Asland Walks Energy Park

Appendix 6: Collision Risk Model Calculations

avianecology

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1 INTRODUCTION

1.1.1 This document has been prepared to accompany the Ecological Assessment Report (EAR) for Asland Walks Energy Park (hereafter the 'Proposed Development').

1.1.2 The document presents details of the Collision Risk Modelling (CRM) calculations that have been carried out to determine the potential collision mortality impacts upon relevant ornithological interests, as a result of the wind turbine component of the Proposed Development.

1.1.3 This document should be read in conjunction with **Appendix 2: Ornithology Baseline Report**, which provides full details of the baseline survey methods and results that informed the CRM calculations.

2 BACKGROUND

2.1.1 The baseline ornithology surveys undertaken for the Proposed Development included Vantage Point (VP) surveys, which recorded flight activity of 'Target Species' in the vicinity of the proposed turbine location. The results of the VP flight activity surveys have been used to carry out the CRM analysis, as set out in this document.

2.1.2 CRM calculations use a large number of parameters, including details of flight activity and turbine parameters, to produce outputs that give an estimate as to the potential collision mortality risk caused by a proposed wind farm project (generally presented as deaths per year (or season)), for those species included in the assessment.

2.1.3 The CRM for the Proposed Development has been undertaken using the model devised by Band (2024)[1], as advocated by NatureScot (2024)[2]. This is an updated model (version 2), which supersedes that which has previously been widely used for wind farm applications (Band *et al*., 2007)[3]. The updated model aims to standardise the calculations, to make estimates more comparable between projects.

2.1.4 The large number of parameters and assumptions involved in CRM analysis, some of which are not quantifiable and are thus reliant on expert judgement, mean that the outputs cannot ever be considered as more than estimates, or a relative indicator of risk. The results presented in this document should therefore not be concluded as being the number of bird deaths that would definitely occur as a result of the Proposed Development.

3 METHODOLOGY

3.1 Process

3.1.1 CRM estimates collision mortality risk in five stages:

[1] Band, W. (2024). *Using a collision risk model to assess bird collision risks for onshore wind farms*. NatureScot Research Report 909.

[2] NatureScot. (2024). *Guidance on using an updated collision risk model to assess collision risk at onshore wind* farms. NatureScot, Inverness.

[3] Band, W., Madders, M., and Whitfield, D.P. (2007). Developing field and analytical methods to assess avian collision risk at wind farms. In: de Lucas, M., Janss, G.F.E. & Ferrer, M. (Eds.) *Birds and Wind Farms: Risk Assessment and Mitigation*, pp. 259- 275. Quercus, Madrid.

- Stage A: bird survey data are examined to establish the density of flying birds in the vicinity of the proposed turbine and the proportion of birds flying at rotor swept height (between the minimum and maximum rotor heights proposed for the project);
- Stage B: an estimate of the potential number of bird transits through the rotors during a set time period is estimated based on bird density and the proportion determined to be at collision risk;
- Stage C: the probability of collision during a single rotor transit is calculated;
- Stage D: the time during which turbines are not operational is estimated and applied, whereby it is assumed that collisions only occur with operational (spinning) turbine rotors; and
- Stage E: appropriate avoidance factors are applied, whereby it is assumed most birds avoid turbines or take action to prevent collision.

3.1.2 A spreadsheet is available from NatureScot[4] to aid in the completion of the CRM calculations using the methods recommended in their guidance.

3.1.3 Details of how the process has been undertaken for the Proposed Development, including the parameters used in the model, are presented below.

3.2 Target Species for Assessment

3.2.1 Collision mortality estimates have only been calculated for those species for which there is a potential for a significant effect. For species with few at-risk flights and recorded in very low numbers during baseline surveys it can reasonably be predicted that the risk of collision mortality would be very small (i.e. a negligible impact at any population level) and no significant effect can be concluded for these ornithological features without the requirement for undertaking a detailed assessment.

3.2.2 For the purposes of the analysis, a Target Species qualified for inclusion in the CRM if there were three or more 'at-risk' flights (see **Section 3.4**), or 10 or more individuals, within either baseline survey year (September 2022 to May 2023 (Year 1) or October 2023 to May 2024 (Year 2)).

3.2.3 There were 10 species that met these criteria, and these were:

- Cormorant;
- Golden plover;
- Lapwing;
- Lesser black-backed gull;
- Mallard;
- Oystercatcher;
- Pink-footed goose;
- Shelduck;
- Snipe; and

[4] Available from: https://www.nature.scot/sites/default/files/2024-12/collision-risk-model-for-onshore-wind-farm-spreadsheet-2024_0.xlsm (accessed October 2025).

- Whooper swan.

3.2.4 The flight activity recorded for all Target Species during the baseline VP surveys is presented in **Annex 1**. Note that only flights within the turbine envelope (see **Section 3.3**) are listed.

3.3 Determining Bird Density

3.3.1 The data recorded during the VP flight activity surveys were examined to determine whether the flightlines of each Target Species identified for assessment were best considered as 'directional' or 'non-directional' flights; with these flight patterns analysed differently by the model. Directional flights describe flights used by birds passing over the Site in a regular pattern following the same orientation (e.g. migrating geese) and non-directional, or random, flights describe those that have no regular pattern (e.g. foraging flights or local movements). Following consideration of the flight activity data, all Target Species assessed were determined as having non-directional flights.

3.3.2 In addition, the nature of the Proposed Development (one wind turbine) means that the analysis is considered best served by one that uses bird density (birds per unit area), as is used for non-directional flights, rather than one that uses bird flux (number of birds crossing an imaginary line (per metre per second)), as is used for directional flights.

3.3.3 For non-directional flights, areal bird density (D_A) is calculated. This is the number of birds in flight at any height at any given point in time, per unit of area (this being km^2 in the calculations). The results of the VP flight activity surveys allow calculation of D_A, based on the following formula:

$D_A = b / (t \times A)$ bird-seconds m^{-2}, where:

- b = the number of flight seconds from a VP;
- t = time (in seconds) that the VP is watched; and
- A = the area of the VP viewshed (visible area) (km^2).

3.3.4 NatureScot guidance (2024) states that D_A should be calculated for each VP and the figure averaged. As the Proposed Development consists of only one turbine and used only one VP during the baseline surveys, this step was not required for the analysis.

3.3.5 The updated model (Band, 2024) requires an appropriate survey area to be defined, as the basis for determining bird number per unit of area (non-directional flights). In the case of the Proposed Development, it was not considered appropriate to use all flight data recorded during the VP surveys given the extent of the VP viewshed (2km radius) and the actual area of collision risk (rotor blade length around one turbine). However, Band (2024) recommends that data collection extends beyond just including flights that intersect with the turbine footprint. NatureScot (2024) states that the key flight activity data for use in the CRM are those data within a 'turbine envelope' (not defined in guidance). For the CRM analysis of the Proposed Development the turbine envelope that has been used encompasses the proposed turbine plus a surrounding 500m buffer. Therefore, only flight activity within this turbine envelope has been used in the CRM, with flights clipped to within this area.

3.3.6 To calculate the number of flight seconds recorded for each species, the total duration recorded for each target flight was multiplied by the number of individuals.

3.3.7 The area of the turbine envelope that was covered by the VP viewshed has been calculated using GIS, based on a 20m above ground level cut-off. This is shown in **Table 3.1**. For the Proposed Development, the turbine envelope (turbine plus 500m) was fully covered by the VP viewshed.

Table 3.1: Vantage Point details

VP Number	Grid Reference	Visible Area of Turbine Envelope
VP1	SD 46114 18798	0.78km^2

3.3.8 **Table 3.2** presents the time that was watched from the VP during baseline surveys, presented as both hours and seconds. Year 1 of baseline surveys covered the period September 2022 to May 2023 (inclusive) and Year 2 covered October 2023 to May 2024 (inclusive).

Table 3.2: Vantage Point survey duration (hours/seconds per month)

Month	Year 1		Year 2	
	hours	seconds	hours	seconds
Sep	12	43200		
Oct	12	43200	12	43200
Nov	12	43200	12	43200
Dec	9	32400	6	21600
Jan	9	32400	6	21600
Feb	6	21600	6	21600
Mar	12	43200	12	43200
Apr	12	43200	12	43200
May	12	43200	12	43200
Total	**96h**	**345600s**	**78h**	**280800s**

3.3.9 For Target Species recorded in both survey years, both Year 1 and Year 2 data were used in the analysis. Mean areal bird density was calculated and this was used in the CRM.

3.3.10 Lesser black-backed gull, mallard and cormorant were only treated as a Target Species in Year 2, and so bird density for these species was calculated based on the Year 2 data only.

3.3.11 Bird density was calculated based on season (as opposed to being estimated for each individual month), using the time period in which each Target Species was present in the vicinity of the Site. The baseline ornithology surveys for the Proposed Development, which included breeding bird surveys as well as the VP flight activity surveys, showed that lapwing and oystercatcher bred on Site whilst lesser black-backed gull, mallard and shelduck were also present through the summer months. Thus, for these five species, bird density was calculated for species-specific breeding and non-breeding seasons (in reference to NatureScot guidance (2014)[5]), with the breeding season bird density estimates extrapolated across all applicable months. For the other Target Species (cormorant, golden plover, pink-footed goose, snipe and whooper swan), which are non-breeding birds only in the vicinity of the Site, bird density was calculated for the period in which each species was present, based on the results of the VP flight activity surveys (e.g. for pink-footed goose a density estimate was calculated for the period September to March, with an estimate of zero used for the period April to August).

3.3.12 **Table 3.3** presents bird density by season, as used in the analyses.

[5] Scottish Natural Heritage (2014). *Breeding season dates for key breeding species in Scotland.* SNH (now NatureScot), Inverness.

Table 3.3: Seasonal bird density

Species	Season Present	Density (birds/km^2)
Cormorant	Non-breeding (Sept-Mar)	0.0034
Golden plover	Non-breeding (Feb-Apr)	0.0161
Lapwing	Breeding (Mar-Jul)	0.0465
	Non-breeding (Aug-Feb)	0.2562
Lesser black-backed gull	Breeding (Apr-Aug)	0.0028
	Non-breeding (Sep-Mar)	0.0211
Mallard	Breeding (Mar-Sep)	0.0066
	Non-breeding (Oct-Feb)	0.0069
Oystercatcher	Breeding (Apr-Aug)	0.0147
	Non-breeding (Sep-Mar)	0.0019
Pink-footed goose	Non-breeding (Sep-Mar)	0.7987
Shelduck	Breeding (Apr-Aug)	0.0220
	Non-breeding (Sep-Mar)	0.0107
Snipe	Non-breeding (Nov-Feb)	0.0020
Whooper swan	Non-breeding (Oct-Feb)	0.1416

3.4 Determining Proportion of Flights at Risk of Collision

3.4.1 The flights recorded for the 10 species brought forward for CRM analysis were further examined to determine the proportion of flights in the turbine envelope at potential risk of collision. The potential risk of collision was informed by the details of the Proposed Development, as set out below.

3.4.2 The Proposed Development comprises a single turbine that would have a hub height of 110.64m and a rotor diameter of 138m. This means that minimum rotor swept height would be 41.62m and maximum rotor swept height would be 179.64m. This range between 41.62m and 179.64m (simplified to 42m-180m hereafter) is referred to as potential collision height (PCH).

3.4.3 The proportion of flights at-risk has been assessed for each species, based on turbine parameters and recorded flight heights. For each individual flight, the proportion at-risk was calculated using the data recorded during survey, which recorded height bands at 15 second intervals.

3.4.4 During the VP flight activity surveys, Target Species were recorded into the following height bands (HT): HT1: 0-25m, HT2: 25-50m, HT3: 50-75m, HT4: 75-100m, HT5: 100-125m, HT6: 125-150m, and HT7: >150m.

3.4.5 Only flights recorded in HT1 can definitively be determined as not being at collision risk; this height band being well below PCH. All flights recorded in HT3 to HT6 represent flights at risk of collision due to them being within PCH. HT2 and HT7 overlap with PCH and also need to be considered. As recommended in guidance (Band, 2024), for height bands that only partly overlap with PCH further proportioning should be applied. An assumption has been made that flights are equally distributed within each height band. For HT2, where 8m out of 25m overlap with PCH (42-50m), 32% of flights recorded in HT2 were considered to be at-risk. For HT7, which comprises an unbounded height range (all flights above 150m), it is not possible to apportion flights to those within or above PCH. Therefore, a precautionary approach has been taken and all flights recorded at HT7 are assumed to be at-risk;

though in reality at least some of these flights are likely to have been above maximum rotor swept height.

3.4.6 The duration of all flights at-risk were summed and this total was divided by the sum of total flight durations, to provide an overall proportion of at-risk flight activity for that species. For lesser black-backed gull, mallard and cormorant only Year 2 data were used; for the other species the data from both baseline survey years were used to determine at-risk flight activity. The percentage of at-risk flights considered to be a potential collision height for each of the assessed species were:

- Cormorant – 69.5%;
- Golden plover – 30.0%;
- Lapwing – 18.6%;
- Lesser black-backed gull – 30.9%;
- Mallard – 13.7%;
- Oystercatcher – 7.5%;
- Pink-footed goose – 90.8%;
- Shelduck – 44.0%;
- Snipe – 50.6%; and
- Whooper swan – 31.2%.

3.5 Application of Nocturnal Activity Factor

3.5.1 The results of the baseline VP flight activity surveys, as used in the CRM, provide details of daytime flight activity. The hours of daylight experienced at a location are factored into the calculations. The hours of daylight per month, and subsequently in each species-specific survey season, have been calculated using a latitude of 53.668 decimal degrees for the Proposed Development.

3.5.2 For most species, flight activity is considered to only occur during daylight hours, with birds going to roost at night or otherwise remain within one location between dusk and dawn.

3.5.3 However, for the wader species (golden plover, lapwing, oystercatcher and snipe) a low level of flight activity outside daylight hours has been assumed as these species have been shown to do at least some foraging at night (e.g. Whittingham *et al*., 2000[6]; Lourenco *et al*., 2008[7]), although it can be expected that time in flight would be less than during daylight hours. A nocturnal activity factor of '2' has been applied, which adds an additional 25% to the calculated (day-time) flight activity for these species.

[6] Whittingham, M.J., Percival, S.M. and Brown, A.F. (2000). Time budgets and foraging of breeding golden plover *Pluvialis apricaria. Journal of Applied Ecology,* 37(4), 632-646.

[7] Lourenco, P.M., Silva, A., Santos, C.D., Miranda, A.C., Granadeiro, J.P. and Palmeirim, J.M. (2008). The energetic importance of night foraging for waders wintering in a temperate estuary. *Acta Oecologica* 34(1), 122-129.

3.6 Species Parameters

3.6.1 The CRM analyses use parameters for each species to inform potential collision risk. The parameters used are presented in **Table 3.4**.

