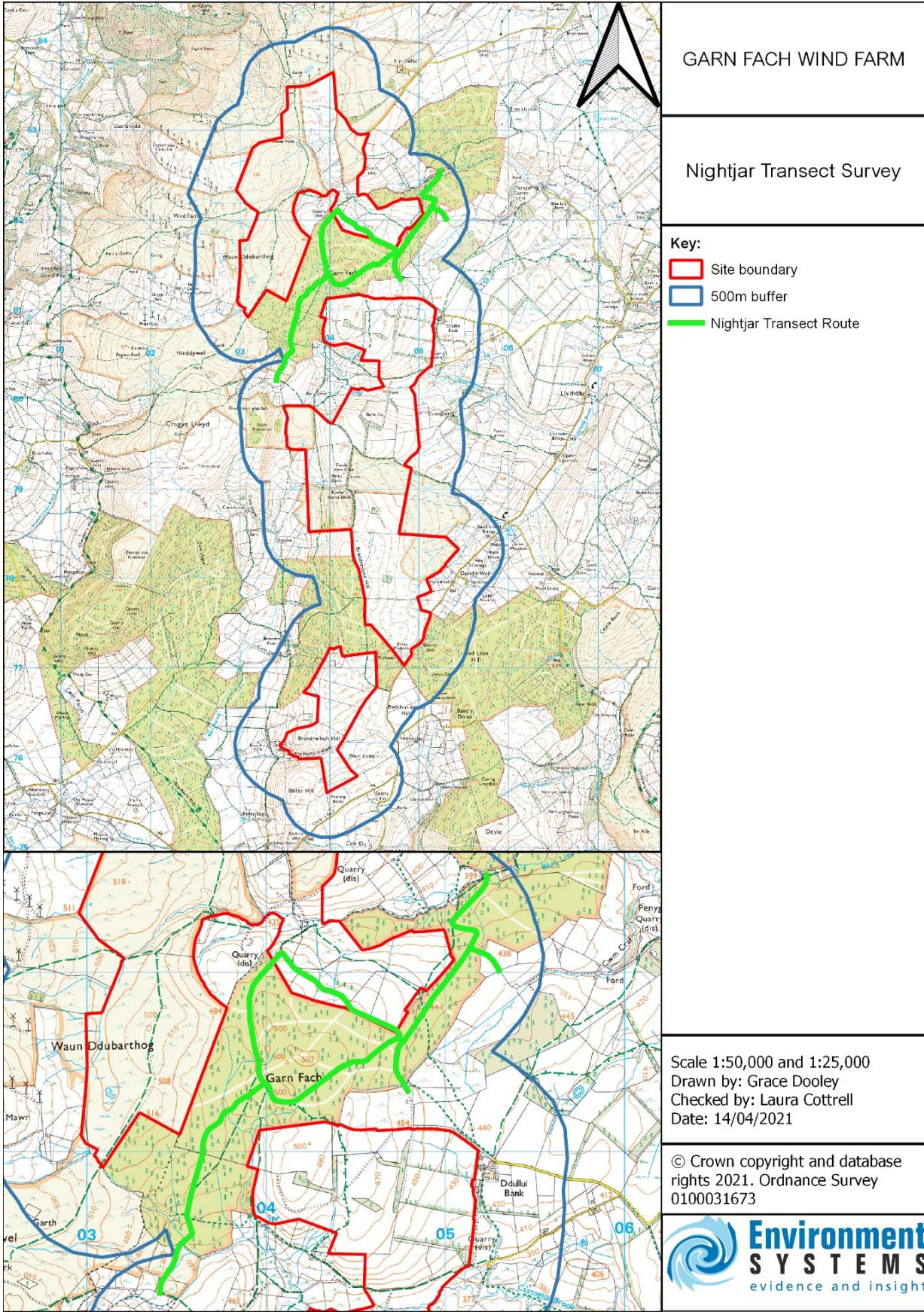


Figure 5: Nightjar Transect Route

Goshawk

The goshawk *Accipiter gentilis* is a large hawk known to favour dense woodland and old coniferous forest with a varied structure of tree age (Penteriani & Faivre, 1997). Goshawk are named on Schedule 1 of the Wildlife and Countryside Act 1981 (as amended). The species is currently listed as a BoCC Green species within the UK with limited threat to the population, although concern is given over the impacts of felling on breeding pairs.

Goshawk as a species was included as part of the BBS and VP survey efforts, although particular focus was given to assessing Garn Fach plantation for the presence of and habitat suitability for breeding goshawk. Garn Fach plantation was identified as felling of trees is proposed to make way for the access track.

No specific methodology is published for the assessment of habitat suitability for nesting goshawk. Published guidance and research (Crocker-Bedford, 1990; Petty, 1996) indicate that a buffer of 400m from any occupied nests must be maintained to prevent abandonment of nest and unnecessary disturbance. This 400m figure was used to identify a targeted survey area, where the proposed access track (where trees will be felled) was buffered by 400m (Figure 6).

Survey effort was undertaken in October 2021 and thus outside the breeding season. Survey effort comprised an experienced ornithological surveyor walking methodically through the survey area and focussed on searching for:

- Evidence of recent nesting activity from goshawk (prey remains; plucked feathers; historical nests; aggregations of whitewashes/droppings);
- Trees large enough to support goshawk nests;
- Areas with a suitable ‘forest architecture’ to support goshawk nesting activity.

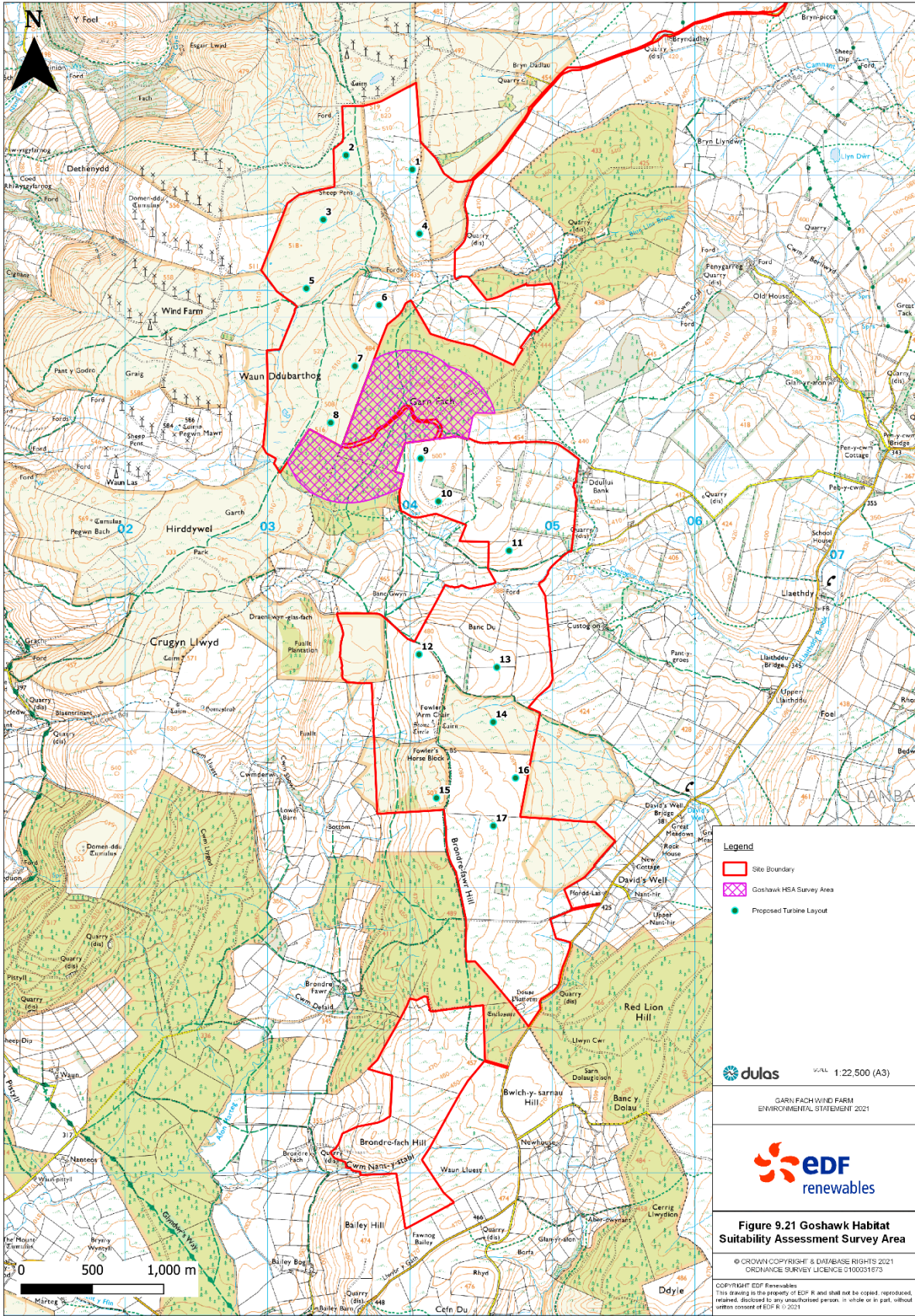


Figure 6: Goshawk Habitat Suitability Assessment Survey Area

Collison Risk Modelling

All flight lines recorded during VP watches were digitised using QGIS software to aid the identification of core flight areas and analysis of flight distribution. The theoretical collision mortality for each target species was calculated by entering the VP flight data into the Band model (Band *et al.*, 2007). Only flight activity recorded at the heights swept by the rotor blades will be used in the model as flights at all other heights would not put the target species at risk of collision. The southernmost area of the site was excluded from modelling as no turbines will be sited there.

