



Galileo 03 Ltd.

# Mynydd Ty-talwyn Energy Park - Environmental Statement Volume III

Appendix 11.3: Ornithology Collision Risk Modelling Report

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**RSK**

# RSK GENERAL NOTES

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Galileo 03 Ltd.

Mynydd Ty-talwyn Energy Park – Environmental Statement Volume III  
663870

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# 1.0 INTRODUCTION

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## 1.1 Purpose of this Report

- 1.1.1 This report has been prepared by RSK Biocensus on behalf of Galileo 03 Ltd (part of Galileo Empower UK Ltd) (hereinafter referred to as 'Galileo' or the 'Applicant'). It presents the methodology and results of ornithological collision risk modelling undertaken in relation to the proposed construction, operation and subsequent decommissioning, of up to six wind turbines, ground mounted solar photovoltaic (PV) modules, one project substation, and ancillary infrastructure works (hereafter referred to as 'the Proposed Development'). This report forms a technical appendix to the **Environmental Statement (ES) Volume II, Chapter 11: Ornithology** for the Proposed Development and has been produced using field survey data presented in **ES Volume III, Appendix 11.1: 2021 – 2023 Ornithology Report**.
- 1.1.2 The collision risk modelling study presented in this report was undertaken order to identify the potential impacts of the Proposed Development on target bird species through collisions with new wind turbines, and to inform any requirement for mitigation measures.
- 1.1.3 This study has been prepared in reference to current good practice guidance, using field data from monthly Vantage Point (VP) surveys undertaken between 2021 and 2023. Methods for these surveys are detailed by Avian Ecology in **ES Volume III, Appendix 11.1: 2021 – 2023 Ornithology Report**.

## 1.2 Site Context

- 1.2.1 The Proposed Development Site (hereafter referred to as 'the Site'), covering approximately 578 hectares (ha), is located approximately 4 km north of Bridgend and approximately 8 km east of Port Talbot as shown on **Figure 1**. The Site predominantly comprises grassland fields bordered by hedgerows, with smaller areas of woodland, scrub, fen marsh and swamp. Several watercourses extend through the Site, and grassland management includes grazing by sheep and cows, with some areas mown for silage. The Site is situated within a largely agricultural landscape interspersed with smaller woodland and residential areas.
- 1.2.2 A desk-based search was undertaken for designated sites for features of ornithological interest (notably Special Protection Areas (SPAs) and Ramsar sites) within 10 km of the Site Boundary (RSK Biocensus, 2023) as shown on **Figure 2**.

## 1.3 Key Guidance

- 1.3.1 This collision risk modelling study has been undertaken in reference to current key industry standard guidance including that provided by SNH (now NatureScot), which is also considered relevant to Wales, this includes:
- Recommended bird survey methods to inform impact assessment of onshore wind farms (SNH, 2017);
  - Wind farms and birds: Calculating a theoretical collision risk assuming no avoiding action (SNH, 2000);

- Avoidance Rates for the onshore SNH Wind Farm Collision Risk Model (SNH, 2018);
- Using a collision risk model to assess bird collision risks for onshore wind farms (Band, 2024). NatureScot Research Report 909;
- Guidance on using an updated collision risk model to assess bird collision risk at onshore wind farms (NatureScot, 2024); and
- The status of our bird populations: the fourth Birds of Conservation Concern in Wales (Johnstone et al., 2022).

1.3.2 Any deviations from the standard approaches specified in the above good practice guidance, and any additional assumptions, are highlighted in the relevant sections of this report.

## 2.0 DEVELOPMENT DESIGN

### 2.1 Wind Farm and Turbine Specification

- 2.1.1 Collision risk modelling within this report has been based on wind element of the Proposed Development and turbine specifications provided in **Table 1** below. It is understood that the turbines will have an operational lifespan of 50 years.

**Table 1: Energy Park and Turbine Technical Specifications**

| Specification                                                                                                                          | Value                        |
|----------------------------------------------------------------------------------------------------------------------------------------|------------------------------|
| Name of Energy Park                                                                                                                    | Mynydd Ty-talwyn Energy Park |
| Turbine                                                                                                                                | Nordex 163                   |
| Central latitude                                                                                                                       | 56.1                         |
| Width of Energy Park (km)                                                                                                              | 2.4                          |
| Number of turbines within the Proposed Development                                                                                     | 6                            |
| Number of blades per turbine                                                                                                           | 3                            |
| Hub height (m)                                                                                                                         | 118.5                        |
| Rotor radius (m)                                                                                                                       | 81.5                         |
| Rotation speed (rpm)                                                                                                                   | 8*                           |
| Maximum blade width (m)                                                                                                                | 4.17                         |
| Blade pitch (°)                                                                                                                        | 15                           |
| Average proportion of time operational (%)                                                                                             | 85**                         |
| *An average rpm has been used due to variation in rotation speed in high/low wind periods                                              |                              |
| **Default value recommend by NatureScot for estimated operational time of a wind farm whereby periods of inactivity will be necessary. |                              |

### 2.2 The Proposed Development

- 2.2.1 The Proposed Development comprises the construction and operation of up to six wind turbines, ground mounted solar photovoltaic (PV) modules, one project substation, and ancillary infrastructure works. The Site is indicated in **ES Volume IV, Figure 1.2: Planning Application Boundary**. Although there are three candidate turbines identified for the Proposed Development, collision risk modelling has been undertaken using the specifications for the Nordex 163 turbine model (the largest rotor diameter of the candidate turbines); relevant specifications of which are presented in **Section 2.1**.
- 2.2.2 The use of this model is anticipated to provide a sufficiently precautionary estimate for the collision mortality of key ornithological features should a similar alternative model be used.

## 3.0 METHODOLOGY

### 3.1 Survey Methods

- 3.1.1 Field data used for collision risk modelling were collected during VP surveys undertaken at the Site in 2021 to 2023 inclusive. Survey locations, methods and effort are described in full in **ES Volume III, Appendix 11.1: 2021 – 2023 Ornithology Report**. Detailed viewshed analysis of these locations was also undertaken to produce the total visible survey area coverage as shown in **Figure 3**.
- 3.1.2 VP surveys were undertaken in accordance with good practice guidance (SNH, 2017) in order to record bird flight activity throughout the Site year-round for two years: Year 1 (November 2021 to October 2022 inclusive), and Year 2 (November 2022 to October 2023 inclusive). As such, data were collected during the breeding season, winter season and during the spring and autumn passage periods. Three VPs were surveyed from, with survey effort exceeding the recommended minimum of 72 hours per year specified by good practice guidance (SNH, 2017). Survey effort for each VP during the two years surveyed is summarised in **Table 2** below.

**Table 2: Summary of VP Survey Effort**

| VP | Hours of observation |     |      |     |        |     |     |     |     |     |            |     | Total  |
|----|----------------------|-----|------|-----|--------|-----|-----|-----|-----|-----|------------|-----|--------|
|    | 2021                 |     | 2022 |     |        |     |     |     |     |     |            |     |        |
|    | NB 2021/22           |     |      |     | B 2022 |     |     |     |     |     | NB 2022/23 |     |        |
|    | Nov                  | Dec | Jan  | Feb | Mar    | Apr | May | Jun | Jul | Aug | Sep        | Oct | Year 1 |
| 1  | 3                    | 6   | 3    | 12  | 12     | 6   | 6   | 3   | 6   | 9   | 6          | 6   | 78     |
| 2  | 3                    | 6   | 6    | 9   | 12     | 9   | 9   | 3   | 9   | 0   | 6          | 6   | 78     |
| 3  | 3                    | 9   | 3    | 9   | 12     | 6   | 6   | 3   | 15  | 9   | 6          | 6   | 87     |
| VP | Hours of observation |     |      |     |        |     |     |     |     |     |            |     | Total  |
|    | 2022                 |     | 2023 |     |        |     |     |     |     |     |            |     |        |
|    | NB 2022/23           |     |      |     | B 2023 |     |     |     |     |     | NB 2023/24 |     |        |
|    | Nov                  | Dec | Jan  | Feb | Mar    | Apr | May | Jun | Jul | Aug | Sep        | Oct | Year 2 |
| 1  | 6                    | 6   | 6    | 6   | 6      | 9   | 6   | 6   | 9   | 9   | 6          | 6   | 81     |
| 2  | 0                    | 6   | 12   | 6   | 6      | 9   | 6   | 6   | 9   | 9   | 6          | 6   | 81     |
| 3  | 6                    | 6   | 6    | 6   | 6      | 9   | 6   | 6   | 9   | 9   | 6          | 6   | 81     |

## Recording of Flight Data

- 3.1.3 Parameters for target species observed flying within or in close proximity to the Site were recorded to enable collision risk modelling. Parameters recorded were as follows:
- Start time of flight observation;
  - Duration of flight observation;
  - Species and number of individuals;
  - Approximate height of flight in metres, with the time spent in each flight height category; and
  - The likely purpose of the flight (e.g. foraging, displaying, commuting, etc).
- 3.1.4 The following flight height categories were used during the VP surveys undertaken between November 2021 and March 2023 inclusive:
- HT1: 0-60 m;
  - HT2: 61-90 m;
  - HT3: 91-180 m;
  - HT4: 181-200 m; and
  - HT5: >200 m.
- 3.1.5 Based on emerging design information, the following flight height categories were used during the VP surveys undertaken between April and October 2023 inclusive (i.e., to account for a potential increase in turbine tip height):
- HT1: 0-40 m;
  - HT2: 41-90 m;
  - HT3: 91-180 m;
  - HT4: 181-200 m;
  - HT5: 201-280 m; and
  - HT6: >280 m.
- 3.1.6 Based on the turbine specifications described in **Section 2.1**, a turbine swept range of 37-200 m for the Nordex 163 turbine blades is identified. Therefore, the flight records included within collision risk modelling would be those recorded at flight heights within the rotor swept area, this would correspond to categories HT1 – HT4 used within both scenarios described above.

## 3.2 Collision Risk Modelling Overview

- 3.2.1 This section presents the methods used for collision risk modelling, including survey coverage, identification of target species and collision risk model selection.
- 3.2.2 Collision risk modelling was undertaken using the standard approach described in the good practice guidance and calculation tools specified in **Section 1.3**.
- 3.2.3 Collision risk modelling is essentially a six-stage process:

- Stage A: Initial modelling uses field survey data on bird flight activity, in the absence of displacement, avoidance or attraction effects to the wind farm, to estimate the number of birds at risk from the proposed wind farm through the calculation of monthly bird densities within the total VP survey viewshed, factoring in species underrepresentation due to nocturnal activity and consideration of the proportion of birds within the density calculations which would be flying at collision risk height. Estimates of aerial density were produced for the VP survey results for each VP location with an average generated for bird occupancy present within the airspace of each associated viewshed within a survey year;
- Stage B: Modelling then follows the principle that the total number of bird transits expected through the wind farm rotors is proportional to the number and cross-sectional area of the rotors, and to the density of birds in the airspace at risk height. Therefore, Stage B estimates the monthly and yearly number of bird transits potentially flying through rotors during the survey period through use of Aerial density outputs from Stage A, turbine specifications, bird flight speed and nocturnal activity factors;
- Stage C: Following on from the estimation of the number of transits, Stage C aims to use the turbine specifications and species biometrics to estimate the risk of collision of a bird flying through a rotating turbine blade. Stage C evaluates the probability of collision if a bird passes at random at any point through the rotor disk on a flight path perpendicular to the rotor plane with the assumption of no influence from alternative angles of approach, turbulence and slipstream effects. Probability of wind direction and potential bias from upwind and down-wind flights are also factored into the model. If no influence from predominant wind direction is anticipated an equal probability of upwind and downwind flights is used. Further consideration of the blade profile is made through measurements of chord width using 5% intervals along the length of the blade from the turbine hub. An average collision risk probability is then generated for the passage of a bird at any point across the rotor;
- Stage D: Stage D multiplies the outputs of the number of flights through rotors across the wind farm (Stage B) and calculated risk of collision for a single bird transit through a rotor (Stage C). An estimate of total potential collision risk is produced when adjusted to factor in the proportion of time the wind farm turbines are operational;
- Stage E: Previous calculations assume no avoiding action is taken in response to turbine operation. Stage E applies a standard avoidance rate percentage (e.g. 98%) or avoidance rates provided in referenced literature to determine the potential collision risk mortality outlined in Stage D, inclusive of avoidance rates. Further consideration should be given for attraction effects from wind farm infrastructure, which may pose additional risk to birds. Where the wind farm is arranged in rows and collision risk is additive, an additional large array correction is also provided where birds may pass through the early rows of the array and therefore also be exposed to later rows; and
- Stage F: Stage F outlines the potential variability and uncertainty inherent in mathematical modelling. The output of Stage E should convey the uncertainty in a collision risk estimate by indicating the results are a best estimate with a range of confidence around that estimate reflecting variability due to flight activity data,

nocturnal data confidence, variability of bird dimensions and flight speed, simplification of turbine profile in the model and any unconfirmed designs.