Table 3.4: Target Species parameters

Species	Length (m)	Wing-span (m)	Flight Speed (m/s)	'Gliding' or 'flapping' flight	Collision Probability (%)	Avoidance Rate (%)
Cormorant	0.90	1.45	15.2	Flapping	6.62	98.0
Golden plover	0.28	0.72	17.9	Flapping	4.30	98.0
Lapwing	0.30	0.85	12.8	Flapping	4.81	98.0
Lesser black-backed gull	0.58	1.43	13.1	Flapping	6.01	99.5
Mallard	0.58	0.90	18.5	Flapping	5.05	98.0
Oystercatcher	0.43	0.83	13.0	Flapping	5.21	98.0
Pink-footed goose	0.68	1.53	16.8	Flapping	5.82	99.8
Shelduck	0.63	1.22	15.4	Flapping	4.11	98.0
Snipe	0.26	0.46	17.1	Flapping	5.67	98.0
Whooper swan	1.53	2.31	17.3	Flapping	8.34	99.5

3.6.2 Parameters are primarily taken from Snow and Perrins (1998)[8] (biometrics) and Alerstam *et al*. (2007)[9] (flight speeds). Biometrics (bird length and wingspan) are average measurements. Where data for a particular species could not be found in Alerstam *et al*. (2007), the flight speed of a relevant congener species has been used.

3.6.3 Avoidance rates are taken from NatureScot guidance (2025a)[10], with a default value of 98% applied where species-specific avoidance rates are not available.

3.6.4 All species are considered to have 'flapping' flights.

3.6.5 'Collision probability' in **Table 3.4** relates to the probability of collision in a single bird rotor transit, as calculated by the NatureScot spreadsheet.

3.6.6 It has been assumed that there would be an even spread of upwind and downwind flights for all species given their non-directional (random) nature.

3.6.7 It is also assumed that none of the assessed species would be attracted towards the turbines.

[8] Snow, D. W. & Perrins, C. M. (1998). *The Birds of the Western Palearctic. Concise Edition*. Oxford University Press.
[9] Alerstam T., Rosén M., Bäckman J., Ericson P.G.P., and Hellgren O. (2007). Flight speeds among bird species: allometric and phylogenetic effects. *PLoS Biol*, 5, 1656-1662
[10] NatureScot (2025a). *Wind farm impacts on birds – use of avoidance rates in the NatureScot Wind Farm Collision Risk Model*. NatureScot, Inverness.

3.7 Turbine Parameters

3.7.1 Turbine parameters used in the analysis are summarised in **Table 3.5**. Where certain details were not available, a representative value has been utilised, with these parameters marked with an asterisk in the table.

Table 3.5: Turbine parameters used in the collision risk model

Parameter	Value	Unit
No. of turbines	1	-
No. of blades (per turbine)	3	-
Rotor diameter	138	metres
Rotor radius	69	metres
Max chord*	3.7	metres
Pitch (average)*	15	degrees
Rotation speed (average)*	10	revolutions per minute
Downtime*	15	%

* Representative values

3.7.2 The CRM calculations include for turbine downtime, for example time when the wind is below cut-in speed, time when rotors are idling or stationary, time when rotors are stopped to protect against very high wind speeds and down-time for maintenance. Downtime will vary through the year and can only be estimated. In accordance with guidance (NatureScot, 2024) a default value of 15% has been used, which has been applied across all months.

3.7.3 The model allows for a 'large array correction' where the collision rate would be expected to decline significantly as birds pass through the turbine array. Given the small scale of the Proposed Development (one turbine) the large array correction has not been applied.

3.8 Alternative Approach to Assessing Collision Risk to Pink-footed Geese

3.8.1 Whilst the methods outlined above represent the standardised approach to calculating the theoretical risk of birds colliding with wind turbines, NatureScot has developed a common approach to assessing the risk of collision from small-scale wind farms on migratory pink-footed and greylag geese where they are connected with Special Protection Areas (NatureScot (2025b[11]). This alternative approach involves a simple and streamlined method and has been developed based on a number of previous studies in order to estimate the number of collisions expected over the average lifespan of small-scale wind energy developments and is based on the follow information:

- the known distribution of feeding areas for pink-footed (and greylag) geese;
- knowledge of the flight behaviour of these species near roosts and feeding areas; and
- the relationship between flight density and roost distance to predict the average number of goose encounters with turbines per year.

[11] NatureScot (2025b). *Assessing impacts to pink-footed and greylag geese from small-scale wind farms in Scotland*. NatureScot, Inverness.

3.8.2 For the known distribution of feeding areas for pink-footed geese, it should be noted that the NatureScot guidance, which was developed for applications in Scotland, refers to a report on the distribution of foraging greylag and pink-footed geese in Scotland (Mitchell, 2012[12]). However, for the purposes of the Proposed Development, the equivalent report on the distribution of foraging pink-footed geese in England (Brides *et al*., 2013[13]) has been used.

3.8.3 The method involves populating a pre-prepared spreadsheet, available in Appendix 1 of the NatureScot guidance (2025b), with information on the Proposed Development's number of turbines and their rotor radius (as detailed in **Section 3.4**) and according to the distance band within which the nearest SPA(s) is from the Proposed Development.

3.8.4 The method is based on a number of critical assumptions:

- mean flight activity for all sites at any given distance from an SPA roost will be a reasonable estimate of mean flight activity at any one site over the operational life of a wind farm;
- birds in flight very close to roosts are likely to occur at particularly high densities;
- all birds in flight within 1.5km of an SPA boundary will be at collision risk height;
- all birds in flight within 1km squares used regularly for foraging (based on Brides *et al.*, 2013, as explained above), and within 1.5km of such squares, will be at collision risk height; and
- no birds more than 1.5km from an SPA boundary, and more than 1.5km from foraging areas as defined above, will be at collision risk height.

3.8.5 Based on these assumptions, small scale wind farm sites can be placed into one of three categories regarding collision risk to geese:

- **High risk:** sites less than 1.5km from SPA boundaries. These sites are likely to be associated with particularly high densities of birds at collision risk height;
- **Moderate risk:** sites more than 1.5km from SPA boundaries, but within 1.5km of feeding areas as defined by Brides *et al*., 2013. The numbers of geese in flight are likely to be variable but may be substantial in some years. Most birds will be at collision risk height. A generic collision risk calculation should be carried out in line with the spreadsheet in Appendix 1 of NatureScot's guidance (2025b); and
- **Low risk:** sites more than 1.5km from SPA roosts and away from regularly used foraging areas. Almost all geese will be above collision risk height, and goose collisions at these sites are expected to be very rare.

3.8.6 Given the critical assumptions upon which the collision risk modelling approach is based, notably the distance of the Site from the nearest goose SPA and known foraging grounds, the Site is considered to be of Moderate Risk to pink-footed geese.

[12] Mitchell, C. (2012). *Mapping the distribution of feeding Pink-footed and Iceland Greylag Geese in Scotland.* Wildfowl & Wetlands Trust / Scottish Natural Heritage Report, Slimbridge.

[13] Brides, K., Mitchell, C. and Hearn R.D. (2013). *Mapping the distribution of feeding Pink-footed Geese in England.* Wildfowl & Wetlands Trust / Natural England Report, Slimbridge.

4 COLLISION MORTALITY RISKS

4.1 Collision Risk Estimates Using the Standard Modelling Approach

4.1.1 The completed collision risk calculations are provided in **Annex 2** for the 10 Target Species assessed.

4.1.2 The outputs are summarised in **Table 4.1**. The presented values are the estimated number of bird collisions per year. The table provides these estimates before and after the application of avoidance rates. The recommended avoidance rate to be used for each species is highlighted, in accordance with NatureScot guidance (2025a). For seven of the 10 species assessed, a 98% avoidance rate has been used as this is the default rate when there is insufficient available data to utilise a higher avoidance rate.

Table 4.1: Collision mortality estimates.

Species	Annual Mortality Estimate					
	No avoidance	**95.0% avoidance**	**98.0% avoidance**	**99.0% avoidance**	**99.5% avoidance**	**99.8% avoidance**
Cormorant	2	0.08	**0.03**	0.02	0.01	0.00
Golden plover	3	0.15	**0.06**	0.03	0.01	0.01
Lapwing	57	2.84	**1.14**	0.57	0.28	0.06
Lesser black-backed gull	4	0.21	0.08	0.04	**0.02**	0.01
Mallard	1	0.06	**0.03**	0.01	0.01	0.00
Oystercatcher	1	0.07	**0.03**	0.01	0.01	0.00
Pink-footed goose	493	24.66	9.87	4.93	2.47	**0.99**
Shelduck	10	0.48	**0.19**	0.10	0.05	0.02
Snipe	1	0.03	**0.01**	0.01	0.00	0.00
Whooper swan	28	1.42	0.57	0.28	**0.14**	0.06

4.2 Collision Risk Estimate for Pink-footed Geese Using the Alternative NatureScot Approach for Small Scale Wind Farms

4.2.1 The collision risk calculation for pink-footed geese using NatureScot's alternative method for small scale wind farm developments is presented in **Annex 3**.

4.2.2 This provides a collision risk estimate of 0.56 birds per year which provides a lower estimate than the 0.99 birds per year estimated using the standard approach, as presented in **Table 4.1**.

5 UNCERTAINTIES IN THE CALCULATIONS

5.1.1 CRM guidance (Band (2024), NatureScot (2024)) acknowledges that there are many uncertainties in the model output, and it is recommended that this uncertainty be conveyed by presenting a range of confidence around the best estimate. Therefore, quantification of the potential sources of error within the CRM analyses is provided below, where possible, using professional judgment.

5.1.2 It should be noted that Band (2024) states that the uncertainty in species-specific avoidance rates is likely to "dwarf" all other uncertainties (see **Table 4.1** for the full range of mortality estimates). Those species which use a high avoidance rate (lesser black-backed gull, pink-footed goose, whooper swan) are likely to have least uncertainty in the estimates, as use of these higher avoidance rates is based on sufficient research having been done on these species to determine that their use is appropriate. Those species that have used the default avoidance rate of 98.0% are the species that have the largest uncertainty, although it is considered that any error is likely to be an over-estimate in risk rather than an under-estimate.

5.1.3 As set out in guidance (Band, 2024) five main sources of uncertainty have been assessed (e_1-e_5):

- Uncertainty in the flight activity data:
    - Bird density (e_1);
    - Nocturnal activity (e_2);
    - Proportion of at-risk flights (e_3);
- Uncertainty due to limitations in the collision model (e_4); and
- Uncertainty arising from turbine options that are yet to be confirmed (e_5).

5.1.4 Each of these sources of uncertainty are expressed as a relative proportional error (0-1). The value of e_1 varies between species, whilst for the uncertainty values of e_2-e_5 the same values have been used for all species.

5.1.5 The combined uncertainty (E) is then calculated as the root mean square (i.e. $E = \sqrt{(e_1^2+e_2^2+e_3^2+e_4^2+e_5^2)}$).

5.2 Uncertainty in Flight Activity Data

5.2.1 Uncertainty is introduced into the density estimates where there is variation in the baseline data. For all species that used density estimates from both survey years in order to calculate risk, the variation between years was high. Golden plover, lapwing and whooper swan, in particular, exhibited flight activity that was considerably greater in one survey year.

5.2.2 In reference to guidance (Band, 2024), the confidence interval for bird density is calculated as 1.96 x standard deviation. Relative error (e_1) is then calculated as 1.96 x standard deviation/ sum of the bird densities. For the species assessed for which more than one survey year of data was included in the model, in most cases this produced an error greater than one. As the method suggested in guidance (Band, 2024) for calculating combined uncertainty uses relative errors (range 0-1), for these species (golden plover, lapwing, oystercatcher, snipe and whooper swan) a capped value of 0.95 has been used.

5.2.3 For species for which density estimates have been calculated using data from one survey season from one survey year (cormorant, mallard and lesser black-backed gull) there is no variation present in the data, although clearly inter-annual variation would still be expected to occur. The presence of these

species is considered to be more predictable than e.g. highly mobile large flocks of golden plover or pink-footed goose, and a relative error estimate of 0.25 has been applied for these three species.

5.2.4 Uncertainty is also introduced by the application of the nocturnal activity factor. For wader species (golden plover, lapwing, oystercatcher and snipe) a factor of '2' has been applied in the model, which assumes nocturnal activity is 25% of diurnal activity. For all other species it has been assumed there would not be any nocturnal flights over the Site. There is considered to be reasonable confidence in this approach, but a 0.10 relative error has been estimated, which has been applied to all species (waders and non-waders).

5.2.5 Finally, uncertainty in flight height recording needs to be accounted for. Due to all flights in HT2 - HT7 being considered as at-risk flights, and the large separation between minimum rotor swept height (42m) and the minimum height covered by HT2 (25m) any small errors in observer estimation of flight height would not have affected the number of flights considered as being at PCH. However, flights within HT2 were apportioned in the model to determine those at-risk, and observer error could have influenced the number of flights recorded in this height band. This makes up a small proportion of at-risk flight activity and a small relative error of 0.05 has been estimated. This value has been applied to all species.

5.3 Uncertainty as a Result of Simplifications in the Model

5.3.1 Band (2024) gives a relative error of 0.20 in respect to this uncertainty, and so this value has been used for all species.

5.4 Uncertainty in Turbine Parameters

5.4.1 The mortality estimates have been calculated based on the parameters of the turbine that is anticipated for the Proposed Development. Some parameters used in the model are representative values. There may be small differences in the data used in the predictive model and those that transpire to be the true values. Experimental manipulation of these variables was undertaken whilst carrying out the CRM analysis (not presented) and this suggests that these changes would result in a less than 10% difference from the values presented. Therefore, a relative error of 0.10 has been used for all species.

5.5 Combined Uncertainty Estimates

5.5.1 The following are based on the species-specific avoidance rates highlighted in **Table 4.1**.

- For cormorant the mortality estimate is 0.03 ± 35%, giving a range of 0.02 - 0.04 collisions per year.
- For golden plover the mortality estimate is 0.06 ± 97%, giving a range of 0.00 - 0.12 collisions per year.
- For lapwing the mortality estimate is 1.14 ± 97%, giving a range of 0.03 – 2.25 collisions per year.
- For lesser black-backed gull the mortality estimate is 0.02 ± 35%, giving a range of 0.01 - 0.03 collisions per year.
- For mallard the mortality estimate is 0.03 ± 35%, giving a range of 0.02 - 0.04 collisions per year.
- For oystercatcher the mortality estimate is 0.03 ± 97%, giving a range of 0.00 - 0.06 collisions per year.

- For pink-footed goose the mortality estimate is 0.99 ± 95%, giving a range of 0.05 - 1.93 collisions per year.
- For shelduck the mortality estimate is 0.19 ± 90%, giving a range of 0.02 - 0.36 collisions per year.
- For snipe the mortality estimate is 0.01 ± 97%, giving a range of 0.00 - 0.02 collisions per year.
- For whooper swan the mortality estimate is 0.14 ± 97%, giving a range of 0.00 - 0.28 collisions per year.