The Band model uses a two-stage approach to calculate the number of collisions in a given time period (this could be per annum or per season). Stage one predicts the number of transits a species will make through the turbine rotor volume, stage two predicts the probability of a bird being struck, should it pass through the rotors. The product of stages one and two gives a predicted collision mortality assuming that the birds make no attempt to avoid colliding with the moving rotor blade. A predicted collision mortality can be given after taking into account the avoidance action of birds.

There are a number of assumptions made in the Band model. For instance, the model calculation assumes that bird activity is consistent throughout all hours of the day, and near-misses do not affect a bird making a pass close to the rotors, despite the slipstream created around a turbine blade. The model requires an estimation of the amount of time a species is active in the survey area in a year and also utilises avian biometric data. For example, flight speed of the target species is used in both stages of the calculation, but this may vary depending on whether a species uses the area primarily for breeding (and hence display flights) or traversing the site, as well as factors such as prevailing weather conditions. These two behaviours would be likely to result in different flight speeds at different sites, which could deviate significantly from mean air speed velocities recorded elsewhere.

In the general absence of empirically derived collision avoidance rates for individual species, further assumptions are made about the likely level of active avoidance that may occur. Avoidance rates in excess of 99% have been reported on other wind farms by a number of researchers (Percival, 2005), however collision rates are likely to be highly site and species-specific. Collision rates have more recently become better understood at upland onshore wind farms. The Band model used in this assessment will implement the guidance set out in Use of Avoidance Rates in the SNH Wind Farm Collision Risk Model (SNH, 2010) following guidance for modelling from Band *et al.*, (2007).

Evaluation and Assessment Methodology

The Guidelines for Ecological Impact Assessment in the UK and Ireland (CIEEM, 2018) (hereafter referred to as the ‘CIEEM Guidelines’) provides guidance on the process of identifying the value of ecological receptors, characterising effects upon them and the magnitude of these affects, and assessing whether these effects are significant. These guidelines form the basis of the evaluation and assessment methodology for which the designed ornithological survey was completed. The CIEEM Guidelines have no legal standing and are not a substitute for professional judgement and interpretation. However, they are well-established and recognized guidelines which are used throughout the industry.

The approach to identifying and determining the magnitude and the significance of the effects on ornithological receptors to be used is presented in Chapter 9.

Table 5 Definition of nature conservation value for bird interest at Garn Fach Wind Farm

Value	Example of qualifying nature conservation definition
Very high	Qualifying species of an internationally designated site (i.e. SPA or Ramsar) Species present in internationally important numbers (>1% of UK population).
High	Species that contribute to the integrity of a SPA or SSSI but which are not cited as species for which the site is designated (SPAs) or notified (SSSIs). Ecologically sensitive species such as rare birds (<300 breeding pairs in the UK). Species present in nationally important numbers (>1% Welsh population). Species listed on Annex I of the EC Birds Directive or breeding species listed on Schedule 1 of the Wildlife and Countryside Act. Regularly occurring relevant migratory species, which are either rare or vulnerable, or warrant special consideration (i.e. Schedule 1 of the Wildlife and Countryside Act and Section 7 of the Environment Act) on account of the proximity of migration routes, breeding, wintering and staging areas in relation to the Development.
Medium	Species present in regionally (i.e. mid-Wales) important numbers (>1% regional population) Species occurring within SPAs and SSSIs but not crucial to the integrity of the site. Species of Principal Importance as defined in Section 7 of the Environment Act. Regularly occurring relevant migratory species, which are either rare or vulnerable, or warrant special consideration (i.e. BoCC Wales 3 Red List) on account of the proximity of migration routes, breeding, wintering and staging areas in relation to the Development.
Low	Regularly occurring relevant migratory species, which are either rare or vulnerable, or warrant special consideration (i.e. BoCC Wales 3 Amber List) on account of the proximity of migration routes, breeding, wintering and staging areas in relation to the Development. Any other species of local conservation interest such as those listed in the LBAP or PNRAP.

Limitations

It is acknowledged that the Brown & Shepherd survey technique is likely to under-estimate the number of breeding snipe. The ‘drumming’ display indicative of breeding usually occurs at dawn and dusk before/after the recommended survey times. In addition, snipe appear to be more active on days when the weather is less suitable for general wader survey. It was possible however to supplement data for breeding snipe by the collection of data during dawn and dusk VP surveys when breeding snipe may be more active.

Vantage points A and B were dropped after 12 and 18 months of surveying, respectively. This was due to changes made to the site boundary and development plan which no longer required survey effort in this part of the site. Their results are removed from this report for clarity.

Due to unforeseen circumstances, in the 2018 breeding season vantage point C was surveyed for 3 hours fewer than the 36 hours recommended by SNH (2017). Whilst not ideal, this will not have an overly adverse effect on the survey effort, largely because there is high level of overlap between the viewsheds of vantage points C and D.

Results

Desk Study

There is one designated site with avian qualifying features in the vicinity of the Proposed Development area. The Elenydd-Mallaen Special Protection Area (SPA) is located at its nearest point 6.7km to the southwest of the site boundary. The Elenydd-Mallaen SPA qualifying features are seven breeding pairs of merlin, 34 breeding pairs of red kite and 15 breeding pairs of peregrine.

Historic surveys

Bird surveys were conducted by ‘Ecology Matters’ on the site in 2006 consisting of vantage point, wintering and breeding bird surveys, including nightjar. A pair of breeding red kite were recorded within the site boundary and were the most frequently observed species during vantage point surveys. No nightjar were encountered during surveys. Four or five pairs of curlew were recorded, a population determined as important at a county level. All of these pairs were outside of the site boundary and all more than 600m from a turbine location. Surveys indicated that there was potential for adverse residual affects to

Mitigation was proposed to avoid disturbance to breeding curlew during the spring and summer months. Exclusion zones of 800m were proposed around active curlew nesting sites between 15th February and the 31st of July. No other mitigation for ornithological receptors was proposed.

Vantage Point Survey Results

A total of 1,047 observations consisting of 14,526 individual birds recorded over the course of 573 hours of vantage point surveys. Of these observations, 14,526 were birds that have been identified as being of importance to CRM on the site. The following table shows species which were identified for CRM.

Table 6 Summary of target species flights for CRM

Species	No. of flight observations	Total no. of birds	Time at medium or high height band	Total time in flight	Percentage of time in collision risk zone %
Curlew	1	1	00:00:00	00:00:00	0
Great black-backed gull	37	50	1:02:45	01:43:45	60.48
Goshawk	10	10	00:08:15	00:10:15	80.49
Golden plover	22	2164	148:05:30	210:46:00	70.26
Herring gull	7	14	00:23:45	00:29:00	81.90
Hen harrier	13	13	00:06:45	00:31:15	21.90
Kestrel	115	125	02:51:15	06:17:30	45.36
Red kite	685	857	31:37:10	36:50:10	85.84
Lesser black-backed gull	10	47	00:58:15	01:01:15	95.1
Merlin	3	3	00:00:15	00:02:30	10
Peregrine	11	11	00:25:00	00:27:00	92.55
Starling	133	11231	16:48:30	534:37:30	3.14

Breeding Bird Survey Results

Breeding bird surveys have shown that the site does not host breeding populations of great importance. A total of 75 species were encountered during the breeding seasons in 2018 and 2019.

Census Methods

Table 7 Species observed during breeding bird surveys, summaries and their breeding status