### 3.3 Target Species

- 3.3.1 Selection of target species for VP surveys undertaken in 2021-2023 inclusive is described in detail in **ES Volume III, Appendix 11.1: 2021 – 2023 Ornithology Report**. In summary, the following species were identified as target species:
- All species of raptor included on EC Birds Directive Annex 1, Schedule 1 of the Wildlife and Countryside Act (WCA) 1981 (as amended) and the Birds of Conservation Concern (BoCC) Red List (Stanbury *et al.*, 2021); and
  - All species of wader, swan, goose and duck (excluding mallard (*Anas platyrhynchos*) and feral species).
- 3.3.2 In addition, consideration was given to the inclusion of secondary species within collision risk modelling. Secondary species recorded during VP surveys were:
- Common raptor species (i.e., those not covered by the legislation and conservation status criteria described above in relation to target raptor species);
  - All species of gull;
  - Feral species;
  - Mallard;
  - Raven (*Corvus corax*); and
  - Passerine species included on Schedule 1 of the WCA 1981 (as amended) and the BoCC Red List.
- 3.3.3 Based on the results of the VP surveys, nine species were included in the collision risk modelling exercise, as outlined in **Table 3** below.

**Table 3: Species Included in Collision Risk Modelling**

| Species       | Justification for inclusion                                                                                                                                                                                                                                                                                                               |
|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Barn owl      | Regarded as an increasing and widely distributed resident species of conservation concern due to its inclusion on Schedule 1 of the WCA 1981 (as amended) and the BoCC4 Wales Green List. Limited observations with a low number of flight seconds but included on a precautionary basis due to its legislative status.                   |
| Golden plover | Regarded as a widely distributed but declining resident species of conservation concern in Wales due to its inclusion on Annex 1 of the Birds Directive and BoCC4 Wales Red List. Limited observations with a low number of flight seconds but included on a precautionary basis due to the declining conservation status of the species. |
| Hen harrier   | A resident species of high conservation importance in Wales due to its inclusion on Schedule 1 of the WCA 1981 (as                                                                                                                                                                                                                        |

| Species   | Justification for inclusion                                                                                                                                                                                                                                                                                                              |
|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|           | amended), Annex 1 of the Birds Directive, Section 7 of the Environment (Wales) Act and BoCC4 Wales Red List. Limited observations with a low number of flight seconds but included on a precautionary basis due to the legislative and conservation status of the species.                                                               |
| Lapwing   | A resident species of high conservation importance in Wales due to its inclusion on Annex 1 of the Birds Directive, Section 7 of the Environment (Wales) Act and BoCC4 Wales Red List. Frequently observed with a high number of flight seconds during the breeding and non-breeding seasons.                                            |
| Merlin    | A resident species of high conservation importance in Wales due to its inclusion on Schedule 1 of the WCA 1981 (as amended), Annex 1 of the Birds Directive and BoCC4 Wales Red List. Limited observations and flight seconds but included on a precautionary basis due to the legislative and conservation status of the species.       |
| Peregrine | An increasing resident species of conservation concern in Wales due to its inclusion on Schedule 1 of the WCA 1981 (as amended), Annex 1 of the Birds Directive and BoCC4 Wales Green List. Limited observations and flight seconds but included on a precautionary basis due to the legislative and conservation status of the species. |
| Red kite  | An increasingly widespread resident species of high conservation importance in Wales due to its inclusion on Annex 1, Schedule 1 of the WCA 1981 (as amended) and BoCC4 Wales Green List. Frequently observed with a large number of flight seconds during the breeding and non-breeding seasons.                                        |
| Teal      | Widespread species in Wales during the non-breeding season but of conservation importance due to its inclusion on BoCC4 Wales Amber List. Limited observations and flight seconds but included on a precautionary basis due to the conservation status of the species.                                                                   |

- 3.3.4 Whilst consideration was given to other species (including cormorant, grey heron, kestrel, little egret and mallard), on account of the level of activity recorded on-site, classification as secondary species and/or the potential sensitivity of these species to collision impacts, collision risk modelling was not undertaken for these species.
- 3.3.5 To maximise the accuracy of collision risk modelling outputs, collision risk calculations were undertaken for a duration of time appropriate to the species in question. Collision risk modelling requires the typical measurements and flight

parameters of modelled species. Additional consideration is given in Stage B through the use of a nocturnal activity rating to adjust the model for species potentially underrepresented from VP surveys during the survey period. Relevant data for modelled species based on existing literature are detailed in **Table 4** below.

**Table 4: Species Information for Target Species Included in Collision Risk Modelling**

| Species       | Average body length (m) | Average wingspan (m) | Average flight speed (m/s) | Nocturnal activity rating* | Data sources                                                                                                   |
|---------------|-------------------------|----------------------|----------------------------|----------------------------|----------------------------------------------------------------------------------------------------------------|
| Barn owl      | 0.36                    | 0.87                 | 7.7                        | 5                          | Collins (2023); Cheney et al. (2020)                                                                           |
| Golden plover | 0.27                    | 0.56                 | 17.9                       | 3                          | Collins (2023); Alerstam et al. (2007). Grey plover biometrics used                                            |
| Hen harrier   | 0.47                    | 1.13                 | 9.1                        | 1                          | Collins (2023); Alerstam et al. (2007); Bruderer & Boldt (2001)                                                |
| Kestrel       | 0.34                    | 0.76                 | 9.95                       | 1                          | BTO BirdFacts (2023); Hawk & Owl Trust (2023); Robinson (2005); Snow & Perrins (1998); Bruderer & Boldt (2001) |
| Lapwing       | 0.3                     | 0.7                  | 12.3                       | 2                          | Collins (2023); Alerstam et al. (2007); Bruderer & Boldt (2001), Gillings and Sutherland (2007)                |
| Merlin        | 0.29                    | 0.62                 | 12.8**                     | 1                          | Collins (2023); Alerstam et al. (2007)                                                                         |
| Peregrine     | 0.42                    | 1.02                 | 12.1                       | 1                          | BTO BirdFacts (2023); Alerstam et al. (2007)                                                                   |
| Red kite      | 0.63                    | 1.85                 | 10                         | 1                          | Collins (2023); Alerstam et al.                                                                                |

| Species                                                                                                                                                                                                                                                                                                                                                                    | Average body length (m) | Average wingspan (m) | Average flight speed (m/s) | Nocturnal activity rating* | Data sources                           |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|----------------------|----------------------------|----------------------------|----------------------------------------|
|                                                                                                                                                                                                                                                                                                                                                                            |                         |                      |                            |                            | (2007); Bruderer & Boldt (2001)        |
| Teal                                                                                                                                                                                                                                                                                                                                                                       | 0.36                    | 0.56                 | 19.7                       | 1                          | Collins (2023); Alerstam et al. (2007) |
| <p>*Nocturnal activity rating is defined as a value between one to five given in collision risk modelling for the degree at which a species is expected to be active during dusk or overnight whereby one is entirely inactive and five is entirely active during this period.</p> <p>**Adapted flight speed from Red footed falcon provided in Alerstam et al. (2007)</p> |                         |                      |                            |                            |                                        |

### 3.4 Aerial Density

- 3.4.1 NatureScot has published one consistent model for assessing flight activity. This model relies on the calculation of aerial density for individual species. Viewshed analysis as detailed in **Section 3.1.1** of the three VP's assessed during the survey period identified a total viewshed area of 8.82 km<sup>2</sup>. In Stage A, the total viewshed area and monthly survey effort at the VP's (as shown in **Table 2**) was used to calculate the monthly aerial densities (birds per km<sup>2</sup>) for each target species included in the collision risk modelling.

### 3.5 Rotor Transit Collision Risk

- 3.5.1 The aerial density values for each species calculated in Stage A is factored into the model to produce an estimated number of monthly transits whereby the species assessed would fly directly through the volume of the turbine rotors in Stage B, and therefore be at risk of collision. Following this, detailed turbine specifications provided in **Table 1** and species biometrics outlined in **Table 4** were factored into the model in Stage C, to produce an estimate of the number of transits of a species that would be at direct risk of collision due to the Proposed Development.
- 3.5.2 Wind turbines are not typically operational throughout the entirety of the year due to minimum/maximum wind thresholds not being suitable for operational activity, regular maintenance or scheduled curtailment. Therefore, further consideration should be given for the operational time of the Proposed Development in the model. This was considered in Stage D, whereby a percentage of operational time per month is provided to produce an average operational time whereby a species would potentially be at risk of collision with the turbines, to estimate a proportion of the total bird transits which would occur during the operational phase of the Proposed Development.

### 3.6 Avoidance Rates

- 3.6.1 Stage E of collision risk modelling takes account of the understanding that birds will often take action to avoid collision with wind turbines, either by avoiding the wind farm entirely (i.e., displacement), by flying above or below operational turbines, or by performing emergency manoeuvres to avoid moving turbine blades.
- 3.6.2 Avoidance rates are generally derived by comparing data on actual observed collisions with the predicted no-avoidance collision estimate. SNH 'Avoidance Rates for the onshore SNH Wind Farm Collision Risk Model' (SNH, 2018) collates species-specific estimates of avoidance rates from a range of information sources to determine estimates of avoidance that should be used for bird species included in the collision risk modelling.
- 3.6.3 Avoidance rates used are indicated in **Table 5** below. As per SNH guidance (SNH, 2018), a default avoidance rate of 98% has been applied for species for which a specific avoidance rate is not specified (due to a lack of empirical evidence to the contrary).

**Table 5: Avoidance rates for target species (SNH, 2018)**

| Species       | Avoidance rate |
|---------------|----------------|
| Barn owl      | 98%            |
| Golden plover | 98%            |
| Hen harrier   | 99%            |
| Kestrel       | 95%            |
| Lapwing       | 98%            |
| Merlin        | 98%            |
| Peregrine     | 98%            |
| Red kite      | 99%            |
| Teal          | 98%            |

### 3.7 Limitations and Assumptions

- 3.7.1 This report is based on field data collected during VP surveys undertaken at the Site in 2021-2023 inclusive. Limitations of these field data are discussed in the **ES Volume III, Appendix 11.1: 2021 – 2023 Ornithology Report**.
- 3.7.2 As stated in **Section 3.2**, collision risk modelling assumes all bird collisions with turbines will be fatal during transits, which may not necessarily be the case. On a precautionary basis, all birds flying between the rotor swept area for the Nordex 163 model between 37 m and 200 m would be included within collision risk modelling. Despite this, as the data recorded by Avian Ecology is recorded in flight bands whereby HT1 overlaps this threshold, all flight lines within this flight band have been

included in the modelling. As such, based on these assumptions and methods, collision risk modelling is considered to represent a conservative scenario of collision fatalities.