ANNEX 1: TARGET FLIGHTS IN SURVEY AREA

Table A1.1 presents Target Species flight activity identified for the Proposed Development and used in the CRM analyses. The listed records are those flights that passed within the turbine envelope only (proposed turbine location plus 500 m).

The data come from the VP flight activity surveys and were recorded over two survey years, with Year 1 being September 2022 to May 2023 and Year 2 being October 2023 to May 2024 (inclusive).

The following British Trust for Ornithology (BTO) species codes are used to denote species in the table: BO – barn owl, CA – cormorant, CS – common sandpiper, CU – curlew, DN – dunlin, ET – little egret, GD – goosander, GP – golden plover, H. – grey heron, HY – hobby, KT – red kite, L. – lapwing, LB – lesser black-backed gull, MA – mallard, ML – merlin, MS – mute swan, OC – oystercatcher, P. – grey partridge, PE – peregrine, PG – pink-footed goose, RK – redshank, RU – ruff, SN – snipe, SU – shelduck, T. – teal and WS – whooper swan.

Table A1.1: Target Species flight activity used in the CRM analysis.

Date	Species	Number	Start time	Duration	HT1	HT2	HT3	HT4	HT5	HT6	HT7
24/11/2022	T.	4	10:34	15	15	0	0	0	0	0	0
24/11/2022	PG	2	10:55	98	0	0	0	98	0	0	0
24/11/2022	T.	2	12:32	15	15	0	0	0	0	0	0
28/11/2022	PG	33	14:02	130	0	0	0	130	0	0	0
28/11/2022	T.	6	14:24	25	0	25	0	0	0	0	0
28/11/2022	PG	31	14:27	178	0	0	0	178	0	0	0
28/11/2022	T.	3	14:33	15	15	0	0	0	0	0	0
28/11/2022	PG	23	16:09	225	0	225	0	0	0	0	0
28/11/2022	PG	23	16:38	135	0	0	60	75	0	0	0
28/11/2022	SN	2	16:42	15	15	0	0	0	0	0	0
12/12/2022	T.	2	14:16	15	15	0	0	0	0	0	0
13/01/2023	PG	5	08:20	100	0	0	0	100	0	0	0
13/01/2023	PG	26	08:38	110	0	45	60	5	0	0	0
13/01/2023	PG	38	11:02	120	0	120	0	0	0	0	0
29/03/2023	L.	2	13:05	5	5	0	0	0	0	0	0
14/04/2023	L.	1	09:35	30	30	0	0	0	0	0	0
11/05/2023	L.	1	14:00	30	30	0	0	0	0	0	0
29/03/2023	L.	6	12:22	15	15	0	0	0	0	0	0
29/03/2023	OC	2	12:13	10	10	0	0	0	0	0	0
29/03/2023	L.	4	09:02	15	15	0	0	0	0	0	0
18/10/2022	WS	96	12:30	25	25	0	0	0	0	0	0
20/12/2022	PG	50	13:45	90	0	0	0	90	0	0	0
30/01/2023	T.	1	12:23	15	15	0	0	0	0	0	0
22/09/2022	PG	50	08:37	137	0	0	0	0	0	137	0
22/09/2022	PG	34	07:14	171	0	6	30	45	0	90	0
18/10/2022	WS	20	07:51	45	0	15	0	30	0	0	0
30/01/2023	P.	1	14:34	5	5	0	0	0	0	0	0
29/03/2023	OC	5	14:50	5	5	0	0	0	0	0	0
16/02/2023	L.	13	13:00	30	30	0	0	0	0	0	0
24/05/2023	OC	2	10:50	40	40	0	0	0	0	0	0
29/03/2023	L.	2	09:35	15	0	15	0	0	0	0	0

Date	Species	Number	Start time	Duration	HT1	HT2	HT3	HT4	HT5	HT6	HT7
22/09/2022	PG	42	07:22	157	0	0	0	0	0	157	0
13/01/2023	PG	9	10:33	75	0	75	0	0	0	0	0
10/11/2022	WS	39	10:50	30	30	0	0	0	0	0	0
29/03/2023	L.	2	09:36	15	0	15	0	0	0	0	0
10/11/2022	WS	27	10:40	15	15	0	0	0	0	0	0
18/10/2022	PG	43	09:33	121	0	0	0	0	0	121	0
18/10/2022	WS	4	11:18	30	0	30	0	0	0	0	0
12/12/2022	ET	1	11:53	15	15	0	0	0	0	0	0
29/03/2023	L.	5	09:42	30	15	15	0	0	0	0	0
22/09/2022	PG	26	07:29	167	0	2	30	30	0	105	0
30/01/2023	T.	2	13:32	10	10	0	0	0	0	0	0
30/01/2023	T.	8	15:13	15	15	0	0	0	0	0	0
16/02/2023	L.	3	10:40	5	5	0	0	0	0	0	0
20/12/2022	GD	1	14:46	20	20	0	0	0	0	0	0
30/01/2023	T.	6	13:54	15	15	0	0	0	0	0	0
29/03/2023	SU	2	10:25	15	0	15	0	0	0	0	0
16/02/2023	L.	6	13:00	15	15	0	0	0	0	0	0
29/03/2023	L.	4	13:30	10	10	0	0	0	0	0	0
11/05/2023	L.	1	11:50	10	10	0	0	0	0	0	0
14/04/2023	BO	1	08:04	48	48	0	0	0	0	0	0
18/10/2022	WS	33	07:46	45	0	15	0	30	0	0	0
16/02/2023	L.	2	09:35	10	10	0	0	0	0	0	0
14/04/2023	OC	2	08:01	15	15	0	0	0	0	0	0
22/09/2022	PG	24	07:35	125	0	20	30	75	0	0	0
29/03/2023	L.	2	08:35	15	15	0	0	0	0	0	0
16/02/2023	L.	35	12:55	30	15	15	0	0	0	0	0
29/03/2023	OC	2	10:25	15	15	0	0	0	0	0	0
29/03/2023	L.	3	14:42	15	15	0	0	0	0	0	0
18/10/2022	WS	11	12:50	45	0	15	30	0	0	0	0
20/12/2022	T.	2	14:55	15	15	0	0	0	0	0	0
14/04/2023	OC	2	14:08	15	15	0	0	0	0	0	0
18/10/2022	WS	21	07:48	50	5	0	15	30	0	0	0
22/09/2022	PG	4	07:44	178	0	0	0	0	0	0	178
24/04/2023	L.	1	10:33	80	80	0	0	0	0	0	0
29/03/2023	GP	2	13:45	20	20	0	0	0	0	0	0
23/03/2023	OC	2	10:00	25	25	0	0	0	0	0	0
22/09/2022	H.	1	08:06	45	0	0	0	0	0	45	0
18/10/2022	WS	14	07:50	48	3	15	0	30	0	0	0
18/10/2022	PG	32	09:09	63	0	0	0	0	0	63	0
20/12/2022	T.	7	12:59	25	25	0	0	0	0	0	0
14/04/2023	L.	2	10:23	15	15	0	0	0	0	0	0
22/09/2022	PG	56	07:48	150	0	0	0	0	0	45	105
14/04/2023	OC	3	10:06	10	10	0	0	0	0	0	0
18/10/2022	WS	11	07:51	45	0	15	0	30	0	0	0
23/03/2023	L.	2	09:50	60	45	15	0	0	0	0	0

Date	Species	Number	Start time	Duration	HT1	HT2	HT3	HT4	HT5	HT6	HT7
18/10/2022	WS	10	13:01	30	0	0	30	0	0	0	0
13/01/2023	PG	17	10:29	60	0	0	60	0	0	0	0
24/04/2023	L.	2	08:38	55	25	30	0	0	0	0	0
22/09/2022	PG	23	07:56	142	0	0	0	0	67	75	0
18/10/2022	WS	23	07:53	60	0	15	15	30	0	0	0
24/05/2023	L.	1	11:31	10	10	0	0	0	0	0	0
18/10/2022	WS	26	07:54	68	8	15	0	45	0	0	0
30/01/2023	T.	7	12:03	15	15	0	0	0	0	0	0
16/02/2023	T.	2	14:33	15	15	0	0	0	0	0	0
22/09/2022	PG	67	07:59	180	0	0	45	15	15	60	45
29/03/2023	L.	5	08:55	90	45	45	0	0	0	0	0
10/11/2022	WS	4	11:12	20	20	0	0	0	0	0	0
24/04/2023	OC	2	12:31	100	100	0	0	0	0	0	0
23/03/2023	L.	2	11:00	80	80	0	0	0	0	0	0
18/10/2022	WS	258	13:50	58	58	0	0	0	0	0	0
29/03/2023	L.	6	14:25	45	45	0	0	0	0	0	0
14/04/2023	L.	2	09:42	18	18	0	0	0	0	0	0
10/11/2022	WS	42	11:14	45	45	0	0	0	0	0	0
12/12/2022	SN	1	13:12	35	15	20	0	0	0	0	0
22/09/2022	PG	25	08:00	124	0	0	0	0	19	60	45
30/01/2023	L.	1	13:51	45	15	30	0	0	0	0	0
22/09/2022	PG	45	08:04	124	0	4	15	0	45	0	60
12/12/2022	T.	6	09:33	15	15	0	0	0	0	0	0
22/09/2022	PG	18	08:05	120	0	0	15	0	30	75	0
11/05/2023	OC	2	15:20	40	15	25	0	0	0	0	0
18/10/2022	WS	12	07:55	52	7	0	15	30	0	0	0
12/12/2022	H.	2	08:21	15	15	0	0	0	0	0	0
30/01/2023	ET	1	11:17	15	15	0	0	0	0	0	0
22/09/2022	PG	16	08:31	106	0	16	15	0	45	30	0
24/04/2023	L.	2	12:44	60	45	15	0	0	0	0	0
10/11/2022	WS	4	11:22	20	20	0	0	0	0	0	0
29/03/2023	BO	1	08:30	10	10	0	0	0	0	0	0
14/04/2023	L.	2	11:56	25	25	0	0	0	0	0	0
18/10/2022	WS	34	07:55	75	0	15	30	30	0	0	0
20/12/2022	RK	2	12:54	45	30	0	15	0	0	0	0
22/09/2022	PG	3	09:09	106	0	0	0	0	30	76	0
16/02/2023	L.	1	08:42	10	10	0	0	0	0	0	0
10/11/2022	WS	11	11:25	20	20	0	0	0	0	0	0
22/09/2022	PG	50	09:16	150	0	0	0	0	30	30	90
14/04/2023	L.	6	08:18	20	20	0	0	0	0	0	0
12/12/2022	T.	2	08:42	15	15	0	0	0	0	0	0
16/02/2023	T.	1	14:33	10	10	0	0	0	0	0	0
18/10/2022	WS	8	07:57	53	30	15	8	0	0	0	0
29/03/2023	SU	2	09:32	10	10	0	0	0	0	0	0
16/02/2023	SU	1	08:44	10	10	0	0	0	0	0	0

Date	Species	Number	Start time	Duration	HT1	HT2	HT3	HT4	HT5	HT6	HT7
24/05/2023	OC	2	14:00	20	20	0	0	0	0	0	0
18/10/2022	WS	10	07:59	44	0	14	0	30	0	0	0
10/11/2022	PG	2	12:09	30	0	30	0	0	0	0	0
16/02/2023	RK	1	10:45	10	10	0	0	0	0	0	0
29/03/2023	OC	2	14:08	10	10	0	0	0	0	0	0
12/12/2022	L.	6	08:31	68	30	15	23	0	0	0	0
29/03/2023	OC	1	12:48	5	5	0	0	0	0	0	0
18/10/2022	PG	20	08:02	93	0	0	0	0	93	0	0
26/10/2022	PG	90	11:30	90	30	15	45	0	0	0	0
10/11/2022	PG	6	12:50	60	0	60	0	0	0	0	0
29/03/2023	T.	2	08:36	10	0	10	0	0	0	0	0
12/12/2022	PG	14	08:17	30	0	30	0	0	0	0	0
12/12/2022	T.	4	09:29	15	15	0	0	0	0	0	0
14/04/2023	L.	1	11:49	15	15	0	0	0	0	0	0
12/12/2022	ET	1	12:29	35	35	0	0	0	0	0	0
18/10/2022	WS	2	08:04	60	0	15	15	30	0	0	0
13/01/2023	PG	80	08:41	125	0	0	125	0	0	0	0
30/01/2023	P.	1	14:39	45	30	15	0	0	0	0	0
23/03/2023	CU	1	09:31	20	20	0	0	0	0	0	0
14/04/2023	L.	4	08:00	15	15	0	0	0	0	0	0
12/12/2022	T.	3	09:38	15	15	0	0	0	0	0	0
12/12/2022	ET	1	13:29	20	20	0	0	0	0	0	0
18/10/2022	PG	34	08:11	110	0	0	0	0	0	110	0
29/03/2023	PE	1	15:00	15	0	15	0	0	0	0	0
24/04/2023	OC	1	09:00	25	25	0	0	0	0	0	0
23/03/2023	T.	2	11:45	10	10	0	0	0	0	0	0
24/04/2023	L.	1	08:35	42	27	15	0	0	0	0	0
24/04/2023	L.	1	09:18	50	50	0	0	0	0	0	0
18/10/2022	WS	3	08:34	30	0	30	0	0	0	0	0
13/01/2023	PG	3	09:12	15	15	0	0	0	0	0	0
12/12/2022	T.	2	12:25	15	15	0	0	0	0	0	0
12/12/2022	ET	1	14:26	30	30	0	0	0	0	0	0
30/01/2023	T.	4	12:16	20	20	0	0	0	0	0	0
24/05/2023	L.	2	09:40	30	30	0	0	0	0	0	0
29/03/2023	SU	1	10:15	15	15	0	0	0	0	0	0
18/10/2022	SN	3	08:36	48	0	0	0	48	0	0	0
12/12/2022	T.	3	10:54	30	30	0	0	0	0	0	0
29/03/2023	OC	1	09:12	5	5	0	0	0	0	0	0
30/01/2023	T.	10	11:01	5	5	0	0	0	0	0	0
16/02/2023	SU	1	09:35	15	0	15	0	0	0	0	0
18/10/2022	WS	8	09:07	58	13	15	30	0	0	0	0
12/12/2022	T.	4	13:07	25	25	0	0	0	0	0	0
24/05/2023	SU	4	14:22	10	10	0	0	0	0	0	0
20/12/2022	GD	6	12:59	25	25	0	0	0	0	0	0
18/10/2022	ET	1	09:11	43	0	0	0	43	0	0	0