Common Name	Scientific Name	BoCC4 Status	WACA 1981 Schedule 1; Environment (Wales) Act 2016	Birds Directive	Breeding status	Conservation value
Barn owl	<i>Tyto alba</i>	Green	WACA-Sch1 Prt 1			High
The species was not observed directly during any survey work on the site. However, the site and buffer were searched for suitable features for barn owl to use for breeding. None of the features which were deemed suitable held any signs of use by barn owl. It is possible that they may use the site in the future, but for the time being they do not appear to be breeding, or roosting, within the site and buffer. Some old pellets were found on one occasion in 2017 but not again since.						
Blackbird	<i>Turdus merula</i>	Green		Anx 2.2		Low
Blackcap	<i>Sylvia atricapilla</i>	Green				Low
Bullfinch	<i>Pyrrhula pyrrhula</i>	Red			Probable	Medium
In 2019 the species was observed six times, each of which it was a single individual calling out. Each of these observations took place in June, two of which were in very close to proximity to each other. In the 2018 breeding season a pair was observed in four different locations.						
Blue tit	<i>Cyanistes caeruleus</i>	Green				Low
Buzzard	<i>Buteo buteo</i>	Green				Low
Carrion crow	<i>Corvus corone</i>	Green		Anx 2.2		Low
Chiffchaff	<i>Phylloscopus collybita</i>	Green				Low
Collared dove	<i>Streptopelia decaocto</i>	Green		Anx 2.2		Low
Canada goose	<i>Branta canadensis</i>	Green				Low
Chaffinch	<i>Fringilla coelebs</i>	Green				Low
Common cuckoo	<i>Cuculus canorus</i>	Red	Env (Wales) Act S7		Probable	High
Cuckoo were observed 10 times in 2018, nine of which were lone individuals and one sighting was of three birds. There have been sightings in April, June and July, usually calling. Three areas yielded multiple cuckoo sightings with calling, suggesting a territory. In 2018 the species was observed seven times in six different locations, each time a single bird calling.						
Common crossbill	<i>Loxia curvirostra</i>	Green	WACA-Sch1 Prt 1		Possible	Medium
16 crossbill were observed over the two breeding seasons. Observations in April/May were not in close proximity to each other and no evidence of breeding observed.						
Coal tit	<i>Periparus ater</i>	Green				Low
Curlew	<i>Numenius arquata</i>	Red	Env (Wales) Act S7	Anx 2.2	Probable	Very High
Curlew were heard calling on seven occasions, three times in April 2018, twice in May 2018 once in May 2019 and once in June 2019. Each of these records was geographically distinct. The observations in 2018 were all more than 500m away from the site boundary, with the exception of a record in the vicinity of David’s Well. The two incidences in 2019 were opposite sides of the site (Banc Gwyn and Ddullui Bank). On their own these two sightings do not confirm breeding on the site. However, during survey work targeting other taxa, a curlew was consistently heard on multiple occasions close to David’s Well, which when added to the observation recorded in BBS makes the area a likely territory.						
Dunnock	<i>Prunella modularis</i>	Green				Low
Great black-backed gull	<i>Larus marinus</i>	Red		Anx2.2		Medium
Great black-backed gulls were seen flying over the site on eight occasions. Each of them appears to have merely been passing through, and the site does not provide any suitable habitat for them to breed on.						
Goldcrest	<i>Regulus regulus</i>	Amber				Low
Grasshopper warbler	<i>Locustella naevia</i>	Red	Env (Wales) Act S7		Possible	Medium
A single grasshopper warbler was recorded singing in June 2018 approximately 450m outside the site boundary.						
Goshawk	<i>Accipiter gentilis</i>	Green	WACA-Sch1 Prt 1		Possible	High
A single goshawk was observed in April 2018 approximately 850m outside the site boundary and within the vicinity of Garn Fach plantation.						
Grey wagtail	<i>Motacilla cinerea</i>	Amber				Low
Goldfinch	<i>Carduelis carduelis</i>	Green				Low

Common Name	Scientific Name	BoCC4 Status	WACA 1981 Schedule 1; Environment (Wales) Act 2016	Birds Directive	Breeding status	Conservation value
Greenfinch	<i>Chloris chloris</i>	Amber				Low
Great spotted woodpecker	<i>Dendrocopos major</i>	Green				Low
Great tit	<i>Parus major</i>	Green				Low
Garden warbler	<i>Sylvia borin</i>	Green				Low
Grey heron	<i>Ardea cinerea</i>	Amber				Low
Hen harrier	<i>Circus cyaneus</i>	Red	WACA-Sch1 Prt 1; Env (Wales) Act S7	Anx 1	Possible	Very High
A single hen harrier was seen on five different occasions. Two of these were in 2019 one a male (in May) and the other a female (in June). Both of these were seen around the northern end of the site, around Waun Ddubarthog. Three observations were made in 2018 with one in August and two in September. One of these September observations was a juvenile female, likely to have dispersed from another location nearby. There is likely not enough mature heather within the site boundary to provide favourable nesting sites, though it is possible that it is used as part of a territory of a pair that have nested elsewhere.						
House martin	<i>Delichon urbicum</i>	Green				Low
Hobby	<i>Falco subbuteo</i>	Green	WACA-Sch1 Prt 1			High
A single hobby was seen flying over the site in July 2018 and August 2019. The absence of the species for the preceding months makes it highly unlikely that it is breeding in or close to the site. These observations are from the time of year when both adults and juveniles roam further away from their nest before migrating south, making it likely it was just passing through the area.						
House sparrow	<i>Passer domesticus</i>	Amber	Env (Wales) Act S7		Confirmed	Medium
House sparrows were routinely seen around the farmhouse at Ddullui bank, including with juveniles in June and as a pair in April.						
Jay	<i>Garrulus glandarius</i>	Green		Anx 2.2		Low
Jackdaw	<i>Corvus monedula</i>	Green		Anx 2.2		Low
Kestrel	<i>Falco tinnunculus</i>	Red	Env (Wales) Act S7			High
Kestrel were seen on site eleven times in the 2018 breeding season, observed from May until September, with seven of these records occurring in July or later. All but one of these eleven observations were single adult birds which were not exhibiting breeding behaviour. In September a pair of kestrels was seen. The lack of observations of kestrel in the early part of the breeding season and lack of observations of juveniles make the site unlikely to host a breeding pair though it may comprise part of a territory which are nesting nearby.						
Red kite	<i>Milvus milvus</i>	Amber	WACA-Sch1 Prt 1	Anx 1	Confirmed	High
Red kite were routinely observed in all corners of the site boundary, frequently as a pair. Two nests were identified during the survey season, one just north of Garn Fach and the other to the north east of Ddullui bank.						
Lesser black-backed gull	<i>Larus fuscus</i>	Amber		Anx 2.2		Medium
Little grebe	<i>Tachybaptus ruficollis</i>	Green				Low
Linnet	<i>Linaria cannabina</i>	Red			Confirmed	Medium
Linnet were often seen over all parts of the site, many being seen as a pair and showing territorial behaviour, singing and calling to each other early in the season. Larger flocks containing juveniles were seen were seen later on in the summer.						
Lesser redpoll	<i>Acanthis cabaret</i>	Amber	Env (Wales) Act S7		Probable	Medium
Observations of lesser redpoll were frequent at the northern end of the main forestry plantation at Garn Fach, with some also being seen in a family group in a small patch of forest to the south east of the main coup.						
Mistle thrush	<i>Turdus viscivorus</i>	Amber		Anx 2.2		Medium

Common Name	Scientific Name	BoCC4 Status	WACA 1981 Schedule 1; Environment (Wales) Act 2016	Birds Directive	Breeding status	Conservation value
Mallard	<i>Anas platyrhynchos</i>	Amber		Anx 2.1		Medium
Magpie	<i>Pica pica</i>	Green		Anx 2.2		Medium
Merlin	<i>Falco columbarius</i>	Red				High
A single merlin was seen flying overhead on one occasion.						
Meadow pipit	<i>Anthus pratensis</i>	Amber				Medium
Peregrine falcon	<i>Falco peregrinus</i>	Green	WACA-Sch1 Prt 1	Anx 1		High
A juvenile peregrine was observed in late July 2019. This is the time of year when adults and juveniles disperse over a wide area and roam into new habitats. It is not unusual to observe them in areas where they are just passing through so breeding within the site and its buffer remains very low.						
Pheasant	<i>Phasianus colchicus</i>	Green		Anx 2.2		Low
Nuthatch	<i>Sitta europaea</i>	Green				Low
Pied wagtail	<i>Motacilla alba</i>	Green				Low
Robin	<i>Erithacus rubecula</i>	Green				Low
Reed bunting	<i>Emberiza schoeniclus</i>	Amber	Env (Wales) Act S7		Probable	Medium
Reed bunting were recorded in many of the boggy areas of the site, usually as a single male calling. Though a pair was sighted at the far north of the site by the sheep pens at Waun Ddubarthog.						
Red-legged partridge	<i>Alectoris rufa</i>	Green		Anx 2.1		Low
Raven	<i>Corvus corax</i>	Green				Low
Rook	<i>Corvus frugilegus</i>	Green		Anx 2.2		Low
Redstart	<i>Phoenicurus phoenicurus</i>	Green				Low
Reed warbler	<i>Acrocephalus scirpaceus</i>	Green				Low
Skylark	<i>Alauda arvensis</i>	Amber	Env (Wales) Act S7	Anx 2.2	Confirmed	Medium
Skylark were seen displaying in great numbers across the entire site, with the exception of the area around Ddullui bank.						
Stonechat	<i>Saxicola rubicola</i>	Green				Low
Stock dove	<i>Columba oenas</i>	Green		Anx 2.2		Low
Spotted flycatcher	<i>Muscicapa striata</i>	Red	Env (Wales) Act S7		Confirmed	Medium
A pair of spotted flycatcher were confirmed as breeding on the site in both breeding seasons, at different locations in each year. In July 2018 a nest was observed within Fualt plantation and a family group of three was recorded the following month. On two occasions in June 2019 a single spotted flycatcher was recorded calling at [REDACTED] marginally outside the site boundary. As these sightings were late in the year and were only a single individual it appears unlikely that they will have bred in the vicinity of where they were seen. However, a family unit of spotted flycatcher was observed to the north of the main plantation. When juveniles are still dependent on adults they rarely stray far from their home nest, it may well be that they nested in the area, more specifically, around the house at [REDACTED]						
Sparrowhawk	<i>Accipiter nisus</i>	Green				High
Swift	<i>Apus apus</i>	Amber				Low
Siskin	<i>Spinus spinus</i>	Green				Low
Swallow	<i>Hirundo rustica</i>	Green				Low
Sand martin	<i>Riparia riparia</i>	Green				Low
Snipe	<i>Gallinago gallinago</i>	Amber		Anx 2.1		Low
Song thrush	<i>Turdus philomelos</i>	Amber		Anx 2.2		Low
Treecreeper	<i>Certhia familiaris</i>	Green				Low
Tree pipit	<i>Anthus trivialis</i>	Amber	Env (Wales) Act S7			Low
Wheatear	<i>Oenanthe oenanthe</i>	Green				Low
Whinchat	<i>Saxicola rubetra</i>	Red				Low