- 3.7.3 Modelling considers the potential effects from the presence of a prevailing wind direction which could impair or improve movement through a turbine during an individual transit of a bird. As no prevailing wind direction was identified during the surveys, good practice guidance from NatureScot states a standard 50:50 ratio for the proportion of transits upwind or downwind should be used (NatureScot, 2024).
- 3.7.4 A nocturnal activity factor is applied within the model to adjust aerial density estimates for species potentially underrepresented by VP surveys which require survey during daylight periods and, therefore, are limited in the assessment of crepuscular (i.e., active at dawn and/or dusk) or nocturnal species (e.g. barn owl). Professional judgement and relevant literature has been used in this assessment to assign values for the level at which a species may be active at sunrise, sunset and overnight.
- 3.7.5 Collision risk modelling assumes bird activity observed during the VP surveys is representative of the Site, in the absence of the Proposed Development. It does not account for any displacement of birds which may result from the physical presence of the turbines and other associated infrastructure, which may reduce the levels of bird activity within the turbine area during the operational phase. This represents an additional contributory factor to the precautionary nature of the collision risk modelling calculations.

## 4.0 RESULTS

- 4.1.1 Flight times for target species within collision risk range were calculated as the number of birds observed within the viewshed at collision risk height (see **Section 3.1**) during each observation, multiplied by the number of seconds spent within the rotor swept area. For example, two birds flying at a height of 80 m for 15 seconds would constitute 30 flight seconds within collision risk height.
- 4.1.2 The following flight seconds for each target species at collision risk height were recorded within the WFA (as provided in full in **Annex A**):
- Barn owl: 75 seconds;
  - Golden plover: 120 seconds;
  - Hen harrier: 160 seconds;
  - Kestrel: 765 seconds;
  - Lapwing: 8,910 seconds;
  - Merlin: 180 seconds;
  - Peregrine: 45 seconds;
  - Red kite: 59,415 seconds; and
  - Teal: 1,980 seconds.
- 4.1.3 Flight observations for target species recorded during the VP surveys are shown in **Figures 4.1, 4.2, 5.1 and 5.2**. Species-specific collision risk models for each target species are summarised below. Collision risk modelling analysis is summarized in **Annex B**.

### 4.2 Barn Owl

- 4.2.1 As a crepuscular species, barn owl was infrequently recorded during the VP surveys undertaken between 2021 and 2023, with one observation at collision risk height within the VP survey area in December 2021 totalling 75 flight seconds.
- 4.2.2 Based on the blade profile, measurements and flight parameters for the Nordex 163 turbine described in **Table 1**, and the bird biometrics described in **Table 4**, the flight seconds recorded would be equivalent to two and zero transits through the collision risk window of the turbines in 2021/22 and 2022/23 respectively. Using the turbine specifications and species biometrics, the probability of a barn owl flying through an operational turbine resulting in a collision during a single transit, in the absence of any avoiding actions is 5.95%.
- 4.2.3 Therefore, in the absence of any avoiding actions, the average estimated number of barn owl fatalities per year (based on the 2021-2023 data) whilst the turbines are operational is 0.105 and 0.000 birds per year for 2021/22 and 2022/23 respectively.
- 4.2.4 Taking into consideration an avoidance rate of 98% (in line with SNH guidance), the average estimated number of annual barn owl collision fatalities is 0.001 birds. This would equate to an estimated 0.052 collision fatalities over the anticipated lifespan of the Energy Park (50 years). Collision risk modelling for barn owl is summarised in **Table 6** below.

**Table 6: Barn Owl Collision Risk Model Summary**

| Period             | Avoidance Rate (%) | Estimated Collision Fatalities |          |
|--------------------|--------------------|--------------------------------|----------|
|                    |                    | Per Year                       | 50 Years |
| Year 1 (2021-2022) | 98                 | 0.002                          | 0.105    |
| Year 2 (2022-2023) | 98                 | 0.000                          | 0.000    |
| Average            | N/A                | 0.001                          | 0.052    |

### 4.3 Golden Plover

- 4.3.1 A predominantly diurnal species capable of foraging at night on farmland and grasslands, golden plover were infrequently recorded during the VP surveys undertaken between 2021 and 2023, with one observation at collision risk height within the VP survey area in December 2022 totalling 120 flight seconds.
- 4.3.2 Based on the blade profile, measurements and flight parameters for the Nordex 163 turbine described in **Table 1**, and the bird biometrics described in **Table 4**, the flight seconds recorded would be equivalent to zero and five transits through the collision risk window of the turbines in 2021/22 and 2022/23 respectively. Using the turbine specifications and species biometrics, the probability of a golden plover flying through an operational turbine resulting in a collision during a single transit, in the absence of any avoiding actions, is 3.31%.
- 4.3.3 Therefore, in the absence of any avoiding actions, the average estimated number of golden plover fatalities per year (based on the 2021-2023 data) whilst the turbines are operational is 0.000 and 0.136 birds per year for 2021/22 and 2022/23 respectively.
- 4.3.4 Taking into consideration an avoidance rate of 98% (in line with SNH guidance), the average estimated number of annual golden plover collision fatalities is 0.001. This would equate to an estimated 0.068 collision fatalities over the anticipated lifespan of the Energy Park (50 years). Collision risk modelling for golden plover is summarised in **Table 7**.

**Table 7: Golden Plover Collision Risk Model Summary**

| Period             | Avoidance Rate (%) | Estimated Collision Fatalities |          |
|--------------------|--------------------|--------------------------------|----------|
|                    |                    | Per Year                       | 50 Years |
| Year 1 (2021-2022) | 98                 | 0.000                          | 0.000    |
| Year 2 (2022-2023) | 98                 | 0.003                          | 0.136    |
| Average            | N/A                | 0.001                          | 0.068    |

## 4.4 Hen Harrier

- 4.4.1 A diurnal species, hen harrier were infrequently recorded during the VP surveys undertaken between 2021 and 2023, with four observations at collision risk height within the VP survey area in January and October 2023 totalling 160 flight seconds.
- 4.4.2 Based on the blade profile, measurements and flight parameters for the Nordex 163 turbine described in **Table 1**, and the bird biometrics are described in **Table 4**, the flight seconds recorded would be equivalent to zero and ten transits through the collision risk window of the turbines in 2021/22 and 2022/23 respectively. Using the turbine specifications and species biometrics, the probability of a hen harrier flying through an operational turbine resulting in a collision during a single transit, in the absence of any avoiding actions, is 5.66%.
- 4.4.3 Therefore, in the absence of any avoiding actions, the average estimated number of hen harrier fatalities per year (based on the 2021-2023 data) whilst the turbines are operational is 0.000 and 0.0080 birds per year for 2021/22 and 2022/23 respectively.
- 4.4.4 Taking into consideration an avoidance rate of 99% (in line with SNH guidance), the average estimated number of annual hen harrier collision fatalities is <0.001. This would equate to an estimated 0.020 collision fatalities over the anticipated lifespan of the Energy Park (50 years). Collision risk modelling for hen harrier is summarised in **Table 8** below.

**Table 8: Hen Harrier Collision Risk Model Summary**

| Period             | Avoidance Rate (%) | Estimated Collision Fatalities |          |
|--------------------|--------------------|--------------------------------|----------|
|                    |                    | Per Year                       | 50 Years |
| Year 1 (2021-2022) | 99                 | 0.000                          | 0.000    |
| Year 2 (2022-2023) | 99                 | 0.001                          | 0.040    |
| Average            | N/A                | 0.001                          | 0.020    |

## 4.5 Kestrel

- 4.5.1 A diurnal species, kestrel were infrequently recorded during the VP surveys undertaken between 2021 and 2023, with one observation at collision risk height within the VP survey area in August 2023 totalling 765 flight seconds.
- 4.5.2 Based on the blade profile, measurements and flight parameters for the Nordex 163 turbine described in **Table 1**, and the bird biometrics described in **Table 4**, the flight seconds recorded would be equivalent to zero and two transits through the collision risk window of the turbines in 2021/22 and 2022/23 respectively. Using the turbine specifications and species biometrics, the probability of a kestrel flying through an operational turbine resulting in a collision during a single transit, in the absence of any avoiding actions, is 5.66%.
- 4.5.3 Therefore, in the absence of any avoiding actions, the average estimated number of kestrel fatalities per year (based on the 2021-2023 data) whilst the turbines are operational is 0.000 and 0.080 birds per year for 2021/22 and 2022/23 respectively.

- 4.5.4 Taking into consideration an avoidance rate of 95% (in line with SNH guidance), the average estimated number of annual kestrel collision fatalities is 0.010. This would equate to an estimated 0.483 collision fatalities over the anticipated lifespan of the Energy Park (50 years). Collision risk modelling for kestrel is summarised in **Table 9** below.

**Table 9: Kestrel Collision Risk Model Summary**

| Period             | Avoidance Rate (%) | Estimated Collision Fatalities |          |
|--------------------|--------------------|--------------------------------|----------|
|                    |                    | Per Year                       | 50 Years |
| Year 1 (2021-2022) | 95                 | 0.000                          | 0.000    |
| Year 2 (2022-2023) | 95                 | 0.019                          | 0.966    |
| Average            | N/A                | 0.010                          | 0.483    |

## 4.6 Lapwing

- 4.6.1 A predominantly diurnal species capable of foraging at night on farmland and grasslands, lapwing were occasionally recorded during the VP surveys undertaken between 2021 and 2023, with 31 observations at collision risk height within the VP survey area across both survey years totalling 8,910 flight seconds.
- 4.6.2 Based on the blade profile, measurements and flight parameters for the Nordex 163 turbine described in **Table 1**, and the bird biometrics described in **Table 4**, the flight seconds recorded would be equivalent to 33 and three transits through the collision risk window of the turbines in 2021/22 and 2022/23 respectively. Using the turbine specifications and species biometrics, the probability of a lapwing flying through an operational turbine resulting in a collision during a single transit, in the absence of any avoiding actions, is 3.98%.
- 4.6.3 Therefore, in the absence of any avoiding actions, the average estimated number of lapwing fatalities per year (based on the 2021-2023 data) whilst the turbines are operational is 1.127 and 0.112 birds per year for 2021/22 and 2022/23 respectively.
- 4.6.4 Taking into consideration an avoidance rate of 98% (in line with SNH guidance), the average estimated number of annual lapwing collision fatalities is 0.012. This would equate to an estimated 0.620 collision fatalities over the anticipated lifespan of the Energy Park (50 years). Collision risk modelling for lapwing is summarised in **Table 10**.

**Table 10: Lapwing Collision Risk Model Summary**

| Period             | Avoidance Rate (%) | Estimated Collision Fatalities |          |
|--------------------|--------------------|--------------------------------|----------|
|                    |                    | Per Year                       | 50 Years |
| Year 1 (2021-2022) | 98                 | 0.023                          | 1.127    |
| Year 2 (2022-2023) | 98                 | 0.002                          | 0.112    |

| Period  | Avoidance Rate (%) | Estimated Collision Fatalities |          |
|---------|--------------------|--------------------------------|----------|
|         |                    | Per Year                       | 50 Years |
| Average | N/A                | 0.012                          | 0.620    |

## 4.7 Merlin

- 4.7.1 A diurnal species, merlin were occasionally recorded during the VP surveys undertaken between 2021 and 2023, with five observations at collision risk height within the VP survey area across both survey years totalling 180 flight seconds.
- 4.7.2 Based on the blade profile, measurements and flight parameters for the Nordex 163 turbine described in **Table 1**, and the bird biometrics described in **Table 4**, the flight seconds recorded would be equivalent to two transits through the collision risk window of the turbines each for 2021/22 and 2022/23. Using the turbine specifications and species biometrics, the probability of a merlin flying through an operational turbine resulting in a collision during a single transit, in the absence of any avoiding actions, is 3.83%.
- 4.7.3 Therefore, in the absence of any avoiding actions, the average estimated number of merlin fatalities per year (based on the 2021-2023 data) whilst the turbines are operational is 0.075 and 0.058 birds per year for 2021/22 and 2022/23 respectively.
- 4.7.4 Taking into consideration an avoidance rate of 98% (in line with SNH guidance), the average estimated number of annual merlin collision fatalities is 0.001. This would equate to an estimated 0.067 collision fatalities over the anticipated lifespan of the Energy Park (50 years). Collision risk modelling for merlin is summarised in **Table 11**.