Date	Species	Number	Start time	Duration	HT1	HT2	HT3	HT4	HT5	HT6	HT7
20/12/2022	L.	14	13:07	30	15	15	0	0	0	0	0
16/02/2023	T.	2	12:35	10	10	0	0	0	0	0	0
24/04/2023	L.	1	12:55	30	30	0	0	0	0	0	0
24/04/2023	OC	2	13:20	60	60	0	0	0	0	0	0
24/04/2023	L.	1	12:20	30	30	0	0	0	0	0	0
13/01/2023	PG	2	08:15	60	0	0	0	60	0	0	0
18/10/2022	PG	27	09:18	128	0	0	0	0	0	128	0
30/01/2023	T.	23	12:05	15	15	0	0	0	0	0	0
18/10/2022	L.	11	11:28	145	15	25	15	90	0	0	0
11/05/2023	OC	1	09:51	20	20	0	0	0	0	0	0
13/01/2023	SU	3	09:36	15	15	0	0	0	0	0	0
18/10/2022	WS	1	09:21	30	0	30	0	0	0	0	0
30/01/2023	T.	2	12:06	10	10	0	0	0	0	0	0
14/04/2023	SU	1	08:11	15	15	0	0	0	0	0	0
11/05/2023	L.	1	12:59	20	20	0	0	0	0	0	0
18/10/2022	WS	3	09:29	64	4	0	30	30	0	0	0
14/04/2023	L.	2	12:27	15	15	0	0	0	0	0	0
30/01/2023	T.	5	12:07	5	5	0	0	0	0	0	0
13/01/2023	PG	13	11:01	45	0	45	0	0	0	0	0
18/10/2022	PG	36	10:28	140	0	0	0	0	30	110	0
26/10/2022	PG	8	11:44	118	0	0	0	0	0	0	118
16/02/2023	T.	1	08:30	10	10	0	0	0	0	0	0
29/03/2023	L.	2	09:12	5	5	0	0	0	0	0	0
24/04/2023	CS	1	09:07	25	25	0	0	0	0	0	0
26/10/2022	WS	2	15:26	79	0	0	79	0	0	0	0
13/01/2023	PG	36	08:21	160	15	75	45	25	0	0	0
16/02/2023	SU	1	08:50	10	10	0	0	0	0	0	0
29/03/2023	SU	2	13:40	10	10	0	0	0	0	0	0
24/04/2023	SU	2	09:40	60	60	0	0	0	0	0	0
24/05/2023	OC	2	09:41	40	40	0	0	0	0	0	0
10/11/2022	PG	70	10:50	180	105	75	0	0	0	0	0
16/02/2023	OC	2	12:10	10	10	0	0	0	0	0	0
29/03/2023	L.	6	14:50	10	10	0	0	0	0	0	0
11/05/2023	L.	1	13:26	30	30	0	0	0	0	0	0
10/11/2022	PG	3	11:10	20	0	20	0	0	0	0	0
30/01/2023	P.	1	13:56	30	30	0	0	0	0	0	0
24/04/2023	SU	4	09:40	70	70	0	0	0	0	0	0
10/11/2022	PG	4	11:56	120	120	0	0	0	0	0	0
30/01/2023	ET	1	15:05	30	30	0	0	0	0	0	0
30/01/2023	T.	6	15:17	10	10	0	0	0	0	0	0
24/04/2023	L.	1	08:42	15	15	0	0	0	0	0	0
24/04/2023	L.	1	09:01	40	40	0	0	0	0	0	0
24/04/2023	SU	2	12:41	25	25	0	0	0	0	0	0
12/12/2022	SN	2	08:28	40	15	15	15	0	0	0	0
16/02/2023	RK	2	09:55	10	10	0	0	0	0	0	0

Date	Species	Number	Start time	Duration	HT1	HT2	HT3	HT4	HT5	HT6	HT7
29/03/2023	L.	4	09:55	45	30	15	0	0	0	0	0
24/04/2023	L.	2	09:13	55	55	0	0	0	0	0	0
24/04/2023	OC	2	09:43	50	50	0	0	0	0	0	0
10/11/2022	PG	17	12:39	30	30	0	0	0	0	0	0
13/01/2023	SU	2	08:23	30	30	0	0	0	0	0	0
29/03/2023	GP	3	09:22	20	15	5	0	0	0	0	0
24/05/2023	SU	2	14:08	20	20	0	0	0	0	0	0
10/11/2022	MS	2	12:48	90	90	0	0	0	0	0	0
16/02/2023	SU	1	13:15	45	45	0	0	0	0	0	0
29/03/2023	T.	2	15:04	45	45	0	0	0	0	0	0
14/04/2023	ET	1	10:25	10	10	0	0	0	0	0	0
12/12/2022	PG	6	09:04	65	5	30	30	0	0	0	0
16/02/2023	SU	4	08:53	40	40	0	0	0	0	0	0
29/03/2023	L.	1	09:36	30	30	0	0	0	0	0	0
14/04/2023	L.	2	12:31	180	180	0	0	0	0	0	0
11/05/2023	SU	3	10:14	30	30	0	0	0	0	0	0
12/12/2022	SN	1	09:43	45	30	15	0	0	0	0	0
13/01/2023	PG	27	09:21	90	0	55	45	0	0	0	0
16/02/2023	L.	17	11:00	90	60	30	0	0	0	0	0
29/03/2023	OC	2	10:45	10	10	0	0	0	0	0	0
11/05/2023	BO	1	09:28	50	50	0	0	0	0	0	0
24/05/2023	SU	2	14:05	20	20	0	0	0	0	0	0
20/12/2022	RK	2	13:17	60	30	0	0	30	0	0	0
23/03/2023	L.	2	13:10	40	10	15	15	0	0	0	0
24/04/2023	OC	1	12:51	20	20	0	0	0	0	0	0
24/05/2023	SU	2	11:59	30	30	0	0	0	0	0	0
20/12/2022	PG	75	13:29	225	0	0	0	225	0	0	0
14/04/2023	ET	1	13:51	10	10	0	0	0	0	0	0
20/12/2022	PG	1	14:02	125	0	0	0	0	125	0	0
23/03/2023	RK	1	10:05	40	40	0	0	0	0	0	0
20/12/2022	ET	4	15:57	50	50	0	0	0	0	0	0
13/01/2023	PG	28	08:23	180	0	0	0	180	0	0	0
16/02/2023	OC	2	11:55	10	10	0	0	0	0	0	0
29/03/2023	OC	2	14:35	30	30	0	0	0	0	0	0
13/01/2023	PG	24	08:29	120	0	0	30	90	0	0	0
13/01/2023	PG	150	08:51	135	0	0	135	0	0	0	0
30/01/2023	PG	1	16:50	70	0	70	0	0	0	0	0
13/01/2023	SU	24	09:06	100	0	0	100	0	0	0	0
13/01/2023	SU	4	09:06	90	90	0	0	0	0	0	0
24/04/2023	L.	3	09:41	80	50	30	0	0	0	0	0
13/01/2023	PG	4	09:17	140	0	75	65	0	0	0	0
24/04/2023	SU	1	09:57	40	40	0	0	0	0	0	0
24/04/2023	SU	2	13:40	40	40	0	0	0	0	0	0
13/01/2023	PG	55	10:12	75	0	0	0	75	0	0	0
29/03/2023	L.	2	13:40	15	15	0	0	0	0	0	0

Date	Species	Number	Start time	Duration	HT1	HT2	HT3	HT4	HT5	HT6	HT7
13/01/2023	PG	24	10:12	75	0	0	0	75	0	0	0
29/03/2023	OC	1	10:38	10	10	0	0	0	0	0	0
24/04/2023	L.	2	12:30	25	25	0	0	0	0	0	0
11/05/2023	SU	1	11:00	30	30	0	0	0	0	0	0
13/01/2023	PG	22	11:01	60	0	60	0	0	0	0	0
16/02/2023	L.	30	11:46	30	30	0	0	0	0	0	0
23/03/2023	L.	1	09:35	60	30	30	0	0	0	0	0
11/05/2023	L.	1	13:05	40	40	0	0	0	0	0	0
30/01/2023	PG	2	15:11	65	0	65	0	0	0	0	0
14/04/2023	SU	1	09:31	20	20	0	0	0	0	0	0
16/02/2023	GP	12	08:37	45	15	30	0	0	0	0	0
11/05/2023	SU	3	14:02	20	20	0	0	0	0	0	0
11/05/2023	L.	1	11:52	40	40	0	0	0	0	0	0
16/02/2023	L.	1	08:49	10	10	0	0	0	0	0	0
29/03/2023	L.	3	14:30	30	0	0	30	0	0	0	0
23/03/2023	L.	1	11:01	90	75	15	0	0	0	0	0
24/05/2023	L.	1	11:06	20	20	0	0	0	0	0	0
24/05/2023	L.	1	13:00	40	40	0	0	0	0	0	0
16/02/2023	L.	18	08:51	90	90	0	0	0	0	0	0
23/03/2023	T.	4	14:48	40	40	0	0	0	0	0	0
16/02/2023	SU	2	13:15	15	15	0	0	0	0	0	0
29/03/2023	OC	1	11:10	10	10	0	0	0	0	0	0
24/05/2023	OC	1	09:41	60	60	0	0	0	0	0	0
16/02/2023	SU	1	13:15	30	0	30	0	0	0	0	0
24/04/2023	SU	2	08:50	45	45	0	0	0	0	0	0
14/04/2023	SU	2	09:14	25	25	0	0	0	0	0	0
29/03/2023	OC	2	09:07	10	10	0	0	0	0	0	0
29/03/2023	SU	3	13:25	10	10	0	0	0	0	0	0
24/04/2023	SU	2	10:35	70	70	0	0	0	0	0	0
24/04/2023	OC	2	10:55	30	30	0	0	0	0	0	0
14/04/2023	OC	2	09:34	15	15	0	0	0	0	0	0
11/05/2023	L.	1	09:36	60	60	0	0	0	0	0	0
29/03/2023	GP	2	09:18	10	10	0	0	0	0	0	0
29/03/2023	OC	1	09:32	10	10	0	0	0	0	0	0
11/05/2023	SU	2	13:22	25	25	0	0	0	0	0	0
29/03/2023	OC	1	12:19	25	25	0	0	0	0	0	0
24/04/2023	L.	1	09:18	70	70	0	0	0	0	0	0
14/04/2023	L.	1	11:34	15	15	0	0	0	0	0	0
11/05/2023	L.	1	13:15	50	50	0	0	0	0	0	0
29/03/2023	L.	1	12:45	10	10	0	0	0	0	0	0
24/04/2023	L.	2	10:32	90	60	30	0	0	0	0	0
24/04/2023	L.	2	14:40	60	60	0	0	0	0	0	0
29/03/2023	L.	5	13:05	10	10	0	0	0	0	0	0
14/04/2023	OC	3	08:10	20	20	0	0	0	0	0	0
14/04/2023	SU	2	08:33	32	32	0	0	0	0	0	0

Date	Species	Number	Start time	Duration	HT1	HT2	HT3	HT4	HT5	HT6	HT7
14/04/2023	OC	1	12:45	30	30	0	0	0	0	0	0
23/03/2023	T.	2	11:40	20	20	0	0	0	0	0	0
14/04/2023	OC	1	12:10	20	20	0	0	0	0	0	0
11/05/2023	SU	2	12:50	30	30	0	0	0	0	0	0
23/03/2023	L.	1	13:20	60	30	0	30	0	0	0	0
24/04/2023	SU	4	09:14	60	60	0	0	0	0	0	0
24/04/2023	SU	1	12:04	25	25	0	0	0	0	0	0
11/05/2023	SU	2	10:02	20	20	0	0	0	0	0	0
24/04/2023	L.	2	13:20	90	60	30	0	0	0	0	0
11/05/2023	OC	4	13:20	40	15	25	0	0	0	0	0
11/05/2023	L.	1	14:38	30	30	0	0	0	0	0	0
24/04/2023	SU	4	14:15	40	40	0	0	0	0	0	0
14/04/2023	OC	2	08:42	20	20	0	0	0	0	0	0
14/04/2023	L.	1	13:33	15	15	0	0	0	0	0	0
14/04/2023	OC	2	09:11	12	12	0	0	0	0	0	0
24/05/2023	L.	3	09:51	20	20	0	0	0	0	0	0
14/04/2023	SU	2	09:24	45	45	0	0	0	0	0	0
14/04/2023	OC	1	09:31	64	64	0	0	0	0	0	0
14/04/2023	L.	1	12:15	30	30	0	0	0	0	0	0
11/05/2023	L.	2	13:35	30	30	0	0	0	0	0	0
14/04/2023	OC	1	13:25	35	35	0	0	0	0	0	0
11/05/2023	SU	2	09:50	40	40	0	0	0	0	0	0
11/05/2023	L.	1	10:31	45	45	0	0	0	0	0	0
24/05/2023	SU	1	09:21	20	20	0	0	0	0	0	0
24/05/2023	L.	4	10:15	40	40	0	0	0	0	0	0
24/05/2023	HY	1	09:50	25	25	0	0	0	0	0	0
24/05/2023	L.	2	13:15	30	30	0	0	0	0	0	0
18/10/2022	WS	6	13:03	39	0	0	39	0	0	0	0
18/10/2023	DN	2	16:20	84	39	45	0	0	0	0	0
25/10/2023	LB	3	14:44	82	0	82	0	0	0	0	0
22/11/2023	WS	4	10:34	75	0	60	15	0	0	0	0
22/11/2023	PG	68	09:28	65	0	0	0	65	0	0	0
22/11/2023	WS	13	12:53	110	0	110	0	0	0	0	0
22/11/2023	L.	10	12:56	65	35	30	0	0	0	0	0
22/11/2023	L.	16	10:01	42	42	0	0	0	0	0	0
22/11/2023	WS	5	10:28	121	60	61	0	0	0	0	0
22/11/2023	L.	9	10:52	108	0	108	0	0	0	0	0
22/11/2023	PG	6	11:13	94	0	34	30	30	0	0	0
22/11/2023	PG	2	13:05	65	0	0	65	0	0	0	0
22/11/2023	PG	24	13:11	128	0	0	128	0	0	0	0
22/11/2023	PG	9	14:13	150	0	30	120	0	0	0	0
22/11/2023	PG	28	14:32	114	0	0	114	0	0	0	0
17/04/2024	SU	2	07:36	3	3	0	0	0	0	0	0
20/05/2024	L.	1	13:08	8	8	0	0	0	0	0	0
18/10/2023	L.	30	13:49	96	6	90	0	0	0	0	0