Common Name	Scientific Name	BoCC4 Status	WACA 1981 Schedule 1; Environment (Wales) Act 2016	Birds Directive	Breeding status	Conservation value
Wood warbler	<i>Phylloscopus sibilatrix</i>	Red	Env (Wales) Act S7		Confirmed	Low
There were two observations of wood warbler, one within the site itself and the other within the 500m buffer, both in July. A family unit was seen to the south of the site, within the buffer.						
Whitethroat	<i>Sylvia communis</i>	Red				Low
Wood pigeon	<i>Columba palumbus</i>	Green		Anx 2.1		Low
Wren	<i>Troglodytes troglodytes</i>	Green				Low
Willow tit	<i>Poecile montanus</i>	Red				Low
Willow warbler	<i>Phylloscopus trochilus</i>	Red				Low

Peregrine breeding survey

Table 8 Description of potential peregrine features surveyed

Feature ID	Suitable for PE	Description
P1	No	Gentle slope with bracken.
P2	No	Too shallow.
P3	No	Too shallow.
P4	No	Too shallow.
P5	No	Too shallow.
P6	No	No quarry found.
P7	No	Too shallow.
P8	No	Too shallow.
P9	No	Too shallow.
P10	No	Too shallow.
P11	No	Too shallow.
P12	No	Too shallow.
P13	No	Too shallow.
P14	No	Too shallow.

During the desk study, 14 potential features were identified as providing potential nest sites for peregrine (Table 8). None of the 14 features identified within the desk study were found to provide an adequately protected shelf for peregrines to nest on. The features listed as quarries were very small in nature and did not have a large enough sheer cliff face in order to provide the protection from terrestrial predators that is needed for a peregrine nest.



Figure 7 The former quarry at P1 was assessed to be much too shallow a slope to support peregrines.

Barn owl breeding survey

Table 9 Description of potential barn owl features surveyed

Feature ID	Presence of BO	Description
O1	No	Actively used small sheet metal building. No opening.
O2	No	Actively used home. No suitable opening for BO.
O3	No	Actively used home. No suitable opening for BO.
O4	No	Small old stone livestock barn. Unused kestrel box inside. Could be suitable if an owl box was placed inside.
O5	No	Abandoned home. No suitable opening for BO.
O6	No	Actively used home. Small bungalow with no opening for BO.
O7	No	Ruin with no standing walls.
O8	No	Actively used sheet metal barn. No owl box present.
O9	No	Static caravans.
O10	No	Actively used sheet metal barn. No owl box present.
O11	No	Actively used holiday cottage. No suitable opening for BO.
O12	No	Actively used home. No suitable opening for BO.
O13	No	Abandoned home. Potential for roost/nest upstairs though no signs of use.
O14	No	Ruin with no standing walls.
O15	No	Ruin with no standing walls.
O16	No	Ruin with no standing walls.
O17	No	Small caravan.
O18	No	Abandoned & dilapidated home. Potential for roost/nest though no signs of use.
O19	No	Ruin with no sheltered area remaining.

Of all the 19 features that had been identified as potentially suitable during desk study, not one showed visible signs of being used by barn owl as either a roost or as a nesting site.



Figure 8 O4 from two different angles



Figure 9 O13 provides both plenty of shelter and good entry points for barn owl



Figure 10 Though somewhat exposed in parts O10 could provide favourable habitat for barn owl

Nightjar breeding surveys

Surveys did not confirm the presence of nightjar within the site boundary. The transect was visited during peak season for nightjar activity on two occasions and there was not a single observation, either by sight or by sound, of a nightjar. This is despite some areas of the site appearing to offer favourable habitat for the species.

Goshawk Habitat Suitability Assessment

Survey effort was conducted over the course of several days in October 2021 within the survey area outlined in Figure 6.

- No abandoned/disused goshawk nests were observed.
- No evidence of historical nesting activity by goshawk was noted, such as plucked feathers, aggregations of whitewashes/droppings, nor remains of prey items.
- No trees large enough to support a goshawk nest were observed.
- It was noted that the plantation has not recently been thinned, resulting in an extremely dense and closely-crowded thicket considered to be unsuitable for goshawk.

It was observed by the surveyor that coniferous woodland plantations in the local area (off-site) have greater suitability to support nesting goshawk on account of their structure and age.

Wintering bird surveys

Over the course of two winter survey periods a total of 67 species were recorded within the site with a total number of 1792 bird observations. The species encountered included resident passerines such as robins and wrens as well as flocks of winter migrants such as starling and fieldfare, on occasion as numerous as 5000 in a single flock.

Table 10 Summary of species observed in wintering bird surveys and their conservation value

Common Name	BoCC4 Status	Protection	Peak count	UK BAP Priority spp.	Value
Barn owl	Green	WACA-Sch1 Prt 1	0 (No sightings but pellets found)		High
Blackbird	Green		-		Low
Blue tit	Green		-		Low
Bullfinch	Red		-	☑	Medium
Buzzard	Green		-		Low
Carrion crow	Green	Anx 2.2	-		Low
Chaffinch	Green		-		Low
Chiffchaff	Green		-		Low
Coal tit	Green		-		Low
Collared dove	Green	Anx 2.2	-		Low
Crossbill	Green	WACA-Sch1 Prt 1	22 (Feb 19)		High
Curlew	Red	Env (Wales) Act S7, Anx 2.2	8 (Mar 19)	☑	Very high
Dunnock	Green		-	☑	Low
Fieldfare	Amber	Anx2.2	5000 (Oct 17)		Medium
Goldcrest	Amber		-		Low
Golden plover	Red	Anx1, Anx2.2, Env (Wales) Act S7	400 (Feb 19)		High
Goldfinch	Green		-		Low
Goshawk	Green	WACA-Sch1 Prt 1	-		High
Great black-backed gull	Red	WACA-Sch1 Prt 1, Anx2.2	-		High
Great spotted woodpecker	Green		-		Low
Great tit	Green		-		Low
Green woodpecker	Amber		-		Low
Grey heron	Green		-		Low
Grey wagtail	Amber		-		Low
Hawfinch	Amber	Env (Wales) Act S7	-		Medium
Hen harrier	Red	Anx1, WACA-Sch1 Prt 1, Env (Wales) Act S7	-		Very high
Herring gull	Red	Anx2.2	-	☑	Medium
House sparrow	Amber	Env (Wales) Act S7	10 (Dec 18)	☑	Medium
Jack snipe	Amber	Anx2.1	-		Low
Jackdaw	Green	Anx2.2	-		Low
Jay	Green	Anx2.2	-		Low
Kestrel	Red	Env (Wales) Act S7	-		High
Lesser black-backed gull	Amber	Anx2.2	-		Medium
Lesser redpoll	Amber	Env (Wales) Act S7	1 (Feb 19)	☑	Medium
Linnet	Red		8 (Nov 18)	☑	Medium
Long-tailed tit	Amber		10 (Nov 18)		Low
Magpie	Green	Anx2.2	-		Medium
Mallard	Amber	Anx2.1	7 (Nov 17)		Medium
Meadow pipit	Amber		47 (Mar 18)		Medium
Merlin	Red		-		High
Mistle thrush	Amber	Anx2.2	2		Medium
Nuthatch	Green		-		Low
Peregrine	Green	Anx1, WACA-Sch1 Prt 1	-		High
Pied wagtail	Green		-		Low
Raven	Green		42 (Dec 17)		Low
Red kite	Amber	Anx1, WACA-Sch1 Prt 1	-		High
Red legged partridge	Green	Anx2.1	-		Low

Common Name	BoCC4 Status	Protection	Peak count	UK BAP Priority spp.	Value
Redwing	Amber	Anx2.1, WACA-Sch1 Prt 1	5000 (Oct 17)		Medium
Reed bunting	Amber	Env (Wales) Act S7	-	☑	Medium
Ring necked pheasant	Green	Anx2.1	-		Low
Robin	Green		-		Low
Rook	Green	Anx2.2	82 (Feb 18)		Low
Short-eared owl	Red	Anx1	0 (No sightings but pellets found)		High
Siskin	Green		8 (Feb 19)		Low
Skylark	Amber	Anx2.2	25 (Feb 18)	☑	Medium
Snipe	Amber	Anx2.1	-		Low
Song thrush	Amber	Anx2.2	2	☑	Low
Sparrowhawk	Green		-		High
Starling	Red	Anx2.2	3000 (Nov 17)	☑	Medium
Stock dove	Green	Anx2.2	-		Low
Stonechat	Green		81 (Oct 17)		Low
Tawny owl	Green		-		Low
Treecreeper	Green		-		Low
Willow tit	Red		-	☑	Medium
Woodcock	Red	Anx2.1	-		Medium
Woodpigeon	Green	Anx2.1	60 (Nov 18)		Low
Wren	Green		-		Low

Discussion and Analysis of the Results

Breeding bird surveys

Census

With a total of 75 species observed during the breeding season over the two years, the site can be said to hold a relatively diverse number of habitats and ornithological diversity too. Many low priority species can be assumed to have been breeding such as wren, blue tit and stonechat. Exceedingly common species such as these do not require individual consideration.