**Table 11: Merlin Collision Risk Model Summary**

| Period             | Avoidance Rate (%) | Estimated Collision Fatalities |          |
|--------------------|--------------------|--------------------------------|----------|
|                    |                    | Per Year                       | 50 Years |
| Year 1 (2021-2022) | 98                 | 0.002                          | 0.075    |
| Year 2 (2022-2023) | 98                 | 0.001                          | 0.058    |
| Average            | N/A                | 0.001                          | 0.067    |

## 4.8 Peregrine

- 4.8.1 A diurnal species, peregrine were infrequently recorded during the VP surveys undertaken between 2021 and 2023, with one observation at collision risk height within the VP survey area in August 2023 totalling 45 flight seconds.
- 4.8.2 Based on the blade profile, measurements and flight parameters for the Nordex 163 turbine described in **Table 1**, and the bird biometrics described in **Table 4**, the flight seconds recorded would be equivalent to zero and one transits through the collision

risk window of the turbines for 2021/22 and 2022/23 respectively. Using the turbine specifications and species biometrics, the probability of a peregrine flying through an operational turbine resulting in a collision during a single transit, in the absence of any avoiding actions, is 4.38%.

- 4.8.3 Therefore, in the absence of any avoiding actions, the average estimated number of peregrine fatalities per year (based on the 2021-2023 data) whilst the turbines are operational is 0.000 and 0.023 birds per year for 2021/22 and 2022/23 respectively.
- 4.8.4 Taking into consideration an avoidance rate of 98% (in line with SNH guidance), the average estimated number of annual peregrine collision fatalities is <0.001. This would equate to an estimated 0.012 collision fatalities over the anticipated lifespan of the Energy Park (50 years). Collision risk modelling for peregrine is summarised in **Table 12**.

**Table 12: Peregrine Collision Risk Model Summary**

| Period             | Avoidance Rate (%) | Estimated Collision Fatalities |          |
|--------------------|--------------------|--------------------------------|----------|
|                    |                    | Per Year                       | 50 Years |
| Year 1 (2021-2022) | 98                 | 0.000                          | 0.000    |
| Year 2 (2022-2023) | 98                 | <0.001                         | 0.023    |
| Average            | N/A                | <0.001                         | 0.012    |

## 4.9 Red Kite

- 4.9.1 A diurnal species, red kite were frequently recorded during the VP surveys undertaken between 2021 and 2023, with 222 observations at collision risk height within the VP survey area across both survey years totalling 59,415 flight seconds.
- 4.9.2 Based on the blade profile, measurements and flight parameters for the Nordex 163 turbine described in **Table 1**, and the bird biometrics described in **Table 4**, the flight seconds recorded would be equivalent to 142 and 630 transits through the collision risk window of the turbines for 2021/22 and 2022/23 respectively. Using the turbine specifications and species biometrics, the probability of a red kite flying through an operational turbine resulting in a collision during a single transit, in the absence of any avoiding actions, is 5.99%.
- 4.9.3 Therefore, in the absence of any avoiding actions, the average estimated number of red kite fatalities per year (based on the 2021-2023 data) whilst the turbines are operational is 7.219 and 32.069 birds per year for 2021/22 and 2022/23 respectively.
- 4.9.4 Taking into consideration an avoidance rate of 99% (in line with SNH guidance), the average estimated number of annual red kite collision fatalities is 0.196. This would equate to an estimated 9.822 collision fatalities over the anticipated lifespan of the Energy Park (50 years). Collision risk modelling for red kite is summarised in **Table 13**.

**Table 13: Red Kite Collision Risk Model Summary**

| Period             | Avoidance Rate (%) | Estimated Collision Fatalities |          |
|--------------------|--------------------|--------------------------------|----------|
|                    |                    | Per Year                       | 50 Years |
| Year 1 (2021-2022) | 99                 | 0.072                          | 3.610    |
| Year 2 (2022-2023) | 99                 | 0.321                          | 16.035   |
| Average            | N/A                | 0.196                          | 9.822    |

## 4.10 Teal

- 4.10.1 A primarily diurnal species capable of foraging on open water at night, teal were infrequently recorded during the VP surveys undertaken between 2021 and 2023, with four observations at collision risk height within the VP survey area across both survey years totalling 1,980 flight seconds.
- 4.10.2 Based on the blade profile, measurements and flight parameters for the Nordex 163 turbine described in **Table 1**, and the bird biometrics described in **Table 4**, the flight seconds recorded would be equivalent to 79 and 0 transits through the collision risk window of the turbines for 2021/22 and 2022/23 respectively. Using the turbine specifications and species biometrics, the probability of a teal flying through an operational turbine resulting in a collision during a single transit, in the absence of any avoiding actions, is 5.99%.
- 4.10.3 Therefore, in the absence of any avoiding actions, the average estimated number of teal fatalities per year (based on the 2021-2023 data) whilst the turbines are operational is 2.283 and 0.000 birds per year for 2021/22 and 2022/23 respectively.
- 4.10.4 Taking into consideration an avoidance rate of 98% (in line with SNH guidance), the average estimated number of annual teal collision fatalities is 0.023. This would equate to an estimated 1.141 collision fatalities over the anticipated lifespan of the Energy Park (50 years). Collision risk modelling for red kite is summarised in **Table 14**.

**Table 14: Teal Collision Risk Model Summary**

| Period             | Avoidance Rate (%) | Estimated Collision Fatalities |          |
|--------------------|--------------------|--------------------------------|----------|
|                    |                    | Per Year                       | 50 Years |
| Year 1 (2021-2022) | 98                 | 0.046                          | 2.283    |
| Year 2 (2022-2023) | 98                 | 0.000                          | 0.000    |
| Average            | N/A                | 0.023                          | 1.141    |

## 5.0 DISCUSSION AND SUMMARY

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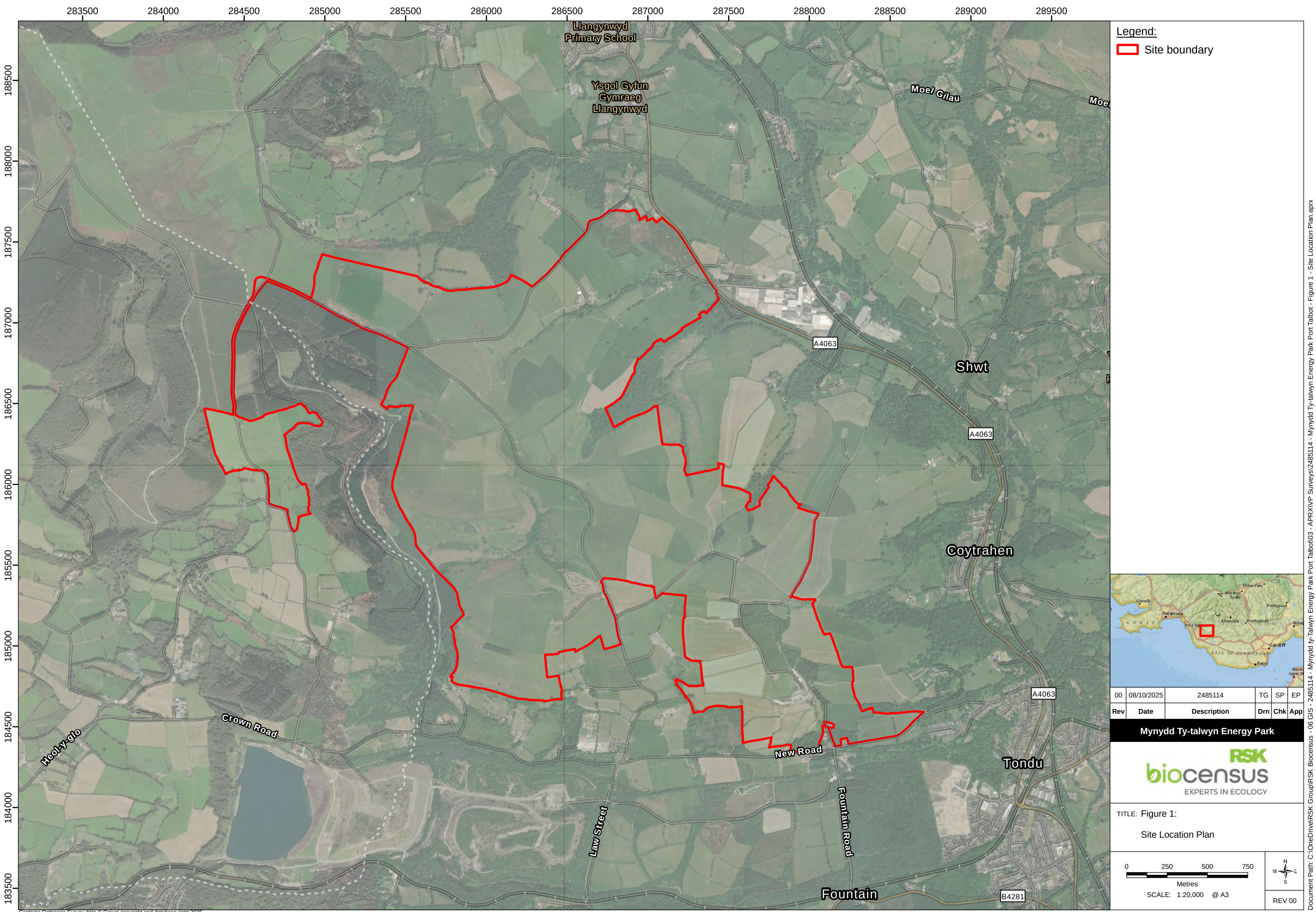
- 5.1.1 Based on the vantage point survey data recorded at the Proposed Development Site between 2021 and 2023 inclusive, nine target species were identified as being potentially susceptible to collision impacts with new wind turbines: specifically barn owl, golden plover, hen harrier, kestrel, lapwing, merlin, peregrine, red kite and teal. These species are potentially susceptible to collision impacts year-round.
- 5.1.2 Estimated collision risk fatalities for these species as a result of the new turbines, both annually and during the anticipated operational lifespan of the Proposed Development (50 years), are presented in **Section 4**.
- 5.1.3 It should be noted that, for the reasons specified in **Section 3.7**, these calculations represent a precautionary, robust scenario of collision fatalities from the Proposed Development.
- 5.1.4 The estimated collision risk fatalities for target species discussed in this report have informed the assessment of likely significant effects from potential collision mortality with turbine blades from the Proposed Development. Further details on the likely effects of the Proposed Development are discussed within **ES Volume II, Chapter 11: Ornithology**.

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## FIGURE 1: SITE LOCATION PLAN

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Legend:  
[Red outline] Site boundary

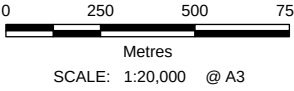


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Mynydd Ty-talwyn Energy Park