Date	Species	Number	Start time	Duration	HT1	HT2	HT3	HT4	HT5	HT6	HT7
18/10/2023	CA	2	16:05	18	18	0	0	0	0	0	0
04/04/2024	L.	2	10:13	10	10	0	0	0	0	0	0
13/03/2024	L.	2	08:56	15	15	0	0	0	0	0	0
25/03/2024	L.	2	09:01	35	35	0	0	0	0	0	0
19/02/2024	L.	4	10:32	20	20	0	0	0	0	0	0
25/03/2024	L.	2	09:41	10	10	0	0	0	0	0	0
18/10/2023	CA	1	15:30	62	0	0	62	0	0	0	0
04/04/2024	L.	1	10:36	30	30	0	0	0	0	0	0
19/02/2024	L.	1	08:36	25	25	0	0	0	0	0	0
19/02/2024	CU	1	08:39	5	5	0	0	0	0	0	0
25/10/2023	PG	42	09:43	108	0	0	15	93	0	0	0
23/01/2024	ET	1	09:37	45	45	0	0	0	0	0	0
25/03/2024	L.	4	13:05	15	15	0	0	0	0	0	0
19/02/2024	L.	40	09:41	50	20	30	0	0	0	0	0
13/03/2024	L.	2	10:38	20	20	0	0	0	0	0	0
19/02/2024	L.	40	10:39	15	15	0	0	0	0	0	0
07/11/2023	PG	18	07:42	42	0	0	42	0	0	0	0
13/03/2024	OC	2	13:51	10	10	0	0	0	0	0	0
25/03/2024	L.	1	12:46	12	12	0	0	0	0	0	0
23/01/2024	MA	2	08:49	25	25	0	0	0	0	0	0
13/03/2024	L.	1	12:48	15	15	0	0	0	0	0	0
19/02/2024	L.	5	09:09	15	15	0	0	0	0	0	0
13/03/2024	L.	2	10:05	25	25	0	0	0	0	0	0
18/10/2023	LB	3	17:38	72	0	15	57	0	0	0	0
25/03/2024	CA	2	10:17	25	0	0	0	0	0	25	0
25/03/2024	LB	1	09:51	16	0	16	0	0	0	0	0
19/02/2024	L.	12	08:47	15	15	0	0	0	0	0	0
18/10/2023	LB	2	13:08	113	38	75	0	0	0	0	0
25/10/2023	MA	2	09:35	38	38	0	0	0	0	0	0
25/10/2023	MA	4	13:46	20	20	0	0	0	0	0	0
13/03/2024	L.	2	09:16	30	30	0	0	0	0	0	0
19/02/2024	RK	4	09:59	35	35	0	0	0	0	0	0
07/11/2023	L.	36	08:20	156	81	75	0	0	0	0	0
18/10/2023	RU	3	13:49	96	6	90	0	0	0	0	0
07/11/2023	PG	13	07:45	52	0	0	0	52	0	0	0
18/10/2023	LB	5	16:23	45	45	0	0	0	0	0	0
25/03/2024	LB	3	12:09	40	0	0	40	0	0	0	0
07/11/2023	SU	2	12:56	35	15	20	0	0	0	0	0
19/02/2024	MA	5	14:11	20	0	0	20	0	0	0	0
13/03/2024	LB	1	12:16	52	37	15	0	0	0	0	0
19/02/2024	MA	3	14:01	18	3	15	0	0	0	0	0
25/10/2023	MA	4	12:31	25	25	0	0	0	0	0	0
07/11/2023	PG	40	07:48	45	0	0	0	45	0	0	0
29/01/2024	ET	1	11:37	28	0	0	0	0	0	0	0
18/10/2023	L.	36	17:24	55	25	30	0	0	0	0	0

Date	Species	Number	Start time	Duration	HT1	HT2	HT3	HT4	HT5	HT6	HT7
25/03/2024	GP	11	10:22	15	15	0	0	0	0	0	0
13/03/2024	MA	3	09:01	30	0	0	30	0	0	0	0
04/04/2024	LB	2	09:41	16	0	0	0	16	0	0	0
04/04/2024	L.	2	14:32	8	8	0	0	0	0	0	0
25/10/2023	T.	2	12:31	25	25	0	0	0	0	0	0
25/10/2023	PG	120	12:47	80	0	0	0	0	80	0	0
19/02/2024	WS	3	10:19	38	0	38	0	0	0	0	0
20/05/2024	L.	2	09:02	10	10	0	0	0	0	0	0
23/01/2024	ET	1	10:09	28	28	0	0	0	0	0	0
07/11/2023	L.	46	10:16	26	26	0	0	0	0	0	0
13/03/2024	L.	1	09:03	10	10	0	0	0	0	0	0
13/03/2024	L.	1	09:08	18	18	0	0	0	0	0	0
13/03/2024	L.	2	11:12	45	45	0	0	0	0	0	0
17/04/2024	LB	2	09:30	30	0	0	0	30	0	0	0
25/03/2024	L.	1	09:59	8	8	0	0	0	0	0	0
25/03/2024	L.	1	08:14	3	3	0	0	0	0	0	0
19/02/2024	L.	40	12:23	120	75	45	0	0	0	0	0
25/10/2023	L.	12	09:10	48	0	48	0	0	0	0	0
25/03/2024	L.	2	13:50	18	18	0	0	0	0	0	0
13/03/2024	MA	3	13:05	18	18	0	0	0	0	0	0
29/01/2024	MA	2	09:03	10	10	0	0	0	0	0	0
13/03/2024	L.	1	10:11	15	15	0	0	0	0	0	0
13/03/2024	L.	2	10:44	25	25	0	0	0	0	0	0
19/02/2024	L.	2	14:42	30	30	0	0	0	0	0	0
25/10/2023	CA	1	12:53	58	0	0	58	0	0	0	0
31/05/2024	L.	1	08:36	5	5	0	0	0	0	0	0
04/04/2024	L.	1	13:00	8	8	0	0	0	0	0	0
25/10/2023	PG	36	09:26	210	0	0	0	210	0	0	0
19/02/2024	GP	8	12:23	110	65	45	0	0	0	0	0
13/03/2024	MA	3	13:59	12	12	0	0	0	0	0	0
19/02/2024	CA	1	11:26	30	0	0	30	0	0	0	0
20/05/2024	L.	1	09:10	25	25	0	0	0	0	0	0
25/10/2023	L.	3	09:51	49	0	30	19	0	0	0	0
04/04/2024	L.	2	09:33	10	10	0	0	0	0	0	0
07/11/2023	MA	3	09:19	28	28	0	0	0	0	0	0
04/04/2024	L.	4	14:11	18	18	0	0	0	0	0	0
14/12/2023	SU	1	08:57	58	58	0	0	0	0	0	0
07/11/2023	MA	4	11:28	25	25	0	0	0	0	0	0
17/04/2024	L.	1	12:21	32	32	0	0	0	0	0	0
13/03/2024	L.	2	14:25	20	20	0	0	0	0	0	0
20/05/2024	MA	2	14:27	5	5	0	0	0	0	0	0
25/03/2024	L.	4	13:00	5	5	0	0	0	0	0	0
04/04/2024	L.	2	11:16	18	18	0	0	0	0	0	0
17/04/2024	L.	4	09:35	25	25	0	0	0	0	0	0
07/11/2023	L.	46	08:54	73	58	15	0	0	0	0	0

Date	Species	Number	Start time	Duration	HT1	HT2	HT3	HT4	HT5	HT6	HT7
25/03/2024	L.	1	12:57	8	8	0	0	0	0	0	0
23/01/2024	SU	2	08:23	45	0	45	0	0	0	0	0
13/03/2024	L.	1	12:41	30	30	0	0	0	0	0	0
13/03/2024	L.	2	09:11	25	25	0	0	0	0	0	0
17/04/2024	LB	1	08:41	11	0	11	0	0	0	0	0
19/02/2024	L.	3	08:38	28	28	0	0	0	0	0	0
13/03/2024	L.	2	12:56	40	40	0	0	0	0	0	0
19/02/2024	L.	6	08:43	35	35	0	0	0	0	0	0
23/01/2024	CA	1	08:37	53	45	8	0	0	0	0	0
19/02/2024	LB	1	13:40	40	0	0	40	0	0	0	0
04/04/2024	SU	8	09:23	30	0	0	15	15	0	0	0
13/03/2024	SU	2	13:56	20	20	0	0	0	0	0	0
29/01/2024	CA	1	09:04	49	0	49	0	0	0	0	0
19/02/2024	L.	44	09:04	90	30	60	0	0	0	0	0
13/03/2024	LB	1	13:33	30	30	0	0	0	0	0	0
17/04/2024	L.	2	12:49	25	25	0	0	0	0	0	0
25/10/2023	LB	2	10:15	64	0	0	64	0	0	0	0
07/11/2023	PG	49	07:50	79	0	0	0	79	0	0	0
17/04/2024	SU	2	08:23	28	13	15	0	0	0	0	0
31/05/2024	L.	1	12:22	15	15	0	0	0	0	0	0
25/10/2023	L.	5	10:33	88	0	0	58	30	0	0	0
13/03/2024	L.	3	09:38	25	25	0	0	0	0	0	0
29/01/2024	ET	1	09:01	10	10	0	0	0	0	0	0
13/03/2024	LB	1	12:57	25	25	0	0	0	0	0	0
23/01/2024	SU	2	09:36	20	20	0	0	0	0	0	0
13/03/2024	ET	1	09:45	12	12	0	0	0	0	0	0
04/04/2024	L.	2	09:49	25	25	0	0	0	0	0	0
25/03/2024	L.	9	09:27	18	18	0	0	0	0	0	0
17/04/2024	L.	4	08:02	20	20	0	0	0	0	0	0
29/01/2024	H.	1	09:33	5	5	0	0	0	0	0	0
04/04/2024	MA	1	10:40	3	3	0	0	0	0	0	0
20/05/2024	L.	4	11:58	30	30	0	0	0	0	0	0
19/02/2024	SU	1	10:12	15	15	0	0	0	0	0	0
19/02/2024	SU	3	09:19	16	16	0	0	0	0	0	0
13/03/2024	SU	2	12:45	10	10	0	0	0	0	0	0
25/10/2023	PG	18	11:07	228	0	0	0	228	0	0	0
25/03/2024	OC	2	09:47	10	10	0	0	0	0	0	0
25/10/2023	PG	34	11:24	135	0	0	0	135	0	0	0
17/04/2024	OC	1	09:32	8	8	0	0	0	0	0	0
25/03/2024	LB	3	10:07	28	0	28	0	0	0	0	0
04/04/2024	L.	2	12:14	18	3	15	0	0	0	0	0
25/10/2023	PG	14	11:28	173	0	0	0	0	173	0	0
31/05/2024	L.	1	13:43	8	8	0	0	0	0	0	0
13/03/2024	L.	2	12:35	15	15	0	0	0	0	0	0
25/03/2024	OC	2	08:33	6	6	0	0	0	0	0	0

Date	Species	Number	Start time	Duration	HT1	HT2	HT3	HT4	HT5	HT6	HT7
13/03/2024	OC	2	14:16	10	10	0	0	0	0	0	0
25/10/2023	LB	1	12:37	72	57	15	0	0	0	0	0
20/05/2024	L.	1	09:16	25	25	0	0	0	0	0	0
04/04/2024	GD	1	10:24	5	5	0	0	0	0	0	0
25/10/2023	L.	8	15:05	99	9	60	30	0	0	0	0
07/11/2023	PG	34	07:31	85	0	0	0	85	0	0	0
25/03/2024	H.	1	11:51	35	35	0	0	0	0	0	0
19/02/2024	L.	2	08:37	20	20	0	0	0	0	0	0
07/11/2023	PG	6	12:38	95	0	0	95	0	0	0	0
13/03/2024	MA	2	12:29	5	5	0	0	0	0	0	0
04/04/2024	L.	6	13:04	18	18	0	0	0	0	0	0
07/11/2023	PG	29	07:40	56	0	0	0	56	0	0	0
25/03/2024	LB	1	09:06	15	15	0	0	0	0	0	0
25/03/2024	MA	1	12:04	12	12	0	0	0	0	0	0
07/11/2023	L.	46	11:48	65	20	45	0	0	0	0	0
13/03/2024	LB	7	14:01	60	15	45	0	0	0	0	0
17/04/2024	L.	1	08:29	18	18	0	0	0	0	0	0
07/11/2023	PG	64	07:53	95	0	0	0	0	95	0	0
19/02/2024	SU	1	09:32	45	0	0	45	0	0	0	0
25/03/2024	L.	1	07:57	10	10	0	0	0	0	0	0
19/02/2024	LB	3	08:37	35	35	0	0	0	0	0	0
07/11/2023	PG	29	07:55	88	0	0	0	0	88	0	0
20/05/2024	OC	2	09:46	3	3	0	0	0	0	0	0
07/11/2023	WS	1	08:01	62	15	45	2	0	0	0	0
25/03/2024	L.	2	08:28	15	15	0	0	0	0	0	0
04/04/2024	L.	1	12:30	5	5	0	0	0	0	0	0
25/03/2024	OC	2	11:22	8	8	0	0	0	0	0	0
20/05/2024	L.	2	09:43	15	15	0	0	0	0	0	0
07/11/2023	PG	2	08:39	65	0	0	65	0	0	0	0
23/01/2024	ET	1	09:49	18	18	0	0	0	0	0	0
25/03/2024	ET	1	11:38	10	10	0	0	0	0	0	0
31/05/2024	L.	2	11:51	21	21	0	0	0	0	0	0
23/01/2024	ET	1	08:12	62	0	62	0	0	0	0	0
17/04/2024	OC	2	07:43	25	25	0	0	0	0	0	0
07/11/2023	PG	23	08:45	76	0	0	76	0	0	0	0
25/03/2024	SU	1	10:03	31	0	0	31	0	0	0	0
17/04/2024	LB	2	13:29	25	0	25	0	0	0	0	0
04/04/2024	OC	1	09:03	5	5	0	0	0	0	0	0
19/02/2024	OC	2	08:32	18	18	0	0	0	0	0	0
07/11/2023	PG	13	09:16	138	0	0	108	30	0	0	0
19/02/2024	L.	40	11:14	45	45	0	0	0	0	0	0
04/04/2024	SU	1	12:25	3	3	0	0	0	0	0	0
25/03/2024	L.	1	12:05	15	15	0	0	0	0	0	0
04/04/2024	SU	2	14:37	6	6	0	0	0	0	0	0
19/02/2024	SN	2	11:11	10	10	0	0	0	0	0	0