Species that are identified as either Possible, Probably or Confirmed breeders in Table 5 are of more concern and require consideration. Those species are as follows

- Bullfinch - Possible

Common cuckoo – Probable

Common crossbill – Possible

Curlew – Probable

Hen harrier – Possible

House sparrow – Confirmed

Red kite – Confirmed
- Linnet – Confirmed

Lesser redpoll – Probable

Reed bunting – Probable

Skylark – Confirmed

Spotted flycatcher – Confirmed

Wood warbler – Confirmed

Omitting curlew, hen harrier and red kite, which are discussed later in this section, these species are a combination of arboreal and ground nesting birds. With the numbers of ground nesting species likely to be higher due to the sheer abundance of meadow pipit and skylark within the site. With regards to arboreal nesters, the development will not require the removal of large numbers of trees. It may however require the removal of some scrub and small trees that could provide suitable nesting habitat for some of these species, as well as those deemed of a lower priority which are also afforded protection once breeding has begun

There is a great abundance of ground nesting birds within the site boundary. These species require rough grassland, where many turbines will be placed. Disturbance from the turbines once operating is not thought to displace either meadow pipits or skylarks, nor is collision risk thought to be a major risk for either species, the principal threat is through habitat loss at the outset of the development, though this should be minimal in nature due to the small footprint of turbines and associated infrastructure. Meadow pipit nests are frequently targeted by cuckoos, which are also known to be breeding in the area. Much like the approach taken to tree nesting species, it would be best to begin any groundwork on turbine locations outside of the breeding season to avoid any potential disturbance to nests. The habitat can be made unsuitable during the winter months by removing vegetation in the footprint needed for turbines and access, thereby negating the chance of conflicting with nesting birds leading to project delays.

Peregrine breeding survey

It is fairly certain that peregrine are not breeding within the site boundary, and highly unlikely that they are breeding within 2km of the site. However, there is a peregrine presence in the area, as is demonstrated from the 11 observations of the species during vantage point surveys. Any potential loss of habitat for the species will be negligible and the development is unlikely to impact the movements of their prey species. The key area for potential impact on the species comes from collision risk with any turbines, this is discussed in section 5.3 of this chapter.

Barn owl breeding survey

Based on the observations it is apparent that barn owl did not breed within the site during 2018 or 2019, though they have been present to some extent, with multiple sightings throughout the year. There were no regularly used roosts identified within the site or a 200m buffer, it can be assumed that the barn owl population is transient, coming and going dependent on changing conditions rather than a consistent resident population.

It will be of value in the future to contact local barn owl groups such as the Species Habitat Protection Group in Powys, in order to gain a more complete understanding of the current population of the species and how they are using the site and local habitats.

Nightjar breeding survey

There was a complete absence of nightjar activity during the dedicated surveys for the species. This is furthered by an absence of incidental observations during other survey work. It can be assumed that nightjar are not present on site.

Goshawk HSA

Based on the results of the habitat suitability assessment of the area of Garn Fach plantation that will be affected by the Development, it is not considered that nesting goshawk is at risk from disturbance events. The results of the VP survey effort corroborates this, with a total of 10 birds observed throughout the effort and only four within the breeding season. The observation made by the surveyor that other coniferous plantations within the locality having greater suitability to support nesting goshawk indicates the likelihood that the species may be breeding in the local area, although not on site.

Wintering Bird Surveys

During the winter months of both 17/18 and 18/19, 67 different species were observed, sometimes in flocks as large as 5,000. The following species were selected as being of importance due to either their current conservation status, or the abundance of the species on site:

Bullfinch	Linnet
Crossbill	Mallard
Curlew	Meadow pipit

Fieldfare	Merlin
Golden plover	Peregrine
Goshawk	Red kite
Great black-backed gull	Redwing
Hawfinch	Reed bunting
Hen harrier	Short-eared owl
Herring gull	Sparrowhawk
Kestrel	Starling
House sparrow	Willow tit
Lesser black-backed gull	Woodcock
Lesser redpoll	

Those species in the list which were also identified as target species for vantage point surveys are discussed further in their respective species accounts in section 5.3.

The main concern arising from the winter bird surveys is the large winter flocks that are present on site throughout the season, particularly fieldfare, starling, golden plover and redwing. Flocks of 500 or more were sighted during surveys on 17 occasions. These larger flocks tended to be encountered more frequently at the eastern boundary of the site, at Ddullui Banc.

It can be assumed that collision risk will be relatively low when considered that passerines are generally accepted to be a low-risk group of species. Those species which are at higher risk are considered in more detail in the individual species accounts. Vantage Point surveys and Species accounts

The following sections set out the accounts for all target species observed on site and for those species noted that are of conservation concern. Table 11 provides a summary of the vantage point survey flight records and should be read in conjunction with each species account which also includes results from the winter walkover and breeding bird surveys. Maps of results to aid interpretation of results are presented in Part 2 and the master flight line database is available in Microsoft Excel format.

Note that individual impact will not be made for other species, however mitigation of general impacts to all birds will be included, with consideration given to the survey results.

Table 11 Summary of VP survey effort

VP	Number of surveys	Total number of survey hours	Winter survey hours	Summer survey hours
C	47	141	72	69
D	48	144	72	72
E	48	144	72	72
F	48	144	72	72

Table 12: Flights of target species including their total time at collision risk height

Species	Number of birds	Time observed at collision risk height	Time observed in flight
Raptors			
Goshawk	10	00:08:30	00:10:45
Hen harrier	13	00:07:00	00:35:45
Hobby	1	00:00:00	00:00:45
Kestrel	125	03:03:45	07:19:00

Species	Number of birds	Time observed at collision risk height	Time observed in flight
Merlin	3	00:00:00	00:02:00
Red kite	857	37:16:30	76:14:45
Peregrine	11	00:30:00	00:33:30
Waders			
Golden plover	2164	01:18:30	01:45:45
Gulls			
Great black-backed gull	50	00:50:15	01:25:15
Herring gull	14	00:10:45	00:13:30
Lesser black-backed gull	47	00:17:00	00:17:30
Other			
Starling	11,231	00:21:45	09:52:00

Goshawk

Goshawk were observed in flight on 10 occasions. Six of these observations were in the winter period and four in the breeding period. Seven of these flights were observed around Garn Fach (VPD & VPE) and three were recorded at Brondre-fawr Hill (VPC) . All but one of these flights were recorded within the site boundary.

An observation of goshawk was made during the breeding bird survey 2018 north of Ddullui Bank. The record is of a bird passing through a field between coniferous woodland patches. In July 2019 a juvenile goshawk was seen at VPC, a time of year when young goshawk begin to leave their natal territory. Given the results of the VP survey combined with the breeding bird survey suggests that the coniferous woodland patches at and around Garn Fach are likely to be a core part of the home range for this goshawk, and it can be considered as a Possible Breeder (PO).

The BTO Birdfacts website suggests a UK breeding population of 400 pairs. There is no information provided for wintering goshawk numbers though there is unlikely to be much variation between seasons as the species rarely leaves its territory even in the winter. Goshawk is considered a scarce or rare breeding bird in Wales. This does not mean the meta-population across the UK or Europe is at risk, it is a Welsh BoCC 3 Green List species, but that such species are encountered too infrequently for population estimates and trends to be robustly defined. Of the data that is available the population estimate for Wales is 111 pairs and this is considered as an increasing trend (Bladwell *et al.*, 2018). Local data on goshawk breeding activity and wintering is restricted to studies completed for other wind farm schemes and held by the LERC and bird groups. Goshawk is an Annex 1 and Schedule 1 species meaning it is highly protected. Given that the results show possible breeding, goshawk is considered an Important Ecological Feature and will be discussed further in CRM, though the low number of flights make it unlikely that any collisions will occur.

Hen Harrier

Hen harrier were observed in flight on 13 occasions with 12 of these flights recorded either during the autumn migration period or over the winter. During BBS three observations were made in August/September, whilst in 2019 a male was seen in May and a female in June. Across all surveys, the species was only seen in the breeding season on three occasions, two of which may have been juveniles. If there were any nests within or in close proximity to the site, it would have been expected that there would have been a greater number of observations, and in greater numbers, all sightings were of a single individual.

Hen harrier is an Annex 1 species and is a qualifying feature of the Berwyn SPA which is approximately 33km from the development. The distance to the SPA is large and as such it is not considered that the

observations at the development are directly supportive of the breeding population for which the designation qualifies. Based on this information the hen harrier is considered as Non-Breeding (NB) at the development. Nevertheless, hen harrier is a highly protected species as, in addition to Annex 1, it is a Schedule 1, Section 7 and a Welsh BoCC Red List species. The nature conservation value for hen harrier in relation to the site is high and the species is considered as an Important Ecological Feature to be taken forward into CRM.

Kestrel

In total there were 115 observations of kestrel during the VP surveys. A breakdown is given in Table 13 of the flights at different times of year and shows that most activity was observed during the winter period (October to March) with a limited number of flights during the core breeding season (April – July) and a slight raise in the number of flight observations during late summer (August and September).