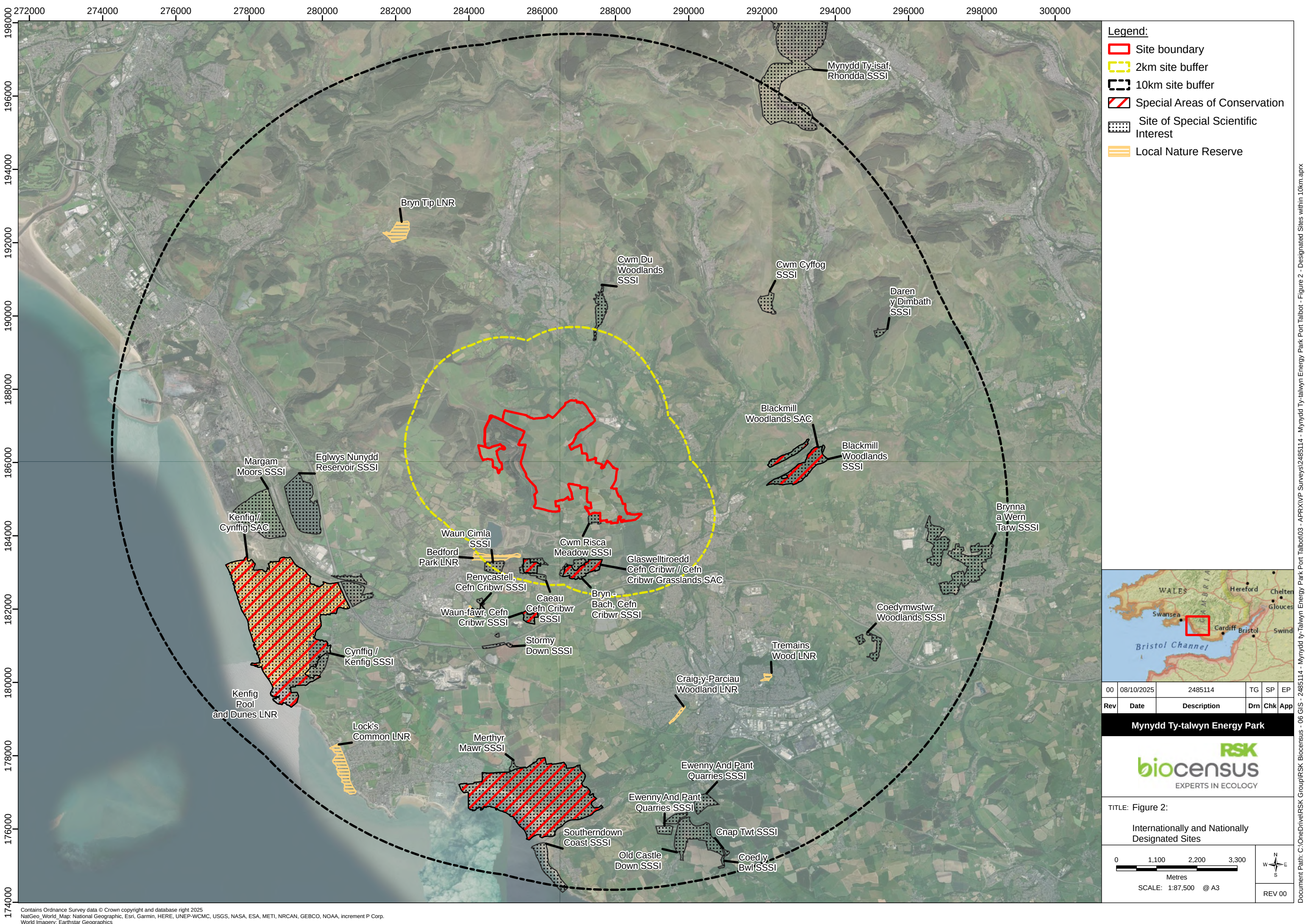


TITLE: Figure 1:  
Site Location Plan



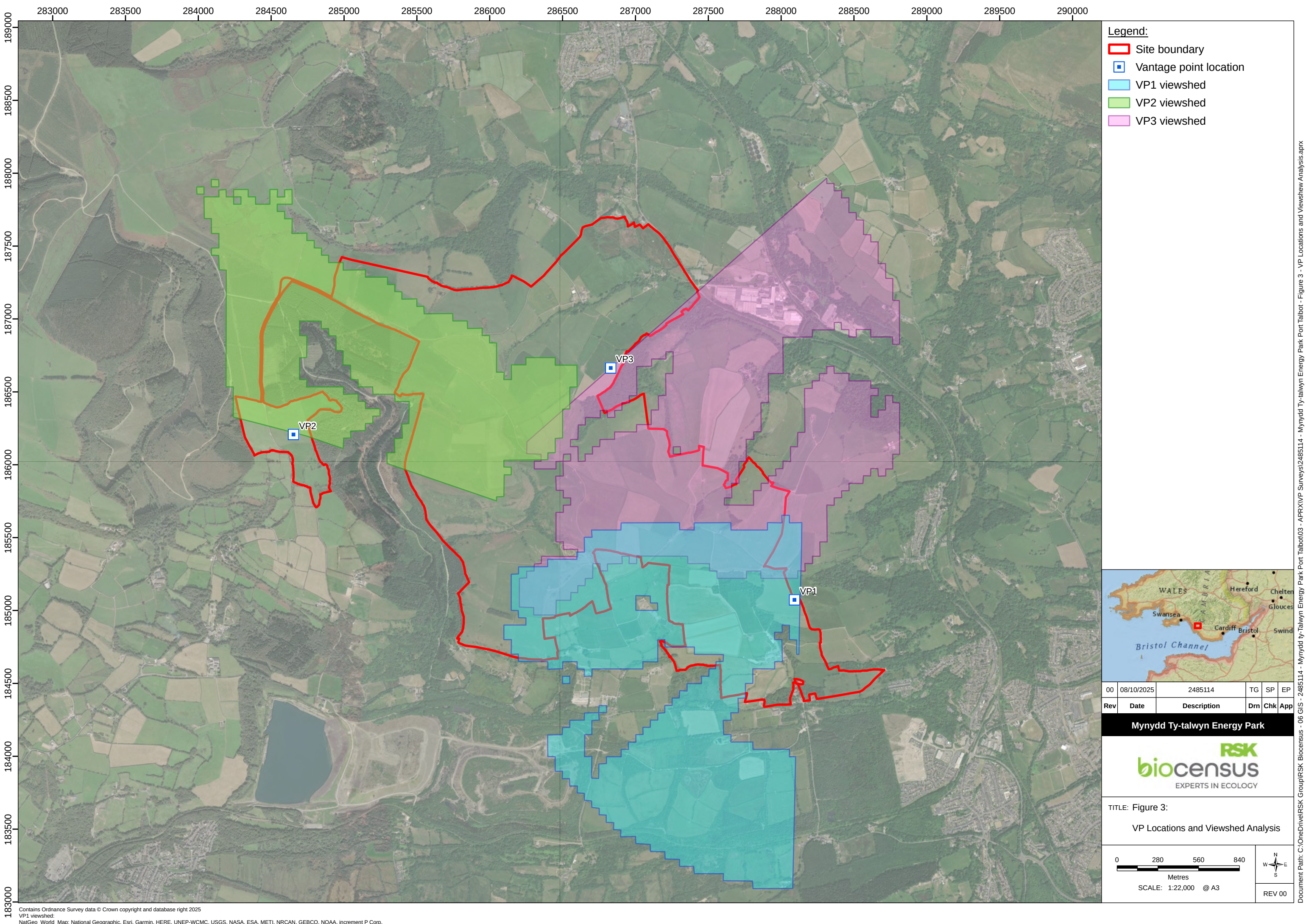
## **FIGURE 2: INTERNATIONALLY AND NATIONALLY DESIGNATED SITES**

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## FIGURE 3: VP LOCATIONS AND VIEWSHED ANALYSIS

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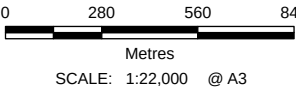


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Mynydd Ty-talwyn Energy Park



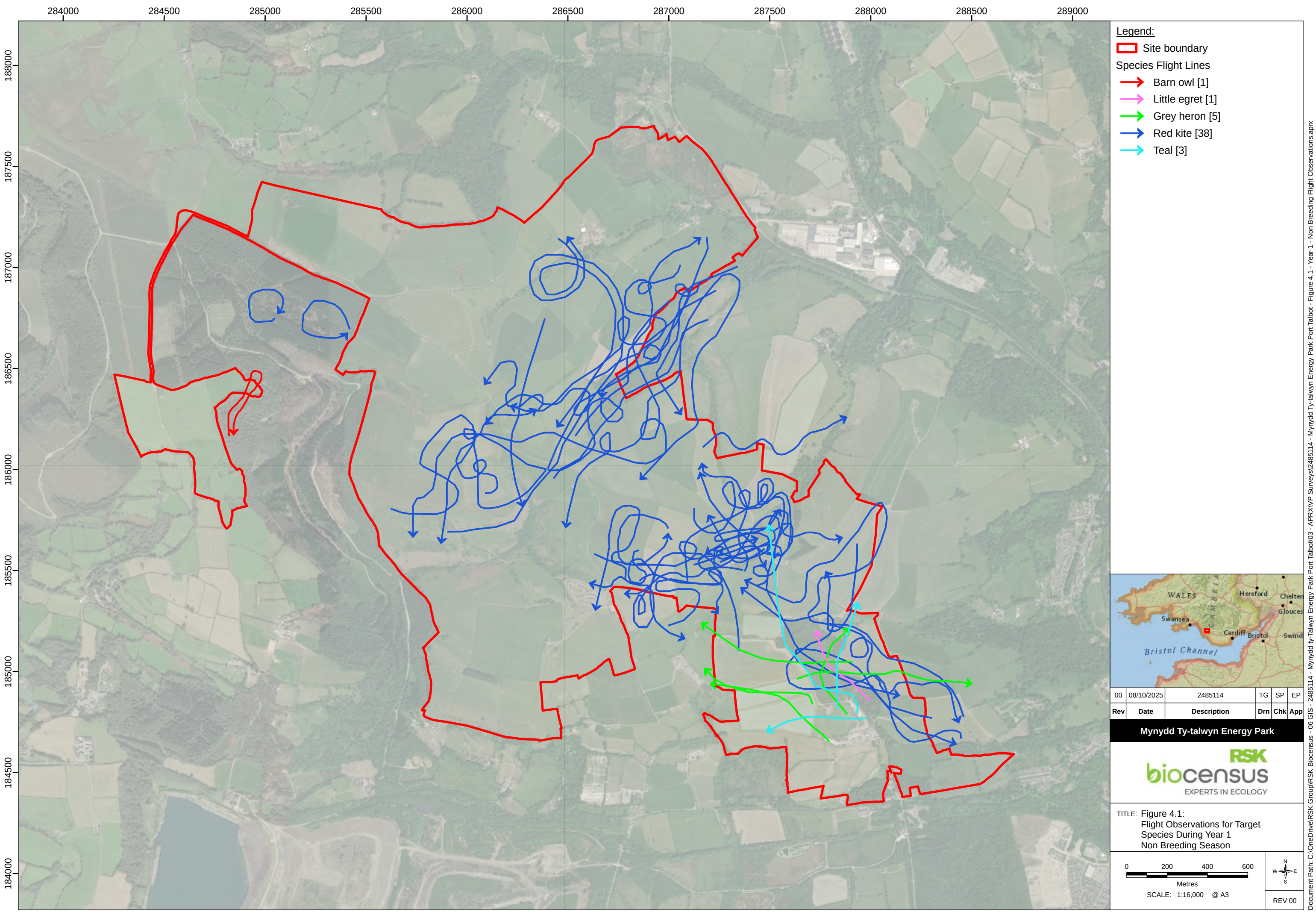
TITLE: Figure 3:  
VP Locations and Viewshed Analysis



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## **FIGURE 4.1: FLIGHT OBSERVATIONS FOR TARGET SPECIES DURING YEAR 1, NON BREEDING SEASON**

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- Legend:**
- Site boundary
  - Species Flight Lines
    - Barn owl [1]
    - Little egret [1]
    - Grey heron [5]
    - Red kite [38]
    - Teal [3]



|     |            |             |     |     |     |
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Mynydd Ty-talwyn Energy Park



TITLE: Figure 4.1:  
Flight Observations for Target  
Species During Year 1  
Non Breeding Season