Date	Species	Number	Start time	Duration	HT1	HT2	HT3	HT4	HT5	HT6	HT7
07/11/2023	PG	28	09:43	105	0	30	75	0	0	0	0
25/03/2024	L.	6	13:26	30	30	0	0	0	0	0	0
19/02/2024	GP	1	11:14	45	45	0	0	0	0	0	0
13/03/2024	L.	2	13:41	30	30	0	0	0	0	0	0
25/03/2024	LB	3	13:20	65	0	55	15	0	0	0	0
20/05/2024	L.	1	11:31	18	18	0	0	0	0	0	0
07/11/2023	WS	3	10:07	48	0	15	33	0	0	0	0
04/04/2024	MA	3	09:16	6	6	0	0	0	0	0	0
19/02/2024	PE	1	12:23	78	0	0	78	0	0	0	0
19/02/2024	L.	2	12:32	25	25	0	0	0	0	0	0
04/04/2024	SU	3	09:38	4	4	0	0	0	0	0	0
17/04/2024	L.	1	08:10	15	15	0	0	0	0	0	0
25/03/2024	L.	2	08:41	10	10	0	0	0	0	0	0
17/04/2024	L.	2	13:40	32	32	0	0	0	0	0	0
31/05/2024	L.	1	09:52	20	20	0	0	0	0	0	0
13/03/2024	OC	2	09:31	15	15	0	0	0	0	0	0
17/04/2024	OC	1	13:12	4	4	0	0	0	0	0	0
13/03/2024	L.	2	14:11	25	25	0	0	0	0	0	0
25/03/2024	LB	2	13:41	25	10	15	0	0	0	0	0
17/04/2024	L.	2	13:18	20	20	0	0	0	0	0	0
31/05/2024	L.	3	08:24	16	16	0	0	0	0	0	0
07/11/2023	PG	27	11:31	101	0	0	0	101	0	0	0
23/01/2024	SU	1	10:21	48	48	0	0	0	0	0	0
07/11/2023	L.	31	11:51	44	15	29	0	0	0	0	0
25/03/2024	SU	2	08:19	8	8	0	0	0	0	0	0
07/11/2023	PG	43	13:49	85	0	0	0	85	0	0	0
31/05/2024	L.	1	07:40	4	4	0	0	0	0	0	0
14/12/2023	CA	2	08:49	64	4	60	0	0	0	0	0
04/04/2024	OC	1	12:18	20	5	15	0	0	0	0	0
20/05/2024	L.	1	14:16	25	25	0	0	0	0	0	0
14/12/2023	SN	1	12:12	35	15	20	0	0	0	0	0
14/12/2023	PG	12	09:19	85	0	0	0	85	0	0	0
19/02/2024	L.	1	12:05	15	15	0	0	0	0	0	0
17/04/2024	L.	2	11:53	15	15	0	0	0	0	0	0
25/03/2024	SU	2	08:22	8	8	0	0	0	0	0	0
04/04/2024	MA	2	14:19	7	7	0	0	0	0	0	0
14/12/2023	PG	1	09:27	65	0	20	15	30	0	0	0
20/05/2024	L.	4	12:43	20	20	0	0	0	0	0	0
17/04/2024	LB	2	12:25	18	3	15	0	0	0	0	0
13/03/2024	L.	2	13:02	30	30	0	0	0	0	0	0
14/12/2023	L.	33	11:48	43	13	30	0	0	0	0	0
20/05/2024	L.	2	14:36	30	30	0	0	0	0	0	0
25/03/2024	OC	2	12:12	18	18	0	0	0	0	0	0
13/03/2024	L.	4	10:56	38	38	0	0	0	0	0	0
25/03/2024	L.	1	12:15	5	5	0	0	0	0	0	0

Date	Species	Number	Start time	Duration	HT1	HT2	HT3	HT4	HT5	HT6	HT7
14/12/2023	WS	3	12:52	55	55	0	0	0	0	0	0
17/04/2024	OC	1	11:12	6	6	0	0	0	0	0	0
31/05/2024	L.	1	13:37	4	4	0	0	0	0	0	0
13/03/2024	LB	15	13:44	25	25	0	0	0	0	0	0
20/05/2024	L.	3	09:48	36	36	0	0	0	0	0	0
31/05/2024	OC	1	08:59	8	8	0	0	0	0	0	0
23/01/2024	ET	1	08:55	65	65	0	0	0	0	0	0
20/05/2024	OC	1	14:24	12	12	0	0	0	0	0	0
29/01/2024	MA	2	09:04	25	25	0	0	0	0	0	0
23/01/2024	ET	1	10:03	5	5	0	0	0	0	0	0
04/04/2024	L.	1	13:21	15	15	0	0	0	0	0	0
25/03/2024	L.	2	08:17	24	9	15	0	0	0	0	0
20/05/2024	OC	1	09:42	4	4	0	0	0	0	0	0
23/01/2024	SU	2	09:37	30	30	0	0	0	0	0	0
13/03/2024	LB	1	09:29	32	17	15	0	0	0	0	0
31/05/2024	H.	1	10:01	6	6	0	0	0	0	0	0
23/01/2024	ET	1	09:45	35	35	0	0	0	0	0	0
04/04/2024	OC	1	08:59	31	1	0	15	15	0	0	0
23/01/2024	ET	1	10:12	35	35	0	0	0	0	0	0
20/05/2024	OC	1	10:41	5	5	0	0	0	0	0	0
13/03/2024	OC	2	09:43	5	5	0	0	0	0	0	0
25/03/2024	L.	2	11:16	15	15	0	0	0	0	0	0
31/05/2024	L.	1	08:06	10	10	0	0	0	0	0	0
13/03/2024	MA	1	12:29	10	10	0	0	0	0	0	0
04/04/2024	OC	3	08:38	38	8	30	0	0	0	0	0
29/01/2024	L.	34	09:09	165	30	135	0	0	0	0	0
29/01/2024	MA	2	10:08	38	38	0	0	0	0	0	0
25/03/2024	SU	2	12:34	16	16	0	0	0	0	0	0
29/01/2024	LB	2	09:48	42	27	15	0	0	0	0	0
20/05/2024	H.	1	13:17	6	6	0	0	0	0	0	0
04/04/2024	L.	4	10:31	28	28	0	0	0	0	0	0
29/01/2024	ET	1	09:57	55	30	25	0	0	0	0	0
20/05/2024	L.	5	10:15	30	30	0	0	0	0	0	0
04/04/2024	OC	1	10:16	4	4	0	0	0	0	0	0
25/03/2024	L.	2	08:11	12	12	0	0	0	0	0	0
29/01/2024	LB	2	10:24	43	28	15	0	0	0	0	0
19/02/2024	CA	1	09:14	65	0	0	65	0	0	0	0
04/04/2024	MA	3	10:01	8	8	0	0	0	0	0	0
19/02/2024	PG	3	08:41	54	0	0	54	0	0	0	0
19/02/2024	L.	1	10:07	52	22	30	0	0	0	0	0
19/02/2024	MA	3	11:21	10	10	0	0	0	0	0	0
25/03/2024	OC	2	12:18	5	5	0	0	0	0	0	0
17/04/2024	L.	1	09:51	11	11	0	0	0	0	0	0
04/04/2024	OC	2	10:51	3	3	0	0	0	0	0	0
19/02/2024	L.	1	13:58	20	20	0	0	0	0	0	0

Date	Species	Number	Start time	Duration	HT1	HT2	HT3	HT4	HT5	HT6	HT7
13/03/2024	LB	2	12:22	105	105	0	0	0	0	0	0
19/02/2024	OC	2	12:32	30	30	0	0	0	0	0	0
17/04/2024	L.	2	12:12	10	10	0	0	0	0	0	0
25/03/2024	GP	2	11:22	4	4	0	0	0	0	0	0
25/03/2024	SU	2	12:37	10	10	0	0	0	0	0	0
04/04/2024	SU	2	12:23	32	2	30	0	0	0	0	0
19/02/2024	L.	23	13:10	52	7	45	0	0	0	0	0
04/04/2024	L.	2	09:42	21	21	0	0	0	0	0	0
20/05/2024	L.	2	11:06	15	15	0	0	0	0	0	0
25/03/2024	OC	2	09:24	20	20	0	0	0	0	0	0
19/02/2024	L.	43	13:32	215	30	185	0	0	0	0	0
31/05/2024	L.	5	08:19	15	15	0	0	0	0	0	0
31/05/2024	L.	1	08:17	12	12	0	0	0	0	0	0
04/04/2024	SU	2	10:45	36	1	0	30	0	0	0	0
19/02/2024	LB	2	14:09	60	15	45	40	0	0	0	0
20/05/2024	L.	2	10:19	18	18	0	0	0	0	0	0
19/02/2024	SU	4	14:27	35	35	0	0	0	0	0	0
20/05/2024	H.	1	10:22	28	28	0	0	0	0	0	0
25/03/2024	MA	2	07:58	5	5	0	0	0	0	0	0
04/04/2024	SU	1	12:44	15	0	15	0	0	0	0	0
13/03/2024	MA	1	08:56	35	35	0	0	0	0	0	0
31/05/2024	SU	2	08:50	10	10	0	0	0	0	0	0
25/03/2024	SU	2	09:18	12	12	0	0	0	0	0	0
13/03/2024	MA	2	09:05	23	23	0	0	0	0	0	0
13/03/2024	PG	14	09:22	85	0	0	0	85	0	0	0
13/03/2024	MA	3	09:42	30	30	0	0	0	0	0	0
25/03/2024	GP	4	11:21	20	20	0	0	0	0	0	0
20/05/2024	OC	1	13:30	5	5	0	0	0	0	0	0
13/03/2024	MA	3	12:27	35	35	0	0	0	0	0	0
13/03/2024	LB	1	12:33	45	45	0	0	0	0	0	0
13/03/2024	CA	2	13:14	78	0	0	0	78	0	0	0
25/03/2024	ET	1	08:48	15	15	0	0	0	0	0	0
04/04/2024	SU	3	08:50	25	25	0	0	0	0	0	0
25/03/2024	MA	4	10:20	8	8	0	0	0	0	0	0
04/04/2024	L.	1	08:52	16	16	0	0	0	0	0	0
04/04/2024	ET	1	12:06	12	12	0	0	0	0	0	0
17/04/2024	L.	1	12:36	15	15	0	0	0	0	0	0
20/05/2024	L.	1	12:52	12	12	0	0	0	0	0	0
31/05/2024	L.	2	07:44	75	75	0	0	0	0	0	0
25/03/2024	GP	7	11:26	16	1	0	15	0	0	0	0
04/04/2024	ML	1	13:35	62	62	0	0	0	0	0	0
25/03/2024	ET	1	11:29	3	3	0	0	0	0	0	0
04/04/2024	H.	1	12:33	35	5	30	0	0	0	0	0
17/04/2024	GP	8	08:46	18	18	0	0	0	0	0	0
31/05/2024	L.	1	11:26	11	11	0	0	0	0	0	0

Date	Species	Number	Start time	Duration	HT1	HT2	HT3	HT4	HT5	HT6	HT7
25/03/2024	KT	1	12:26	175	0	0	0	30	145	0	0
04/04/2024	OC	2	08:41	32	2	30	0	0	0	0	0
04/04/2024	OC	1	12:40	10	10	0	0	0	0	0	0
17/04/2024	L.	2	10:11	18	18	0	0	0	0	0	0
04/04/2024	SU	2	12:49	16	0	16	0	0	0	0	0
17/04/2024	OC	1	08:27	12	12	0	0	0	0	0	0
17/04/2024	GP	6	07:58	130	40	15	60	15	0	0	0
17/04/2024	OC	2	07:42	65	20	15	30	0	0	0	0
17/04/2024	OC	1	07:48	23	23	0	0	0	0	0	0
17/04/2024	SU	7	09:09	31	0	0	16	15	0	0	0
31/05/2024	L.	2	11:14	28	28	0	0	0	0	0	0
20/05/2024	L.	1	10:34	16	16	0	0	0	0	0	0
20/05/2024	SU	2	11:13	16	16	0	0	0	0	0	0
31/05/2024	OC	1	07:50	13	13	0	0	0	0	0	0
31/05/2024	L.	1	09:40	4	4	0	0	0	0	0	0
20/05/2024	SU	2	10:52	10	10	0	0	0	0	0	0
31/05/2024	H.	1	07:45	10	10	0	0	0	0	0	0
20/05/2024	SU	1	13:24	8	8	0	0	0	0	0	0
31/05/2024	SU	2	07:34	15	15	0	0	0	0	0	0
31/05/2024	OC	1	08:28	18	18	0	0	0	0	0	0
31/05/2024	L.	2	11:54	12	12	0	0	0	0	0	0
31/05/2024	L.	1	12:41	17	17	0	0	0	0	0	0
31/05/2024	MA	1	13:06	12	12	0	0	0	0	0	0
31/05/2024	MA	2	13:28	20	20	0	0	0	0	0	0
31/05/2024	L.	1	13:37	10	10	0	0	0	0	0	0

ANNEX 2: COLLISION RISK MODEL ANALYSIS - SPECIES OUTPUTS

- Cormorant
- Golden plover
- Lapwing
- Lesser black-backed gull
- Mallard
- Oystercatcher
- Pink-footed goose
- Shelduck
- Snipe
- Whooper swan

Bird data		Value	Units		Windfarm data		Value	Units		Turbine data			Value	Units
Species name		Cormorant			Site name	Asland Walks				Model	2 MW Type			
Bird Length	L	0.9	m		Latitude	53.668	degrees			Hub height	111			m
Wingspan	W	1.45	m		No of turbines	1				Rotor radius	69	R		m
Bird flight speed	v	15.2	$m\,s^{-1}$		Width of windfarm	1	km			No of blades	3	b		
Flight type, flapping or gliding		0								Rotation speed	10	Ω		rpm
% of flights upwind/downwind		50.0%	50.0%							Max blade width	3.7	C		m
Nocturnal activity rank 1-5		1								Blade pitch	15	λ		degrees
Nocturnal activity rank 1-6	f_{night}	0%								Risk height range	42 - 180			m

Stage A				Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daytime bird density	D_A		birds/km^2	0.0034	0.0034	0.0034	0	0	0	0	0	0.0034	0.0034	0.0034	0.0034	
Proportion at rotor risk height	Q_{2R}	69.50%														
At latitude 53.668		Daylight hours per month		250.2	273.0	366.3	419.2	492.7	509.0	511.8	459.9	382.8	329.2	259.9	234.1	4488.1
		Nighttime hours per month		493.8	399.0	377.7	300.8	251.3	211.0	232.2	284.1	337.2	414.8	460.1	509.9	4271.9

Stage B					Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year total
No of Turbines	T	1															
Rotor radius	R	69	m														
		Total rotor frontal area m^2		14,957													
Nocturnal activity factor	f_{night}	0%															
Bird flight speed	v	15	$m\,s^{-1}$		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
		Projected number of transits			3.5	3.8	5.1	-	-	-	-	-	5.4	4.6	3.6	3.3	**29**

Stage C									
No of blades	b	3		Bird Length	L	0.9	m		
Rotation speed	Ω	10	rpm	Wingspan	W	1.45	m		
Rotor radius	R	69	m	Bird flight speed	v	15.2	$m\,s^{-1}$		
Max blade width	C	3.7	m	Flight type		0			
Pitch	λ	15	degrees	% of flights upwind/downwind		50.0%	50.0%		
Blade profile		See Blade profile sheet							
		Single transit risk		upwind	8.3%				
				downwind	5.0%				
				weighted mean	6.6%				