The winter bird walkover surveys recorded 17 and 12 observations of kestrel in 17/18 and 18/19, respectively. These were spread across the whole site and were predominately of kestrel hunting (a mixture, of stationary, hovering and flying to another area for hunting).

Table 13 Breakdown of kestrel flight time at different times of year from VP surveys

Time of year	Number of birds	Time observed in flight	Time at collision risk height
Winter	85	04:28:15	01:35:00
Breeding	12	00:51:00	00:37:45
Late Summer	18	00:49:15	00:34:30

During the 2018 core breeding bird season kestrels were recorded on five occasions with a further six observations between late August and late September. Observations were spread over the whole site and were all of individual birds with the exception of one observation during late September which was of two birds. This latter record is very late and is not considered as breeding behaviour. In 2019 breeding bird surveys kestrel were not encountered at all, this corroborates with the VP data of the same year, showing that there was no breeding activity within the site.

When the all of the data is brought together it does appear that there is greater level of activity recorded around VPF in the area north of Garn Fach plantation, however no specific breeding activity such as courtship or territorial behaviour. Kestrel are a resident bird species in the area and often stay within their home ranges throughout the autumn and winter, however the size of the non-breeding territory is likely to vary dependent on food supply. At the development it is likely therefore that the kestrel flights observed during the VP surveys are linked to one territory in the area between Banc Du and Garn Fach and was a Probable Breeder (PR) in 2018 within 500m of the Development.

Kestrel is a Section 7 species and listed on the BoCC Red List for Wales. The UK breeding population (BTO Birdfacts) states 45,000 pairs but locally limited information is available. Kestrel are known to have steadily declined in numbers across mid-Wales and this is commonly attributed to changes in farming practices and increases in conifer plantations combined with the decreases in old buildings, structures and trees providing nesting opportunities. Effort will need to be made to ensure impacts of wind farm development are minimised and this may include the need for compensatory habitat creation and/or nest boxes to be erected. The nature conservation value for kestrel is medium and the species is considered as an Important Ecological Feature to be taken forward into CRM.

Merlin

Two merlin flight observations were recorded with two during the same VP watch in November 2017, the other during January 2018. All flights were at a low height with a total time in flight of two minutes. All three flights were on the edge of the development and mainly in the 500m survey buffer area.

During the 17/18 winter walkover surveys, a single female (ringed) was observed south of David’s well in marshy grassland, and a single female was observed stationary before flying south of Waun Lluest in the 500m survey extension area to the south, though there were no records in the 18/19 season. Merlin was not recorded during the 2018 breeding bird surveys, but there was a single record close to Ddullui Banc in May 2019.

With only a single brief encounter with merlin during the breeding season it is confirmed as a Non-Breeding (NB) species at or in close proximity to the development. Displacement and disturbance are therefore not considered to be a potential effect as a result of the wind farm and it is only collision that could pose a risk if turbines are located in places where merlin has been observed close by. However, due to the very small number of flights recorded at the site, CRM is not viable for the species and collision risk can be assumed to be minimal.

Merlin is an Annex I (and a Schedule 1) species and is a qualifying feature for the Elenydd-Mallaen SPA, which at its nearest point is approximately 6.7km west of the development. The Elenydd-Mallaen SPA is estimated to represent at least 0.5% (seven pairs) of the merlin breeding population for Great Britain. The SPA is not designated for its wintering population of merlin. It is clear therefore that of the merlin recorded in the winter period, some birds may be linked to the SPA and some of the habitat present in the northern area of the development may be suitable for nesting and winter roosting. Merlin is considered a very high in nature conservation terms and is an Important Ecological Feature.

Red kite

Red kite were observed over the entire survey period on 677 occasions from all VP locations, with a total of 857 birds recorded. Figures 9 and 10 give a summary of kite activity recorded during VP surveys. Table 14 shows that the species spends on average 85.8% of its time flying within the sweep of a rotor blade.

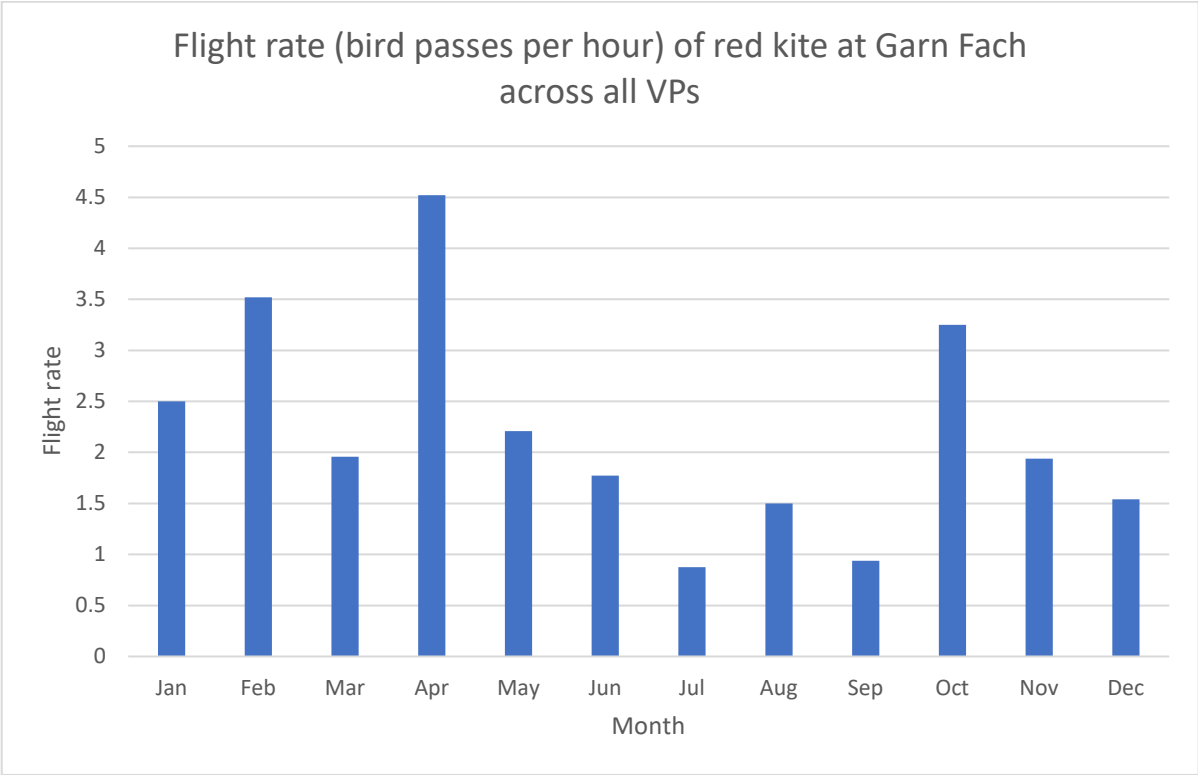


Figure 11 Flight rate of red kite at Garn Fach

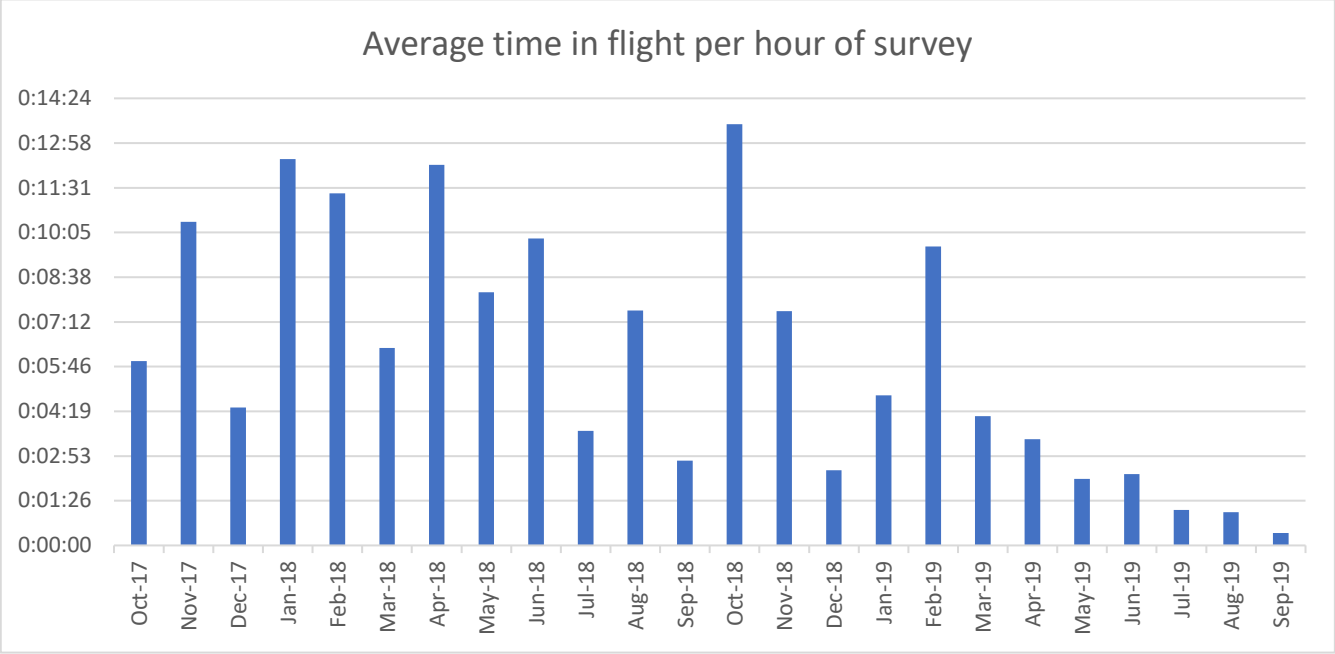


Figure 12 Red kite minutes per hour in flight

Table 14 Red kite flight records for each vantage point

VP	Number of flights	Time observed in flight	Number of survey hours	Minutes in flight per survey hour
C	210	15:24:15	141	06:33
D	264	25:33:30	144	10:39
E	85	04:25:00	144	1:50
F	118	07:44:00	144	03:13

Red kite were observed on 105 occasions during the winter walkover surveys and were present in all months. There was no observable pattern to the winter observations of the species.