0200400600

Metres

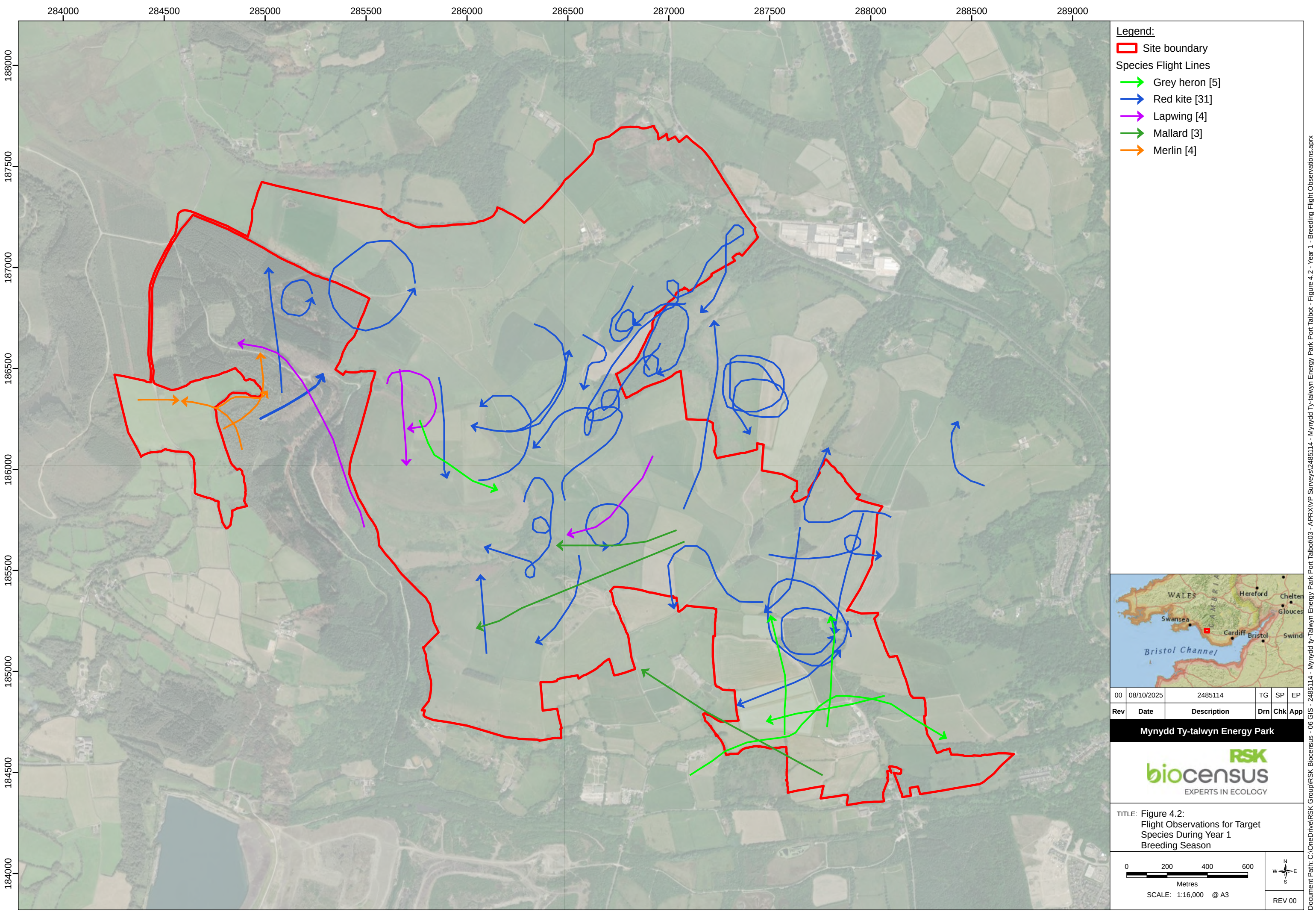
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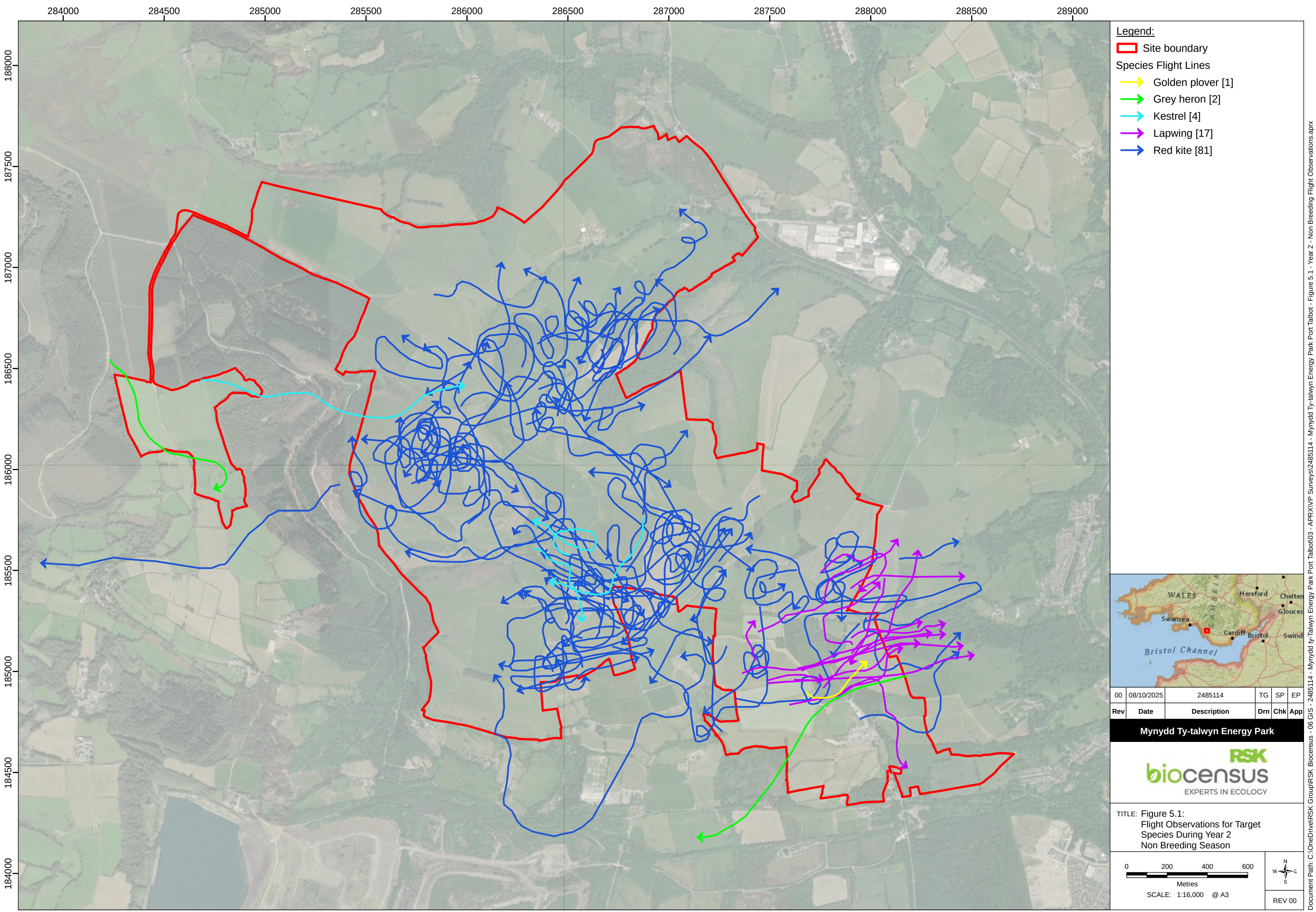
## **FIGURE 4.2: FLIGHT OBSERVATIONS FOR TARGET SPECIES DURING YEAR 1, BREEDING SEASON**

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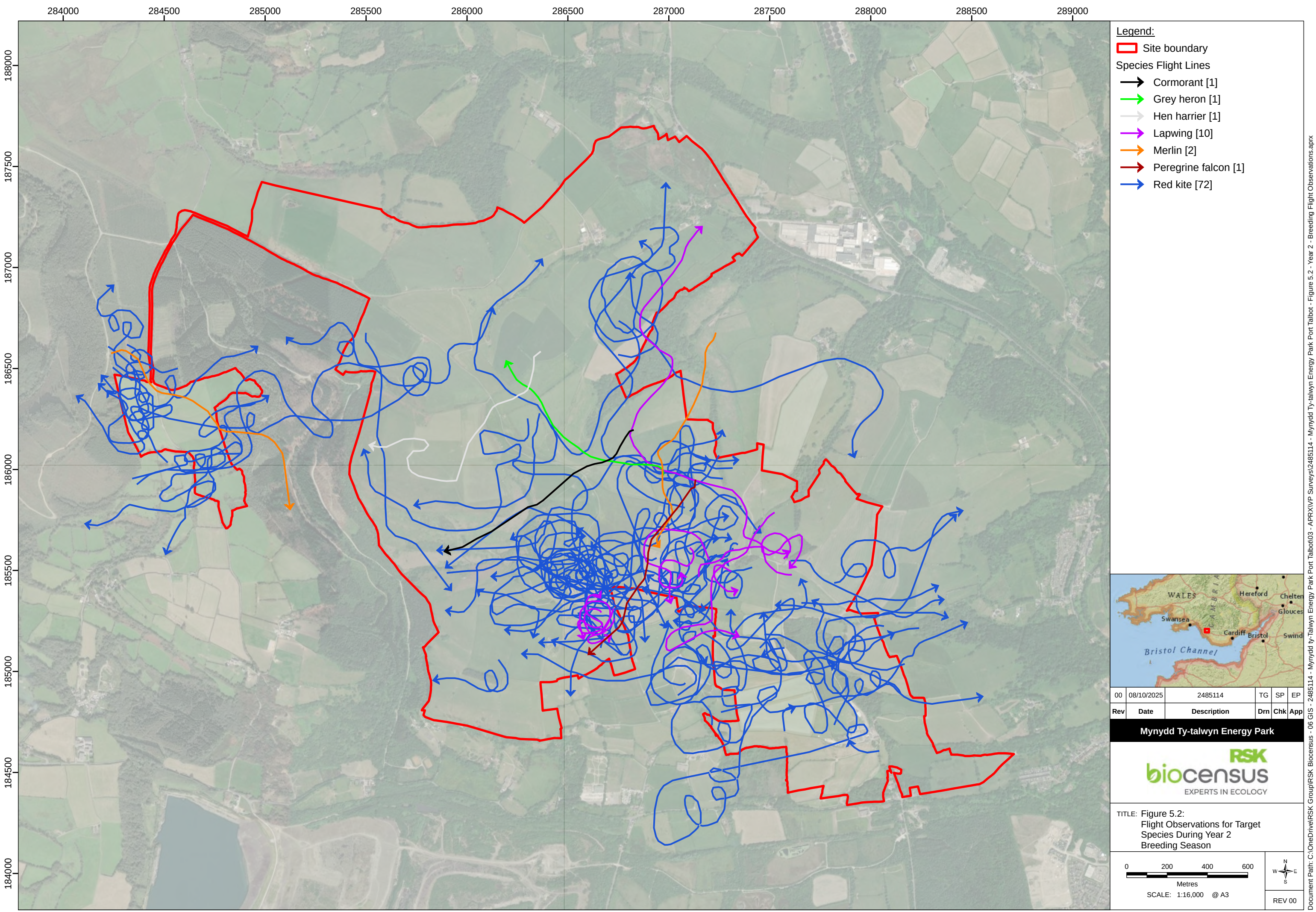
## **FIGURE 5.1: FLIGHT OBSERVATIONS FOR TARGET SPECIES DURING YEAR 2, NON BREEDING SEASON**

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## **FIGURE 5.2: FLIGHT OBSERVATIONS FOR TARGET SPECIES DURING YEAR 2, BREEDING SEASON**