Stage D		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year average
Prop time operating	Qop	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	**85.0%**
		Collision rates before avoidance												Year total
		0.2	0.2	0.3	0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.2	0.2	**2**

Stage E																
Allow for Large array correction?	1.0000	No														
Width of windfarm	w	1	km													
			large array correction		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	PerYear
					Collision rates allowing for avoidance												
Avoidance rates modelled		95.0%	100.0%		0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.02	0.01	0.01	0.01	**0.08**
		98.0%	100.0%		0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	**0.03**
		99.0%	100.0%		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.02**
		99.5%	100.0%		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.01**
		99.9%	100.0%		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**

		Value	Units			Value	Units			Value	Units
Bird data					**Windfarm data**				**Turbine data**		
Species name		Golden plover			Site name	**Asland Walks**			Model	**2 MW Type**	
Bird Length	L	0.28	m		Latitude	53.668	degrees		Hub height	111	m
Wingspan	W	0.72	m		No of turbines	1			Rotor radius	69	R m
Bird flight speed	v	17.9	$m\,s^{-1}$		Width of windfarm	1	km		No of blades	3	b
Flight type, flapping or gliding		0							Rotation speed	10	Ω rpm
% of flights upwind/downwind		50.0%	50.0%						Max blade width	3.7	C m
Nocturnal activity rank 1-5		2							Blade pitch	15	λ degrees
Nocturnal activity rank 1-6	f_{night}	125%							Risk height range	42 - 180	m

Stage A					Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daytime bird density	D_A		birds/km^2		0	0.0161	0.0161	0.0161	0	0	0	0	0	0	0	0	
Proportion at rotor risk height	Q_{2R}	30.00%															
At latitude 53.668		Daylight hours per month			250.2	273.0	366.3	419.2	492.7	509.0	511.8	459.9	382.8	329.2	259.9	234.1	4488.1
		Nightime hours per month			493.8	399.0	377.7	300.8	251.3	211.0	232.2	284.1	337.2	414.8	460.1	509.9	4271.9

Stage B																	
No of Turbines	T	1															
Rotor radius	R	69	m														
		Total rotor frontal area m^2		14,957													
Nocturnal activity factor	f_{night}	125%															
Bird flight speed	v	18	$m\,s^{-1}$		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year total
		Projected number of transits			-	20.7	27.8	31.8	-	-	-	-	-	-	-	-	**80**

Stage C								
No of blades	b	3			Bird Length	L	0.28	m
Rotation speed	Ω	10	rpm		Wingspan	W	0.72	m
Rotor radius	R	69	m		Bird flight speed	v	17.9	$m\,s^{-1}$
Max blade width	C	3.7	m		Flight type		0	
Pitch	λ	15	degrees	% of flights upwind/downwind			50.0%	50.0%
Blade profile		See Blade profile sheet						
		Single transit risk		upwind	5.7%			
				downwind	2.9%			
				weighted mean	4.3%			

Stage D			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year average
Prop time operating	Qop		85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	**85.0%**
		Collision rates before avoidance													Year total
			0.0	0.8	1.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**3**

Stage E																
Allow for Large array correction?	1.0000	No														
Width of windfarm	w	1	km													
			large array correction		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Per Year
					Collision rates allowing for avoidance												
Avoidance rates modelled		95.0%	100.0%		0.00	0.04	0.05	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.15**
		98.0%	100.0%		0.00	0.02	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.06**
		99.0%	100.0%		0.00	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.03**
		99.5%	100.0%		0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.01**
		99.9%	100.0%		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**

		Value	Units			Value	Units			Value	Units
Bird data				**Windfarm data**				**Turbine data**			
Species name		Lapwing		Site name	**Asland Walks**			Model	**2 MW Type**		
Bird Length	L	0.3	m	Latitude	53.668	degrees		Hub height	111		m
Wingspan	W	0.85	m	No of turbines	1			Rotor radius	69	R	m
Bird flight speed	v	12.8	m s^{-1}	Width of windfarm	1	km		No of blades	3	b	
Flight type, flapping or gliding		0						Rotation speed	10	Ω	rpm
% of flights upwind/downwind		50.0%	50.0%					Max blade width	3.7	C	m
Nocturnal activity rank 1-5		2						Blade pitch	15	λ	degrees
Nocturnal activity rank 1-6	f_{night}	125%						Risk height range	42 - 180		m

Stage A				Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daytime bird density	D_A		birds/km^2	0.2562	0.2562	0.0465	0.0465	0.0465	0.0465	0.0465	0.2562	0.2562	0.2562	0.2562	0.2562	
Proportion at rotor risk height	Q_{2R}	18.55%														
At latitude 53.668		Daylight hours per month		250.2	273.0	366.3	419.2	492.7	509.0	511.8	459.9	382.8	329.2	259.9	234.1	4488.1
		Nightime hours per month		493.8	399.0	377.7	300.8	251.3	211.0	232.2	284.1	337.2	414.8	460.1	509.9	4271.9

Stage B					Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year total
No of Turbines	T	1															
Rotor radius	R	69	m														
		Total rotor frontal area m^2		14,957													
Nocturnal activity factor	f_{night}	125%															
Bird flight speed	v	13	m s^{-1}														
		Projected number of transits			133.6	145.8	35.5	40.6	47.8	49.3	49.6	245.6	204.4	175.8	138.8	125.0	**1,392**

Stage C									
No of blades	b	3			Bird Length	L	0.3	m	
Rotation speed	Ω	10	rpm		Wingspan	W	0.85	m	
Rotor radius	R	69	m		Bird flight speed	v	12.8	m s^{-1}	
Max blade width	C	3.7	m		Flight type		0		
Pitch	λ	15	degrees	% of flights	upwind/downwind		50.0%	50.0%	
Blade profile		See Blade profile sheet							
		Single transit risk		upwind	6.7%				
				downwind	2.9%				
				weighted mean	4.8%				

Stage D		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year average
Prop time operating	Qop	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	**85.0%**
		Collision rates before avoidance												Year total
		5.5	6.0	1.5	1.7	2.0	2.0	2.0	10.0	8.4	7.2	5.7	5.1	**57**

Stage E																
Allow for Large array correction?	1.0000	No														
Width of windfarm	w	1	km													
			large array		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Per Year
			correction		Collision rates allowing for avoidance												
Avoidance rates modelled		95.0%	100.0%		0.27	0.30	0.07	0.08	0.10	0.10	0.10	0.50	0.42	0.36	0.28	0.26	**2.84**
		98.0%	100.0%		0.11	0.12	0.03	0.03	0.04	0.04	0.04	0.20	0.17	0.14	0.11	0.10	**1.14**
		99.0%	100.0%		0.05	0.06	0.01	0.02	0.02	0.02	0.02	0.10	0.08	0.07	0.06	0.05	**0.57**
		99.5%	100.0%		0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.05	0.04	0.04	0.03	0.03	**0.28**
		99.9%	100.0%		0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	**0.06**

		Value	Units			Value	Units			Value	Units
Bird data				**Windfarm data**				**Turbine data**			
Species name		Lesser black-backed gull		Site name	**Asland Walks**			Model	**2 MW Type**		
Bird Length	L	0.58	m	Latitude	53.668	degrees		Hub height	111		m
Wingspan	W	1.43	m	No of turbines	1			Rotor radius	69	R	m
Bird flight speed	v	13.1	$m s^{-1}$	Width of windfarm	1	km		No of blades	3	b	
Flight type, flapping or gliding		0						Rotation speed	10	Ω	rpm
% of flights upwind/downwind		50.0%	50.0%					Max blade width	3.7	C	m
Nocturnal activity rank 1-5		1						Blade pitch	15	λ	degrees
Nocturnal activity rank 1-6	f_{night}	0%						Risk height range	42 - 180		m

Stage A				Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daytime bird density	D_A		birds/km^2	0.0211	0.0211	0.0211	0.0028	0.0028	0.0028	0.0028	0.0028	0.0211	0.0211	0.0211	0.0211	
Proportion at rotor risk height	Q_{2R}	30.90%														
At latitude 53.668		Daylight hours per month		250.2	273.0	366.3	419.2	492.7	509.0	511.8	459.9	382.8	329.2	259.9	234.1	4488.1
		Nightime hours per month		493.8	399.0	377.7	300.8	251.3	211.0	232.2	284.1	337.2	414.8	460.1	509.9	4271.9

Stage B					Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year total
No of Turbines	T	1															
Rotor radius	R	69	m														
		Total rotor frontal area m^2		14,957													
Nocturnal activity factor	f_{night}	0%															
Bird flight speed	v	13	$m s^{-1}$		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year total
		Projected number of transits			8.3	9.1	12.2	1.9	2.2	2.3	2.3	2.0	12.8	11.0	8.7	7.8	**80**

Stage C								
No of blades	b	3		Bird Length	L	0.58	m	
Rotation speed	Ω	10	rpm	Wingspan	W	1.43	m	
Rotor radius	R	69	m	Bird flight speed	v	13.1	$m s^{-1}$	
Max blade width	C	3.7	m	Flight type		0		
Pitch	λ	15	degrees	% of flights upwind/downwind		50.0%	50.0%	
Blade profile		See Blade profile sheet						
		Single transit risk	upwind	7.9%				
			downwind	4.2%				
			weighted mean	6.0%				

Stage D			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year average
Prop time operating	Qop		85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	**85.0%**
		Collision rates before avoidance													Year total
			0.4	0.5	0.6	0.1	0.1	0.1	0.1	0.1	0.7	0.6	0.4	0.4	**4**

Stage E															
Allow for Large array correction?	1.0000	No													
Width of windfarm	w	1	km												
			large array correction	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	PerYear
				Collision rates allowing for avoidance												
Avoidance rates modelled		95.0%	100.0%	0.02	0.02	0.03	0.00	0.01	0.01	0.01	0.01	0.03	0.03	0.02	0.02	**0.21**
		98.0%	100.0%	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	**0.08**
		99.0%	100.0%	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	**0.04**
		99.5%	100.0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.02**
		99.9%	100.0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**

		Value	Units			Value	Units			Value	Units
Bird data				**Windfarm data**				**Turbine data**			
Species name		Mallard		Site name	**Asland Walks**			Model	**2 MW Type**		
Bird Length	L	0.58	m	Latitude	53.668	degrees		Hub height	111		m
Wingspan	W	0.9	m	No of turbines	1			Rotor radius	69	R	m
Bird flight speed	v	18.5	$m\,s^{-1}$	Width of windfarm	1	km		No of blades	3	b	
Flight type, flapping or gliding		0						Rotation speed	10	Ω	rpm
% of flights upwind/downwind		50.0%	50.0%					Max blade width	3.7	C	m
Nocturnal activity rank 1-5		1						Blade pitch	15	λ	degrees
Nocturnal activity rank 1-6	f_{night}	0%						Risk height range	42 - 180		m

Stage A				Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daytime bird density	D_A		birds/km^2	0.0069	0.0069	0.0066	0.0066	0.0066	0.0066	0.0066	0.0066	0.0066	0.0069	0.0069	0.0069	
Proportion at rotor risk height	Q_{2R}	13.70%														
At latitude 53.668		Daylight hours per month		250.2	273.0	366.3	419.2	492.7	509.0	511.8	459.9	382.8	329.2	259.9	234.1	4488.1
		Nighttime hours per month		493.8	399.0	377.7	300.8	251.3	211.0	232.2	284.1	337.2	414.8	460.1	509.9	4271.9

Stage B																
No of Turbines	T	1														
Rotor radius	R	69	m													
		Total rotor frontal area m^2		14,957												
Nocturnal activity factor	f_{night}	0%														
Bird flight speed	v	19	$m\,s^{-1}$	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year total
		Projected number of transits		1.7	1.9	2.4	2.7	3.2	3.3	3.3	3.0	2.5	2.2	1.8	1.6	**30**

Stage C								
No of blades	b	3		Bird Length	L	0.58	m	
Rotation speed	Ω	10	rpm	Wingspan	W	0.9	m	
Rotor radius	R	69	m	Bird flight speed	v	18.5	$m\,s^{-1}$	
Max blade width	C	3.7	m	Flight type		0		
Pitch	λ	15	degrees	% of flights upwind/downwind		50.0%	50.0%	
Blade profile		See Blade profile sheet						
		Single transit risk	upwind	6.4%				
			downwind	3.7%				
			weighted mean	5.1%				

Stage D		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year average
Prop time operating	Qop	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	**85.0%**
		Collision rates before avoidance												Year total
		0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	**1**

Stage E																
Allow for Large array correction?	1.0000	No														
Width of windfarm	w	1	km													
			large array correction	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Per Year
				Collision rates allowing for avoidance												
Avoidance rates modelled		95.0%	100.0%	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	**0.06**
		98.0%	100.0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.03**
		99.0%	100.0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.01**
		99.5%	100.0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.01**
		99.9%	100.0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**

		Value	Units			Value	Units			Value	Units
Bird data				**Windfarm data**				**Turbine data**			
Species name		Oystercatcher		Site name	**Asland Walks**			Model	**2 MW Type**		
Bird Length	L	0.43	m	Latitude	53.668	degrees		Hub height	111		m
Wingspan	W	0.83	m	No of turbines	1			Rotor radius	69	R	m
Bird flight speed	v	13	$m\,s^{-1}$	Width of windfarm	1	km		No of blades	3	b	
Flight type, flapping or gliding		0						Rotation speed	10	Ω	rpm
% of flights upwind/downwind		50.0%	50.0%					Max blade width	3.7	C	m
Nocturnal activity rank 1-5		2						Blade pitch	15	λ	degrees
Nocturnal activity rank 1-6	f_{night}	125%						Risk height range	42 - 180		m

Stage A				Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daytime bird density	D_A		birds/km^2	0.0019	0.0019	0.0019	0.0147	0.0147	0.0147	0.0147	0.0147	0.0019	0.0019	0.0019	0.0019	
Proportion at rotor risk height	Q_{2R}	7.50%														
At latitude 53.668		Daylight hours per month		250.2	273.0	366.3	419.2	492.7	509.0	511.8	459.9	382.8	329.2	259.9	234.1	4488.1
		Nightime hours per month		493.8	399.0	377.7	300.8	251.3	211.0	232.2	284.1	337.2	414.8	460.1	509.9	4271.9

Stage B					Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year total
No of Turbines	T	1															
Rotor radius	R	69	m														
		Total rotor frontal area m^2		14,957													
Nocturnal activity factor	f_{night}	125%															
Bird flight speed	v	13	$m\,s^{-1}$														
		Projected number of transits			0.4	0.4	0.6	5.3	6.2	6.4	6.4	5.8	0.6	0.5	0.4	0.4	**34**