During the breeding bird surveys multiple nests were located over the course of the two seasons. [REDACTED] It is not known if the site was used again the following year as due to changes in the site plan it was not visited during the 2019 breeding season.

[REDACTED] On the 30th May the nest was again observed with a female present. No further observations were made of nesting activity, with no chicks or fledging observed during June or July. Nor was the nest observed to be active in the following breeding season.

In [REDACTED] It appears to have been unsuccessful as surveyors were unable to find signs of young or fledglings in any subsequent breeding bird surveys.

Based on the observations made in each breeding season, the red kite is a regular breeder in the area, with at least one nest in or in close proximity to the site boundaries each year, and likely two or more.

The red kite has become synonymous with the mid-Wales region over the past 20 years, as such the reintroduction program is generally considered a success. The red kite is an Annex I and a Schedule 1 species. It is therefore an Important Ecological Feature and is considered in CRM. However, it will be challenging to accurately predict impacts on the local red kite population as the number of observations

and flights recorded that is likely to reflect the actual number of birds may be over-inflated by the presence of local feeding stations. This is reflected in the JNCC SPA Review 2016, specifically the Elenydd-Mallaen SPA, which states a GB population of 4,800 individuals, 1,600 breeding pairs, a short-term trend of +532% and a long-term trend of +2,303%. Information provided on the RSPB website states a breeding population of approximately 1,800 pairs and the BTO Birdfacts website states 1,600 pairs. It is clear that an agreed estimated population to be used in the impact assessment needs to be confirmed with NRW, the local authority and other groups such as the RSPB and Wildlife Trust.

Professional opinion suggests that the loss of one or two nests due to displacement from any kind of development is unlikely to cause a significant effect on the local, regional or national populations (i.e. the loss of one pair will not remove enough birds of sexual maturity to remove the favourable conservation status of the species) and that it is the collision risk that is the key concern from turbines. This is compounded by SNH guidance on assessing SPA connectivity which states that the maximum home range for red kites is 6km, with Garn Fach located approximately 6.7km away from the Elenydd-Mallaen SPA. Red kites breeding in or in close proximity to the site do not contribute significantly to recruitment within the SPA, this can be clearly seen as over the 2-year survey period only a single confirmed individual was able to fledge from the nests identified. It is noted that there is an increase in kite activity in October 2018, this may be linked to the dispersal of juvenile kites at the end of the breeding season. It is expected that there will be some level of impact on red kite, but this is near-certain to be recognized at the site level only and will not affect the longer-term viability of the Elenydd-Mallaen SPA or the wider mid-Wales population.

Peregrine

Eleven records of peregrine were made during the VP surveys at Garn Fach. Seven records were made in the winter, two records in the breeding season and the other five records were made in the late summer and autumn dispersal. All observations were of individual birds with activity focused around the hill where VPD and VPE are located (west of the farm at Ddullui Bank and south of the Garn Fach forestry plantation).

Peregrine were recorded three times during the 17/18 winter bird survey with only one short flight within the development itself at Banc Du. A flight was observed in the fields west of Ddullui Bank and a stationary bird west of Bryn Dadlau (in the 500m extended search area). No observations were made over the 18/19 winter surveys or during both breeding bird surveys and peregrine is confirmed as Non-Breeding (NB) following the dedicated species surveys in 2019. The habitat at the development and its immediate surrounds (i.e. the 500m survey extension area) provides suitable foraging grounds and it is likely that the winter observations were of birds working through the local area searching for food.

It is clear that peregrine use the development area for hunting, predominantly in winter and that the species is not breeding in the immediate vicinity (within 2km of the site). Peregrine is an Annex I (and Schedule 1) species, conservation objective for Elenydd-Mallaen SPA (6.7km west of the site) and a qualifying feature of the Berwyn SPA which is approximately 33km from the site. It is considered a rare bird in Wales, meaning that they are encountered too infrequently for population estimates and trends to be robustly defined. Of the data available for Wales, 249 territories or breeding pairs are known and this is considered is a decreasing trend (Bladwell et al, 2018). Although the results show peregrine to be a non-breeder, there are flights within the Development area and some may be within close proximity to turbine locations. Peregrine is considered to be of high value in nature conservation terms and is an Important Ecological Feature to be taken forward into CRM.

Curlew

Curlew were recorded on a single occasion during the VP survey effort, flying low for 15 seconds outside the site boundary close to Banc Du in April 2019. It was only recorded once near Ddullui Bank during the winter walkover surveys in 2018 and once again the following year further north east, outside of the current site boundary by some 800m.

The breeding bird survey effort in 2018 returned five records between 21st April and 30th May with three individual birds and two occasions where two birds were seen in suitable habitat. This suggests that curlew is a Probable Breeder (PB) in the area. Both territories were located outside of the site boundary, one within 500m and the other over 1400m away. The observations of the individual birds were all identified, at least at first, by vocal utterance, suggesting signs of Possible Breeding (PO); these are not considered as territories. These three observations of individuals were located between Bwlch-y-Sarnau Hill and David's Well with approximately 2km between each call. During 2019 breeding bird surveys there were two observations of the species, both single individuals, one being in May and the second in June. The June observation was made close to Ddullui bank approximately 500m from the site boundary whilst the other individual was recorded close to the southern tip of the Garn Fach plantation. These two observations make the species a Possible Breeding (PO) species in close proximity to the site.

Due to several incidental observations close to VP C during the 2019 breeding season, it was decided to conduct a specialised survey to attempt to locate a breeding pair in the area. Despite this survey not observing any curlew it is still suspected that there was a breeding pair within 500m of the site boundary due to the repeated observations of display flights during bat and other surveys, making curlew a Probable Breeding (PB) species in close proximity to the site.

Curlew have undergone substantial decline and is a Welsh BoCC Red List and Section 7 species. The status of curlew breeding territories is documented in Johnstone & Bladwell (2016) which states that there has been at least a 50% decline in the breeding range and breeding population in the last 25 years and the longer term; and at least a 25% but less than 50% decline in the wintering population in the last 25 years and the longer term. Combined with this there are initiatives regionally such as the Curlew Country project (<https://curlewcountry.org/>) based in the Shropshire Hills and Welsh Marches that are ongoing to restoring the population of curlew, as well as other ground nesting birds. This project has for example moved from monitoring nests to identify the causes of nest failure (predominantly predation by badger, fox and other birds such as corvids) to collecting eggs under license and artificially incubating and raising the chicks before release. It is clear that there is a distinct issue with curlew as a declining species and although the impact of a wind farm is unlikely to be the only cause of nest abandonment or failure the additional disturbance to or displacement of suitable nesting habitat is likely to contribute to the wider decline of the species, at least in the short-term.

The estimated population available from the BTO Birdfacts states 66,000 breeding pairs in 2009 and 140,000 wintering individuals but this is likely to be an over-estimation for 2018. More local information on breeding pairs in Wales is not readily available and so will need discussion and agreement with NRW and other third parties.

Golden plover

In total there were 22 observations made of golden plover, with a number of these observations made in the same day. Five observations were made in a single day in October 2017; three separate dates where three observations recorded in November 2017; and four in a single day in September 2018. The other two across the two survey seasons varied greatly, with 11 flocks of 100 or more and peaking at 350 in February 2019. All flights observed within the site boundary were of flocks with less than 100 birds and with no specific pattern of use. The absence of golden plover entirely between April and July in both years confirms the species as Non-Breeding (NB) within the boundary of the development.

The BTO Birdfacts website suggests a UK breeding population of 49,000 pairs and 400,000 wintering individuals. At the national level, approximately 3.2% of the UK breeding population of golden plover is in Wales and this has decreased by 27% between 1970 and 2010. The winter distribution between 1980-2010 is an increase of 36% accounting for 7.8% of the UK wintering range in Wales (Bladwell et al, 2018). Regionally, golden plover is a species known to be in decline with an estimated 90% decline between 1982-2007 at Elenydd SSSI (Johnstone, 2008) and 92% decline between 1984-2011 at Pumlumon SSSI (Crump and Green, 2012). Reasons for this decline vary but many waders in decline may be considered at risk due to widespread changes to agricultural practices such as reduced grazing

levels prescribed under agri-environment schemes and predation, predominantly, by foxes and crows at the nesting time (Joyce, 2013). Locally, data on golden plover breeding activity and wintering is restricted to studies completed for other wind farm schemes and held by the LERC and bird groups. Golden plover is a Section 7 species and included on the BoCC Red List. Given the information available at this time it is clear that the abundance and distribution of golden plover at the site contributes on a small scale to the regional and national numbers and is only important at the local scale. The nature conservation value for golden plover is medium and the species is considered as an Important Ecological Feature at the Development site and will any impact will be considered further in CRM.