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## ANNEX A: FLIGHT ACTIVITY DATA

| Flight activity by target species within the rotor swept area |                      |            |    |            |           |                   |                       |                                                |
|---------------------------------------------------------------|----------------------|------------|----|------------|-----------|-------------------|-----------------------|------------------------------------------------|
| Species                                                       | Modelled survey year | Season     | VP | Date       | No. birds | Flight height (m) | Total flight time (s) | Flight time at risk height within viewshed (s) |
| Barn owl                                                      | 1                    | NB 2021/22 | 2  | 09/12/2021 | 1         | 0-60              | 60                    | 60                                             |
| Golden plover                                                 | 2                    | NB 2022/23 | 1  | 15/12/2022 | 4         | 0-60              | 120                   | 120                                            |
| Hen harrier                                                   | 2                    | B 2023     | 3  | 24/08/2023 | 1         | 0-60              | 160                   | 160                                            |
| Kestrel                                                       | 2                    | NB 2022/23 | 2  | 02/01/2023 | 1         | 0-90              | 45                    | 45                                             |
| Kestrel                                                       | 2                    | B 2023     | 3  | 04/10/2023 | 1         | 0-60              | 300                   | 300                                            |
| Kestrel                                                       | 2                    | B 2023     | 3  | 04/10/2023 | 2         | 0-60              | 120                   | 120                                            |
| Kestrel                                                       | 2                    | B 2023     | 3  | 04/10/2023 | 1         | 0-90              | 300                   | 300                                            |
| Red kite                                                      | 1                    | NB 2021/22 | 2  | 29/11/2021 | 1         | 0-60              | 60                    | 60                                             |
| Red kite                                                      | 1                    | NB 2021/22 | 2  | 09/12/2021 | 1         | 0-90              | 90                    | 90                                             |
| Red kite                                                      | 1                    | NB 2021/22 | 1  | 14/12/2021 | 1         | 91-180            | 90                    | 90                                             |
| Red kite                                                      | 1                    | NB 2021/22 | 3  | 19/01/2022 | 2         | >200              | 210                   | 0                                              |
| Red kite                                                      | 1                    | NB 2021/22 | 3  | 07/02/2022 | 1         | 61-90             | 60                    | 60                                             |
| Red kite                                                      | 1                    | B 2022     | 3  | 15/03/2022 | 1         | 61-180            | 60                    | 60                                             |
| Red kite                                                      | 1                    | B 2022     | 3  | 16/04/2022 | 1         | 61-180            | 80                    | 80                                             |
| Red kite                                                      | 1                    | B 2022     | 3  | 16/04/2022 | 1         | 0-60              | 40                    | 40                                             |
| Red kite                                                      | 1                    | B 2022     | 3  | 16/04/2022 | 1         | 0-60              | 50                    | 50                                             |
| Red kite                                                      | 1                    | B 2022     | 2  | 16/04/2022 | 1         | 0-90              | 40                    | 40                                             |
| Red kite                                                      | 1                    | B 2022     | 2  | 16/04/2022 | 1         | 0-90              | 170                   | 170                                            |
| Red kite                                                      | 1                    | B 2022     | 2  | 16/04/2022 | 1         | >200              | 35                    | 0                                              |
| Red kite                                                      | 1                    | B 2022     | 2  | 16/04/2022 | 2         | 181-200           | 40                    | 40                                             |
| Red kite                                                      | 1                    | B 2022     | 2  | 16/04/2022 | 1         | 61-90             | 10                    | 10                                             |

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| Flight activity by target species within the rotor swept area |                      |            |    |            |           |                   |                       |                                                |
|---------------------------------------------------------------|----------------------|------------|----|------------|-----------|-------------------|-----------------------|------------------------------------------------|
| Species                                                       | Modelled survey year | Season     | VP | Date       | No. birds | Flight height (m) | Total flight time (s) | Flight time at risk height within viewshed (s) |
| Red kite                                                      | 1                    | B 2022     | 2  | 25/04/2022 | 2         | 91-180            | 120                   | 120                                            |
| Red kite                                                      | 1                    | B 2022     | 1  | 27/04/2022 | 2         | 61-90             | 120                   | 120                                            |
| Red kite                                                      | 1                    | B 2022     | 2  | 29/04/2022 | 2         | 0-60              | 120                   | 120                                            |
| Red kite                                                      | 1                    | B 2022     | 3  | 29/04/2022 | 2         | 61-90             | 120                   | 120                                            |
| Red kite                                                      | 1                    | B 2022     | 2  | 01/05/2022 | 1         | 61-90             | 60                    | 60                                             |
| Red kite                                                      | 1                    | B 2022     | 2  | 03/05/2022 | 2         | 61-90             | 60                    | 60                                             |
| Red kite                                                      | 1                    | B 2022     | 1  | 03/05/2022 | 2         | 0-60              | 90                    | 90                                             |
| Red kite                                                      | 1                    | B 2022     | 1  | 10/05/2022 | 2         | 0-90              | 90                    | 90                                             |
| Red kite                                                      | 1                    | B 2022     | 1  | 22/06/2022 | 4         | 61-90             | 240                   | 240                                            |
| Red kite                                                      | 1                    | B 2022     | 2  | 23/06/2022 | 2         | 61-90             | 60                    | 60                                             |
| Red kite                                                      | 1                    | B 2022     | 3  | 01/07/2022 | 2         | 61-90             | 60                    | 60                                             |
| Red kite                                                      | 1                    | B 2022     | 2  | 02/07/2022 | 2         | 61-90             | 120                   | 120                                            |
| Red kite                                                      | 1                    | B 2022     | 2  | 07/07/2022 | 1         | 0-60              | 60                    | 60                                             |
| Red kite                                                      | 1                    | B 2022     | 2  | 19/07/2022 | 2         | 61-90             | 120                   | 120                                            |
| Red kite                                                      | 1                    | B 2022     | 3  | 20/07/2022 | 2         | 61-90             | 120                   | 120                                            |
| Red kite                                                      | 1                    | B 2022     | 3  | 23/08/2022 | 1         | 61-90             | 30                    | 30                                             |
| Red kite                                                      | 1                    | B 2022     | 3  | 28/08/2022 | 3         | 61-180            | 360                   | 360                                            |
| Red kite                                                      | 2                    | B 2022     | 3  | 28/08/2022 | 2         | 61-90             | 60                    | 60                                             |
| Red kite                                                      | 2                    | B 2022     | 3  | 28/08/2022 | 2         | 61-90             | 80                    | 80                                             |
| Red kite                                                      | 2                    | B 2022     | 3  | 28/08/2022 | 1         | 0-60              | 15                    | 15                                             |
| Red kite                                                      | 2                    | B 2022     | 3  | 28/08/2022 | 1         | 61-90             | 40                    | 40                                             |
| Red kite                                                      | 2                    | B 2022     | 1  | 31/08/2022 | 1         | 61-90             | 60                    | 60                                             |
| Red kite                                                      | 1                    | NB 2022/23 | 1  | 22/09/2022 | 1         | 0-90              | 75                    | 75                                             |
| Red kite                                                      | 1                    | NB 2022/23 | 1  | 22/09/2022 | 1         | 0-180             | 300                   | 300                                            |

| Flight activity by target species within the rotor swept area |                      |            |    |            |           |                   |                       |                                                |
|---------------------------------------------------------------|----------------------|------------|----|------------|-----------|-------------------|-----------------------|------------------------------------------------|
| Species                                                       | Modelled survey year | Season     | VP | Date       | No. birds | Flight height (m) | Total flight time (s) | Flight time at risk height within viewshed (s) |
| Red kite                                                      | 1                    | NB 2022/23 | 1  | 22/09/2022 | 1         | 0-180             | 240                   | 240                                            |
| Red kite                                                      | 1                    | NB 2022/23 | 1  | 22/09/2022 | 1         | 61-90             | 120                   | 120                                            |
| Red kite                                                      | 1                    | NB 2022/23 | 1  | 22/09/2022 | 1         | 0-60              | 90                    | 90                                             |
| Red kite                                                      | 1                    | NB 2022/23 | 1  | 22/09/2022 | 1         | 0-60              | 75                    | 75                                             |
| Red kite                                                      | 1                    | NB 2022/23 | 1  | 22/09/2022 | 2         | 61-180            | 240                   | 240                                            |
| Red kite                                                      | 1                    | NB 2022/23 | 1  | 22/09/2022 | 1         | 0-60              | 90                    | 90                                             |
| Red kite                                                      | 1                    | NB 2022/23 | 1  | 22/09/2022 | 1         | 0-90              | 330                   | 330                                            |
| Red kite                                                      | 1                    | NB 2022/23 | 1  | 22/09/2022 | 1         | 0-90              | 330                   | 330                                            |
| Red kite                                                      | 1                    | NB 2022/23 | 1  | 22/09/2022 | 2         | 0-60              | 330                   | 330                                            |
| Red kite                                                      | 1                    | NB 2022/23 | 3  | 29/09/2022 | 2         | 0-60              | 120                   | 120                                            |
| Red kite                                                      | 1                    | NB 2022/23 | 3  | 29/09/2022 | 1         | 0-60              | 30                    | 30                                             |
| Red kite                                                      | 1                    | NB 2022/23 | 3  | 29/09/2022 | 3         | 0-60              | 540                   | 540                                            |
| Red kite                                                      | 1                    | NB 2022/23 | 3  | 29/09/2022 | 1         | 0-90              | 240                   | 240                                            |
| Red kite                                                      | 1                    | NB 2022/23 | 3  | 29/09/2022 | 1         | 0-60              | 150                   | 150                                            |
| Red kite                                                      | 1                    | NB 2022/23 | 3  | 29/09/2022 | 1         | 61-180            | 60                    | 60                                             |
| Red kite                                                      | 1                    | NB 2022/23 | 3  | 29/09/2022 | 1         | 0-90              | 75                    | 75                                             |
| Red kite                                                      | 1                    | NB 2022/23 | 3  | 29/09/2022 | 3         | 61-200            | 270                   | 270                                            |
| Red kite                                                      | 1                    | NB 2022/23 | 2  | 06/10/2022 | 2         | 91-180            | 120                   | 120                                            |
| Red kite                                                      | 1                    | NB 2022/23 | 3  | 27/10/2022 | 1         | 61-90             | 60                    | 60                                             |
| Red kite                                                      | 1                    | NB 2022/23 | 3  | 27/10/2022 | 1         | 0-90              | 90                    | 90                                             |
| Red kite                                                      | 1                    | NB 2022/23 | 3  | 27/10/2022 | 1         | 61-90             | 90                    | 90                                             |
| Red kite                                                      | 1                    | NB 2022/23 | 3  | 27/10/2022 | 1         | 61-90             | 150                   | 150                                            |
| Red kite                                                      | 1                    | NB 2022/23 | 3  | 27/10/2022 | 1         | 0-60              | 60                    | 60                                             |
| Red kite                                                      | 1                    | NB 2022/23 | 3  | 27/10/2022 | 1         | 61-90             | 210                   | 210                                            |

| Flight activity by target species within the rotor swept area |                      |            |    |            |           |                   |                       |                                                |
|---------------------------------------------------------------|----------------------|------------|----|------------|-----------|-------------------|-----------------------|------------------------------------------------|
| Species                                                       | Modelled survey year | Season     | VP | Date       | No. birds | Flight height (m) | Total flight time (s) | Flight time at risk height within viewshed (s) |
| Red kite                                                      | 1                    | NB 2022/23 | 3  | 27/10/2022 | 2         | 61-90             | 300                   | 300                                            |
| Red kite                                                      | 1                    | NB 2022/23 | 3  | 27/10/2022 | 1         | 0-60              | 30                    | 30                                             |
| Red kite                                                      | 1                    | NB 2022/23 | 3  | 27/10/2022 | 1         | 0-60              | 30                    | 30                                             |
| Red kite                                                      | 1                    | NB 2022/23 | 3  | 27/10/2022 | 1         | 0-180             | 360                   | 360                                            |
| Red kite                                                      | 1                    | NB 2022/23 | 3  | 27/10/2022 | 1         | 0-180             | 180                   | 180                                            |
| Red kite                                                      | 1                    | NB 2022/23 | 3  | 27/10/2022 | 1         | 0-90              | 90                    | 90                                             |
| Red kite                                                      | 1                    | NB 2022/23 | 3  | 27/10/2022 | 1         | 0-60              | 30                    | 30                                             |
| Red kite                                                      | 2                    | NB 2022/23 | 1  | 29/11/2022 | 1         | 0-60              | 30                    | 30                                             |
| Red kite                                                      | 2                    | NB 2022/23 | 3  | 30/11/2022 | 2         | 0-60              | 60                    | 60                                             |
| Red kite                                                      | 2                    | NB 2022/23 | 3  | 30/11/2022 | 1         | 0-60              | 30                    | 30                                             |
| Red kite                                                      | 2                    | NB 2022/23 | 3  | 30/11/2022 | 1         | 0-90              | 240                   | 240                                            |
| Red kite                                                      | 2                    | NB 2022/23 | 3  | 30/11/2022 | 1         | 0-60              | 120                   | 120                                            |
| Red kite                                                      | 2                    | NB 2022/23 | 3  | 30/11/2022 | 2         | 61-90             | 120                   | 120                                            |
| Red kite                                                      | 2                    | NB 2022/23 | 3  | 30/11/2022 | 1         | 0-90              | 165                   | 165                                            |
| Red kite                                                      | 2                    | NB 2022/23 | 3  | 30/11/2022 | 1         | 0-60              | 45                    | 45                                             |
| Red kite                                                      | 2                    | NB 2022/23 | 3  | 30/11/2022 | 4         | 0-60              | 1440                  | 1440                                           |
| Red kite                                                      | 2                    | NB 2022/23 | 3  | 30/11/2022 | 1         | 0-60              | 75                    | 75                                             |
| Red kite                                                      | 2                    | NB 2022/23 | 3  | 30/11/2022 | 1         | 0-90              | 90                    | 90                                             |
| Red kite                                                      | 2                    | NB 2022/23 | 3  | 30/11/2022 | 1         | 0-60              | 60                    | 60                                             |
| Red kite                                                      | 2                    | NB 2022/23 | 3  | 30/11/2022 | 1         | 0-90              | 45                    | 45                                             |
| Red kite                                                      | 2                    | NB 2022/23 | 3  | 30/11/2022 | 1         | 0-90              | 60                    | 60                                             |
| Red kite                                                      | 2                    | NB 2022/23 | 3  | 30/11/2022 | 1         | 0-60              | 165                   | 165                                            |
| Red kite                                                      | 2                    | NB 2022/23 | 3  | 30/11/2022 | 2         | 0-90              | 720                   | 720                                            |
| Red kite                                                      | 2                    | NB 2022/23 | 1  | 15/12/2022 | 1         | 0-60              | 15                    | 15                                             |