Stage C								
No of blades	b	3		Bird Length	L	0.43	m	
Rotation speed	Ω	10	rpm	Wingspan	W	0.83	m	
Rotor radius	R	69	m	Bird flight speed	v	13	$m\,s^{-1}$	
Max blade width	C	3.7	m	Flight type		0		
Pitch	λ	15	degrees	% of flights upwind/downwind		50.0%	50.0%	
Blade profile		See Blade profile sheet						
		Single transit risk		upwind	7.1%			
				downwind	3.3%			
				weighted mean	5.2%			

Stage D			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year average
Prop time operating	Qop		85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	**85.0%**
		Collision rates before avoidance													Year total
			0.0	0.0	0.0	0.2	0.3	0.3	0.3	0.3	0.0	0.0	0.0	0.0	**1**

Stage E																
Allow for Large array correction?	1.0000	No														
Width of windfarm	w	1	km													
			large array correction		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	PerYear
					Collision rates allowing for avoidance												
Avoidance rates modelled		95.0%	100.0%		0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	**0.07**
		98.0%	100.0%		0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	**0.03**
		99.0%	100.0%		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.01**
		99.5%	100.0%		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.01**
		99.9%	100.0%		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**

		Value	Units			Value	Units			Value	Units
Bird data				**Windfarm data**				**Turbine data**			
Species name		Pink-footed goose		Site name	**Asland Walks**			Model	**2 MW Type**		
Bird Length	L	0.68	m	Latitude	53.668	degrees		Hub height	111		m
Wingspan	W	1.53	m	No of turbines	1			Rotor radius	69	R	m
Bird flight speed	v	16.8	m s^{-1}	Width of windfarm	1	km		No of blades	3	b	
Flight type, flapping or gliding		0						Rotation speed	10	Ω	rpm
% of flights upwind/downwind		50.0%	50.0%					Max blade width	3.7	C	m
Nocturnal activity rank 1-5		1						Blade pitch	15	λ	degrees
Nocturnal activity rank 1-6	f_{night}	0%						Risk height range	42 - 180		m

Stage A				Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daytime bird density	D_A		birds/km^2	0.7987	0.7987	0.7987	0	0	0	0	0	0.7987	0.7987	0.7987	0.7987	
Proportion at rotor risk height	Q_{2R}	90.83%														
At latitude 53.668		Daylight hours per month		250.2	273.0	366.3	419.2	492.7	509.0	511.8	459.9	382.8	329.2	259.9	234.1	4488.1
		Nightime hours per month		493.8	399.0	377.7	300.8	251.3	211.0	232.2	284.1	337.2	414.8	460.1	509.9	4271.9

Stage B																
No of Turbines	T	1														
Rotor radius	R	69	m													
		Total rotor frontal area m^2	14,957													
Nocturnal activity factor	f_{night}	0%														
Bird flight speed	v	17	m s^{-1}	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year total
		Projected number of transits		1,189.8	1,298.2	1,741.7	-	-	-	-	-	1,820.5	1,565.7	1,236.1	1,113.1	**9,965**

Stage C								
No of blades	b	3		Bird Length	L	0.68	m	
Rotation speed	Ω	10	rpm	Wingspan	W	1.53	m	
Rotor radius	R	69	m	Bird flight speed	v	16.8	m s^{-1}	
Max blade width	C	3.7	m	Flight type		0		
Pitch	λ	15	degrees	% of flights upwind/downwind		50.0%	50.0%	
Blade profile		See Blade profile sheet						
		Single transit risk	upwind	7.3%				
			downwind	4.3%				
			weighted mean	5.8%				

Stage D			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year average
Prop time operating	Qop		85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	**85.0%**
		Collision rates before avoidance													Year total
			58.9	64.3	86.2	0.0	0.0	0.0	0.0	0.0	90.1	77.5	61.2	55.1	**493**

Stage E																
Allow for Large array correction?	1.0000	No														
Width of windfarm	w	1	km													
			large array correction	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Per Year
				Collision rates allowing for avoidance												
Avoidance rates modelled		95.0%	100.0%	2.94	3.21	4.31	0.00	0.00	0.00	0.00	0.00	4.51	3.87	3.06	2.75	**24.66**
		98.0%	100.0%	1.18	1.29	1.72	0.00	0.00	0.00	0.00	0.00	1.80	1.55	1.22	1.10	**9.87**
		99.0%	100.0%	0.59	0.64	0.86	0.00	0.00	0.00	0.00	0.00	0.90	0.77	0.61	0.55	**4.93**
		99.5%	100.0%	0.29	0.32	0.43	0.00	0.00	0.00	0.00	0.00	0.45	0.39	0.31	0.28	**2.47**
		99.8%	100.0%	0.12	0.13	0.17	0.00	0.00	0.00	0.00	0.00	0.18	0.15	0.12	0.11	**0.99**

		Value	Units			Value	Units			Value	Units
Bird data				**Windfarm data**				**Turbine data**			
Species name		Shelduck		Site name	**Asland Walks**			Model	**2 MW Type**		
Bird Length	L	0.63	m	Latitude	53.668	degrees		Hub height	111		m
Wingspan	W	1.22	m	No of turbines	1			Rotor radius	69	R	m
Bird flight speed	v	15.4	m s^{-1}	Width of windfarm	1	km		No of blades	3	b	
Flight type, flapping or gliding		0						Rotation speed	10	Ω	rpm
% of flights upwind/downwind		50.0%	50.0%					Max blade width	3.7	C	m
Nocturnal activity rank 1-5		1						Blade pitch	15	λ	degrees
Nocturnal activity rank 1-6	f_{night}	0%						Risk height range	42 - 180		m

Stage A				Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daytime bird density	D_A		birds/km^2	0.0107	0.0107	0.0107	0.022	0.022	0.022	0.022	0.022	0.0107	0.0107	0.0107	0.0107	
Proportion at rotor risk height	Q_{2R}	44.00%														
At latitude 53.668		Daylight hours per month		250.2	273.0	366.3	419.2	492.7	509.0	511.8	459.9	382.8	329.2	259.9	234.1	4488.1
		Nightime hours per month		493.8	399.0	377.7	300.8	251.3	211.0	232.2	284.1	337.2	414.8	460.1	509.9	4271.9

Stage B					Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year total
No of Turbines	T	1															
Rotor radius	R	69	m														
		Total rotor frontal area m^2		14,957													
Nocturnal activity factor	f_{night}	0%															
Bird flight speed	v	15	m s^{-1}														
		Projected number of transits			7.1	7.7	10.4	24.4	28.7	29.6	29.8	26.8	10.8	9.3	7.4	6.6	**198**

Stage C								
No of blades	b	3		Bird Length	L	0.63	m	
Rotation speed	Ω	10	rpm	Wingspan	W	1.22	m	
Rotor radius	R	69	m	Bird flight speed	v	15.4	m s^{-1}	
Max blade width	C	3.7	m	Flight type		0		
Pitch	λ	15	degrees	% of flights upwind/downwind		50.0%	50.0%	
Blade profile		See Blade profile sheet						
		Single transit risk	upwind	7.3%				
			downwind	4.0%				
			weighted mean	5.7%				

Stage D		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year average
Prop time operating	Qop	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	**85.0%**
		Collision rates before avoidance												Year total
		0.3	0.4	0.5	1.2	1.4	1.4	1.4	1.3	0.5	0.4	0.4	0.3	**10**

Stage E															
Allow for Large array correction?	1.0000	No													
Width of windfarm	w	1	km												
			large array correction	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Per Year
				Collision rates allowing for avoidance												
Avoidance rates modelled		95.0%	100.0%	0.02	0.02	0.02	0.06	0.07	0.07	0.07	0.06	0.03	0.02	0.02	0.02	**0.48**
		98.0%	100.0%	0.01	0.01	0.01	0.02	0.03	0.03	0.03	0.03	0.01	0.01	0.01	0.01	**0.19**
		99.0%	100.0%	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	**0.10**
		99.5%	100.0%	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	**0.05**
		99.9%	100.0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.01**

Bird data		Value	Units		Windfarm data		Value	Units		Turbine data		Value	Units
Species name		Snipe			Site name		Asland Walks			Model		2 MW Type	
Bird Length	L	0.26	m		Latitude		53.668	degrees		Hub height		111	m
Wingspan	W	0.46	m		No of turbines		1			Rotor radius	R	69	m
Bird flight speed	v	17.1	m s^{-1}		Width of windfarm		1	km		No of blades	b	3	
Flight type, flapping or gliding		0								Rotation speed	Ω	10	rpm
% of flights upwind/downwind		50.0%	50.0%							Max blade width	C	3.7	m
Nocturnal activity rank 1-5		2								Blade pitch	λ	15	degrees
Nocturnal activity rank 1-6	f_{night}	125%								Risk height range		42 - 180	m

Stage A				Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daytime bird density	D_A		birds/km^2	0.002	0.002	0	0	0	0	0	0	0	0	0.002	0.002	
Proportion at rotor risk height	Q_{2R}	50.60%														
At latitude 53.668		Daylight hours per month		250.2	273.0	366.3	419.2	492.7	509.0	511.8	459.9	382.8	329.2	259.9	234.1	4488.1
		Nightime hours per month		493.8	399.0	377.7	300.8	251.3	211.0	232.2	284.1	337.2	414.8	460.1	509.9	4271.9

Stage B					Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year total
No of Turbines	T	1															
Rotor radius	R	69	m														
		Total rotor frontal area m^2		14,957													
Nocturnal activity factor	f_{night}	125%															
Bird flight speed	v	17	m s^{-1}														
		Projected number of transits			3.8	4.1	-	-	-	-	-	-	-	-	3.9	3.6	**15**

Stage C								
No of blades	b	3		Bird Length	L	0.26	m	
Rotation speed	Ω	10	rpm	Wingspan	W	0.46	m	
Rotor radius	R	69	m	Bird flight speed	v	17.1	m s^{-1}	
Max blade width	C	3.7	m	Flight type		0		
Pitch	λ	15	degrees	% of flights upwind/downwind		50.0%	50.0%	
Blade profile		See Blade profile sheet						
		Single transit risk		upwind	5.6%			
				downwind	2.6%			
				weighted mean	4.1%			

Stage D		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year average
Prop time operating	Qop	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	**85.0%**
		Collision rates before avoidance												Year total
		0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	**1**

Stage E															
Allow for Large array correction?	1.0000	No													
Width of windfarm	w	1	km												
			large array correction	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Per Year
				Collision rates allowing for avoidance												
Avoidance rates modelled		95.0%	100.0%	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	**0.03**
		98.0%	100.0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.01**
		99.0%	100.0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.01**
		99.5%	100.0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
		99.9%	100.0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**

		Value	Units			Value	Units			Value	Units
Bird data				**Windfarm data**				**Turbine data**			
Species name		Whooper swan		Site name	**Asland Walks**			Model	**2 MW Type**		
Bird Length	L	1.53	m	Latitude	53.668	degrees		Hub height	111		m
Wingspan	W	2.31	m	No of turbines	1			Rotor radius	69	R	m
Bird flight speed	v	17.3	m s^{-1}	Width of windfarm	1	km		No of blades	3	b	
Flight type, flapping or gliding		0						Rotation speed	10	Ω	rpm
% of flights upwind/downwind		50.0%	50.0%					Max blade width	3.7	C	m
Nocturnal activity rank 1-5		1						Blade pitch	15	λ	degrees
Nocturnal activity rank 1-6	f_{night}	0%						Risk height range	42 - 180		m

Stage A				Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daytime bird density	D_A		birds/km^2	0.1416	0.1416	0	0	0	0	0	0	0	0.1416	0.1416	0.1416	
Proportion at rotor risk height	Q_{2R}	31.19%														
At latitude 53.668		Daylight hours per month		250.2	273.0	366.3	419.2	492.7	509.0	511.8	459.9	382.8	329.2	259.9	234.1	4488.1
		Nightime hours per month		493.8	399.0	377.7	300.8	251.3	211.0	232.2	284.1	337.2	414.8	460.1	509.9	4271.9

Stage B					Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year total
No of Turbines	T	1															
Rotor radius	R	69	m														
		Total rotor frontal area m^2		14,957													
Nocturnal activity factor	f_{night}	0%															
Bird flight speed	v	17	m s^{-1}		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year total
		Projected number of transits			74.6	81.4	-	-	-	-	-	-	-	98.2	77.5	69.8	**401**

Stage C								
No of blades	b	3		Bird Length	L	1.53	m	
Rotation speed	Ω	10	rpm	Wingspan	W	2.31	m	
Rotor radius	R	69	m	Bird flight speed	v	17.3	m s^{-1}	
Max blade width	C	3.7	m	Flight type		0		
Pitch	λ	15	degrees	% of flights upwind/downwind		50.0%	50.0%	
Blade profile		See Blade profile sheet						
		Single transit risk	upwind	9.8%				
			downwind	6.8%				
			weighted mean	8.3%				

Stage D			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year average
Prop time operating	Qop		85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	**85.0%**
			Collision rates before avoidance												Year total
			5.3	5.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.0	5.5	4.9	**28**

Stage E																
Allow for Large array correction?	1.0000	No														
Width of windfarm	w	1	km													
			large array		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Per Year
			correction		Collision rates allowing for avoidance												
Avoidance rates modelled		95.0%	100.0%		0.26	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.35	0.27	0.25	**1.42**
		98.0%	100.0%		0.11	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.11	0.10	**0.57**
		99.0%	100.0%		0.05	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.05	0.05	**0.28**
		99.5%	100.0%		0.03	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.03	0.02	**0.14**
		99.8%	100.0%		0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	**0.06**

ANNEX 3: COLLISION RISK ESTIMATE FOR PINK-FOOTED GEESE USING THE ALTERNATIVE NATURESCOT APPROACH FOR SMALL SCALE WIND FARMS

Estimated number of collisions at a proposed wind farm between 4.6km and 10km from SPA boundary

Turbine maximum tip height (m)	179.64
Turbine blade length (m)	69
Number of turbines	1

Calculation

1. Height of the risk zone around one turbine (m)	179.64
2. Width of the risk zone around one turbine (m)	538
3. Frontal area of the risk window at one turbine (m^2)	96646.32
4. Area of the rotor disc (m^2)	14957.1576
5. Proportion of the risk window occupied by the rotor disc	0.1548
6. Mean number of geese per hour passing the site, per km^2	26.03
7. Area of the risk zone around one turbine (km^2)	0.2273
8. Mean number of geese per hour passing through the risk zone around one turbine	5.92
9. Number of goose-active hours in the goose wintering season	3075
10. Total number of geese passing through the risk window	18196
11. Number of geese passing through rotor disc	2816
12. Proportion of geese passing through rotors likely to collide, from Band model (link in guidance)	0.100
13. Estimated number of collisions per turbine per year, in the absence of avoidance	282
14. Estimated number of collisions per turbine per year, assuming 99.8% avoidance	0.56
15. Estimated total number of collisions per year from all turbines, assuming 99.8% avoidance	**0.56**