Snipe

Twelve flight records of snipe were made during the VP surveys. All flights were recorded within autumn migration or in winter (October 2017 - February) and all but one of these were made at least partly within the development boundary.

During the winter bird survey walkovers 42 observations were made of snipe between October 2017 and March 2018, whilst 17 were made between the same period in 18/19 survey season. The number of birds observed was typically between one and three but the largest flock recorded was 18 birds in November 2018. Snipe were observed mostly in the northern are of the Development around Ddullui Bank, in the fields north the Garn Fach forestry plantation in 17/18. However, in 18/19 observations were relatively evenly distributed around the site.

Two observations were made of individual birds during May 2018. The observations were made on the same day but almost 3km apart. The birds observed were not considered to be displaying nesting or territorial behaviour and as such snipe was considered as a Non-Breeding (NB) species at the Development in 2018. Two further observations were made of snipe in late September 2018. The same conclusion was reached in the 2019 breeding season, when only two observations were made. One of which was three birds at Banc Ddu in early April and the other being a single bird at Wuan Ddubarthog in June which did not show territorial behaviour.

From the results it is clear that disturbance and displacement from winter roosting is likely and there is risk of collision with turbines. Risks to breeding snipe are highly unlikely as there is no evidence to suggest nesting behaviour. Snipe is a Welsh BoCC Amber List species and regularly occurs at the site, giving it a low nature conservation value, but the regularity of occurrence means it is an Important Ecological Feature at the development site.

Great black-backed gull

In total there were 37flight observations made for great black-backed gull with a total of 50 birds recorded. The peak month for observations was during December 2018 with six observations with the peak month during summer period being August with four observations. Although observations were made at all VPs they were marginally more common around the northern area of the site.

No records of great black-backed gull were made during 2017/18 winter walkover surveys whilst four records were made in 2018/19. These were of single birds with the exception of one observation which was 3 birds at the end of March, likely moving on to breeding grounds for the summer. During the breeding bird survey 3 and 5 records of individual birds were made in 2018 and 2019 respectively. None of the observations indicated winter roosting or breeding behaviour (NB). This is mainly due to the lack of suitable habitats such as lakes and open rocky ground protected from predators.

Great black-backed gull is defined as a resident breeder with an estimate of 17,000 pairs and a winter visitor according to the BTO. The JNCC confirms this estimate at 16,800 pairs for both inland and coastal colonies, however information suggest that only 20 pairs were found inland. For Wales, the population estimate was 427 pairs with two pairs breeding inland based on the 2015 census data. Great black-backed gull is included on the Welsh BoCC Red List and the observations made during the survey suggest a number of birds are present or pass through on a regular basis. The nature conservation value

for great black-backed gull is medium and the species is considered as an Important Ecological Feature at the development site and will be considered further in CRM.

Herring Gull

Herring gull were noted on seven occasions, three of which were within 15 minutes of each other in June 2019. Herring gull is considered as a non-breeder at the Development.

Herring gull is listed as a Welsh BoCC Red list and Section 7 species. The BTO defines herring gull as a resident breeder with an estimate of 130,000 pairs and a passage/winter visitor. The JNCC suggest a Welsh estimate at 13,974 pairs in total with only 44 pairs were found inland. The change from the 1985/88 to the 1998-2002 census in wales suggest a 26% increase in apparently occupied nests and suggests a stable although it is recorded as long-term decline. It should be noted that the habitats at the development provide little if not any suitable nesting locations, and passage is considered as the only behaviour. The nature conservation value for herring gull is medium and the species is considered as an Important Ecological Feature at the development site. However, due to the low number of flights any risk of collision can be considered to be negligible and CRM will not be necessary for this species.

Lesser black-backed gull

There were 10 observations of lesser black-backed gull recorded during the VP surveys, with all flights being recorded between June and the end of August. The total number of birds recorded was 47 ranging from a single bird up to 15 birds on the various flights. There was no one specific location to the observations with records being made across the site.

A single bird was recorded on one occasion in August at Ddullui Bank. There is no obvious nesting habitat (lakes, open rocky ground etc.) for lesser black-backed gulls at the development. The results show the site is used for passage and soaring birds and as such it is only collision that is considered a risk to the lesser black-backed gulls at the development.

Lesser black-backed gull is defined as a migrant/resident breeder with an estimate of 110,000 pairs and a passage visitor. The JNCC confirms this estimate at 20,722 pairs for both inland and coastal colonies, however information suggest that only 40 pairs were found inland. Lesser black-backed gull is included on the Welsh BoCC Amber List and the observations made during the survey suggest a number of birds are present or pass through during summer months. The nature conservation value for lesser black-backed gull is low and the species is considered as an Important Ecological Feature at the development site due to the potential collision risk with turbines.

Skylark

Skylark were encountered during most visits to the site and during the 2018 breeding bird survey 125 records were made and 312 in 2019. This was translated into an estimated 96 territories in 2019. The discrepancy in observations likely arises from the changing of site boundaries to take in more rough grassland in the second year of surveying than the first.

Skylark is a Section 7 and Welsh BoCC Amber List species subject to displacement from agricultural conversion from structural grassland and heath habitat into improved grassland and arable ground. The data gathered during the breeding survey will at least give a way of estimating the potential number of territories lost and there will certainly be a need to include space within the wind farm layout for the continuing breeding of skylark at the site.

Crossbill

Crossbill were observed on five occasions during the breeding bird survey in 2018 and on four occasions in 2019. All 2018 records were of two birds in suitable habitat suggesting Probable Breeding (PR) though in 2019 it was on single individuals that were observed. All of the 2018 records were over 200m apart suggesting that they are separate territories. Three located to the west of Ddullui Bank in the tree lines

between the improved grassland; one territory was in the eastern edge of the Garn Fach plantation; and the fifth territory was in the plantation on Brondre-fawr Hill at Fowler’s Horse Block. A map of the probable territories is included in the Part 2.

Crossbill are a Schedule 1 species and considered a resident species throughout much of the UK and Wales. The primary habitat for crossbill is conifer plantation but some use of broadleaf and scrub habitats is also known. The BTO Birdfacts states an estimate of 39,000 breeding pairs and so the likelihood of impacts to the national population is limited. It is likely that any works to develop the area around the Ddullui Bank and Garn Fach will have some level of displacement or disturbance effect.

Collision Risk Modelling Results

All of the species which were modelled showed non-spatially explicit use of the site, meaning that rather than being direct flights from one point to another, rather they exhibited flight behaviour that was not dependent on habitat features. This is sometimes referred to as ‘random’ flight behaviour, as there is no predictable pattern in the direction of these flights. The phase 1 model for estimating the total number of passes through a turbine rotor is based on the SNH Windfarms and Birds Guidance (2000). The model used for estimating the risk of each bird being hit when passing through the rotor was obtained from SNH guidance. Biometric data for the modelled bird species was taken from a combination of Alerstam et (2007) and SNH guidelines.

According to the CRM of this report, over the course of a 30-year life span the implementation of the proposed layout with no mitigation effort would lead to an estimated 413.02 collisions between turbines and birds, the majority of which are with golden plover. The model implements published avoidance rates, which range between 95% - 99%. It also uses a ‘worst case scenario’ in its estimates meaning that in reality the number of collisions is likely to be much lower, although this is not quantifiable as it is largely site-specific. However, it does provide a useful gauge by which to identify where potential mitigation measures are required to reduce risks. From these models it is apparent that mitigation and avoidance measures are necessary, primarily for golden plover and for birds of prey; red kite in particular.

Table 15: Summary of collision risk modelling

Species	Predicted collisions per year	Predicted collisions over 30 years	Percentage of total collisions (%)
Golden plover	7.89	236.70	57.3
Goshawk	0.02	0.63	0.15
Great black-backed gull	0.18	5.45	1.32
Hen harrier	0.02	0.57	0.14
Herring gull	0.06	1.91	0.46
Kestrel	0.68	20.35	4.93
Lesser black-backed gull	0.18	5.42	1.32
Mallard	0.003	0.08	0.01
Merlin	0	0	0
Peregrine	0.07	2.16	0.52
Red kite	2.61	78.30	18.96
Snipe	0.02	0.52	0.13
Sparrowhawk	0.02	0.62	0.15
Starling	2.01	60.31	14.6
TOTAL	13.763	413.02	100

Table 16: Turbine specifications used to model the CRM

Specification	Measurement
Number of turbines	20
Hub Height	84 metres
Rotor radius	66.5 metres
Chord width of blade	2.4 metres
Blade tip height	149.9 metres
Pitch	30 degrees
Rotation period	2.97 seconds
Operational hours	0.85 %
Total area of Wind Farm (Excluding Southern area)	607.9748 hectares
Total area of Wind Farm	687.3926 hectares
Flight risk volume	911354225 m ³
Total volume swept by rotors	864139 m ³

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Annex – Maps