| Flight activity by target species within the rotor swept area |                      |            |    |            |           |                   |                       |                                                |
|---------------------------------------------------------------|----------------------|------------|----|------------|-----------|-------------------|-----------------------|------------------------------------------------|
| Species                                                       | Modelled survey year | Season     | VP | Date       | No. birds | Flight height (m) | Total flight time (s) | Flight time at risk height within viewshed (s) |
| Red kite                                                      | 2                    | NB 2022/23 | 1  | 15/12/2022 | 1         | 0-60              | 45                    | 45                                             |
| Red kite                                                      | 2                    | NB 2022/23 | 1  | 15/12/2022 | 1         | 0-60              | 240                   | 240                                            |
| Red kite                                                      | 2                    | NB 2022/23 | 1  | 15/12/2022 | 1         | 0-60              | 225                   | 225                                            |
| Red kite                                                      | 2                    | NB 2022/23 | 1  | 15/12/2022 | 1         | 0-90              | 180                   | 180                                            |
| Red kite                                                      | 2                    | NB 2022/23 | 1  | 15/12/2022 | 1         | 0-60              | 45                    | 45                                             |
| Red kite                                                      | 2                    | NB 2022/23 | 3  | 27/12/2022 | 1         | 0-60              | 60                    | 60                                             |
| Red kite                                                      | 2                    | NB 2022/23 | 3  | 27/12/2022 | 1         | 0-60              | 45                    | 45                                             |
| Red kite                                                      | 2                    | NB 2022/23 | 3  | 27/12/2022 | 2         | 0-60              | 60                    | 60                                             |
| Red kite                                                      | 2                    | NB 2022/23 | 3  | 30/12/2022 | 1         | 0-60              | 120                   | 120                                            |
| Red kite                                                      | 2                    | NB 2022/23 | 3  | 30/12/2022 | 3         | 0-60              | 540                   | 540                                            |
| Red kite                                                      | 2                    | NB 2022/23 | 3  | 30/12/2022 | 2         | 0-60              | 1080                  | 1080                                           |
| Red kite                                                      | 2                    | NB 2022/23 | 3  | 30/12/2022 | 1         | 0-60              | 180                   | 180                                            |
| Red kite                                                      | 2                    | NB 2022/23 | 3  | 30/12/2022 | 2         | 0-90              | 600                   | 600                                            |
| Red kite                                                      | 2                    | NB 2022/23 | 2  | 02/01/2023 | 2         | 0-90              | 660                   | 660                                            |
| Red kite                                                      | 2                    | NB 2022/23 | 2  | 02/01/2023 | 1         | 0-60              | 60                    | 60                                             |
| Red kite                                                      | 2                    | NB 2022/23 | 2  | 02/01/2023 | 4         | 61-200+           | 1800                  | 360                                            |
| Red kite                                                      | 2                    | NB 2022/23 | 3  | 16/01/2023 | 2         | 0-60              | 90                    | 90                                             |
| Red kite                                                      | 2                    | NB 2022/23 | 3  | 16/01/2023 | 1         | 0-60              | 150                   | 150                                            |
| Red kite                                                      | 2                    | NB 2022/23 | 3  | 16/01/2023 | 2         | 0-60              | 90                    | 90                                             |
| Red kite                                                      | 2                    | NB 2022/23 | 3  | 16/01/2023 | 2         | 0-60              | 1080                  | 1080                                           |
| Red kite                                                      | 2                    | NB 2022/23 | 3  | 16/01/2023 | 1         | 0-60              | 180                   | 180                                            |
| Red kite                                                      | 2                    | NB 2022/23 | 3  | 16/01/2023 | 1         | 0-90              | 300                   | 300                                            |
| Red kite                                                      | 2                    | NB 2022/23 | 3  | 16/01/2023 | 1         | 0-60              | 520                   | 520                                            |
| Red kite                                                      | 2                    | NB 2022/23 | 3  | 16/01/2023 | 4         | 0-90              | 600                   | 600                                            |

| Flight activity by target species within the rotor swept area |                      |            |    |            |           |                   |                       |                                                |
|---------------------------------------------------------------|----------------------|------------|----|------------|-----------|-------------------|-----------------------|------------------------------------------------|
| Species                                                       | Modelled survey year | Season     | VP | Date       | No. birds | Flight height (m) | Total flight time (s) | Flight time at risk height within viewshed (s) |
| Red kite                                                      | 2                    | NB 2022/23 | 3  | 08/02/2023 | 3         | 0-90              | 1620                  | 1620                                           |
| Red kite                                                      | 2                    | NB 2022/23 | 3  | 08/02/2023 | 2         | 0-90              | 720                   | 720                                            |
| Red kite                                                      | 2                    | NB 2022/23 | 3  | 08/02/2023 | 2         | 0-90              | 1320                  | 1320                                           |
| Red kite                                                      | 2                    | NB 2022/23 | 3  | 08/02/2023 | 1         | 0-90              | 240                   | 240                                            |
| Red kite                                                      | 2                    | NB 2022/23 | 3  | 08/02/2023 | 1         | 0-90              | 90                    | 90                                             |
| Red kite                                                      | 2                    | NB 2022/23 | 3  | 08/02/2023 | 1         | 61-90             | 90                    | 90                                             |
| Red kite                                                      | 2                    | NB 2022/23 | 3  | 08/02/2023 | 1         | 0-180             | 225                   | 225                                            |
| Red kite                                                      | 2                    | NB 2022/23 | 3  | 08/02/2023 | 1         | 0-60              | 390                   | 390                                            |
| Red kite                                                      | 2                    | NB 2022/23 | 3  | 08/02/2023 | 4         | 0-60              | 480                   | 480                                            |
| Red kite                                                      | 2                    | NB 2022/23 | 3  | 08/02/2023 | 1         | 0-60              | 180                   | 180                                            |
| Red kite                                                      | 2                    | NB 2022/23 | 3  | 13/02/2023 | 1         | 0-60              | 120                   | 120                                            |
| Red kite                                                      | 2                    | NB 2022/23 | 1  | 23/02/2023 | 1         | 0-60              | 45                    | 45                                             |
| Red kite                                                      | 2                    | NB 2022/23 | 1  | 23/02/2023 | 1         | 0-60              | 105                   | 105                                            |
| Red kite                                                      | 2                    | NB 2022/23 | 1  | 23/02/2023 | 1         | 0-60              | 30                    | 30                                             |
| Red kite                                                      | 2                    | NB 2022/23 | 1  | 23/02/2023 | 2         | 0-60              | 240                   | 240                                            |
| Red kite                                                      | 2                    | NB 2022/23 | 1  | 23/02/2023 | 1         | 0-60              | 30                    | 30                                             |
| Red kite                                                      | 2                    | B 2023     | 3  | 14/03/2023 | 1         | 0-60              | 30                    | 30                                             |
| Red kite                                                      | 2                    | B 2023     | 3  | 14/03/2023 | 1         | 0-60              | 180                   | 180                                            |
| Red kite                                                      | 2                    | B 2023     | 3  | 14/03/2023 | 2         | 0-90              | 330                   | 330                                            |
| Red kite                                                      | 2                    | B 2023     | 3  | 14/03/2023 | 1         | 0-60              | 30                    | 30                                             |
| Red kite                                                      | 2                    | B 2023     | 3  | 14/03/2023 | 2         | 0-60              | 180                   | 180                                            |
| Red kite                                                      | 2                    | B 2023     | 3  | 14/03/2023 | 1         | 0-60              | 75                    | 75                                             |
| Red kite                                                      | 2                    | B 2023     | 3  | 14/03/2023 | 2         | 0-180             | 420                   | 420                                            |
| Red kite                                                      | 2                    | B 2023     | 3  | 14/03/2023 | 1         | 0-90              | 180                   | 180                                            |

| Flight activity by target species within the rotor swept area |                      |        |    |            |           |                   |                       |                                                |
|---------------------------------------------------------------|----------------------|--------|----|------------|-----------|-------------------|-----------------------|------------------------------------------------|
| Species                                                       | Modelled survey year | Season | VP | Date       | No. birds | Flight height (m) | Total flight time (s) | Flight time at risk height within viewshed (s) |
| Red kite                                                      | 2                    | B 2023 | 2  | 17/03/2023 | 1         | 0-180             | 210                   | 210                                            |
| Red kite                                                      | 2                    | B 2023 | 1  | 22/03/2023 | 1         | 0-60              | 90                    | 90                                             |
| Red kite                                                      | 2                    | B 2023 | 1  | 22/03/2023 | 1         | 61-90             | 45                    | 45                                             |
| Red kite                                                      | 2                    | B 2023 | 1  | 22/03/2023 | 1         | 0-90              | 135                   | 135                                            |
| Red kite                                                      | 2                    | B 2023 | 3  | 04/04/2023 | 1         | 0-60              | 45                    | 45                                             |
| Red kite                                                      | 2                    | B 2023 | 3  | 04/04/2023 | 1         | 61-180            | 120                   | 120                                            |
| Red kite                                                      | 2                    | B 2023 | 3  | 04/04/2023 | 1         | 61-200            | 165                   | 165                                            |
| Red kite                                                      | 2                    | B 2023 | 3  | 04/04/2023 | 1         | 0-90              | 345                   | 345                                            |
| Red kite                                                      | 2                    | B 2023 | 1  | 17/04/2023 | 1         | 61-90             | 45                    | 45                                             |
| Red kite                                                      | 2                    | B 2023 | 1  | 17/04/2023 | 1         | 0-60              | 30                    | 30                                             |
| Red kite                                                      | 2                    | B 2023 | 1  | 17/04/2023 | 1         | 0-60              | 30                    | 30                                             |
| Red kite                                                      | 2                    | B 2023 | 1  | 17/04/2023 | 1         | 61-90             | 60                    | 60                                             |
| Red kite                                                      | 2                    | B 2023 | 1  | 17/04/2023 | 1         | 0-60              | 195                   | 195                                            |
| Red kite                                                      | 2                    | B 2023 | 3  | 19/04/2023 | 1         | 0-60              | 105                   | 105                                            |
| Red kite                                                      | 2                    | B 2023 | 3  | 19/04/2023 | 2         | 0-60              | 60                    | 60                                             |
| Red kite                                                      | 2                    | B 2023 | 3  | 19/04/2023 | 1         | 0-60              | 90                    | 90                                             |
| Red kite                                                      | 2                    | B 2023 | 1  | 29/04/2023 | 1         | 0-90              | 75                    | 75                                             |
| Red kite                                                      | 2                    | B 2023 | 1  | 29/04/2023 | 2         | 61-180            | 120                   | 120                                            |
| Red kite                                                      | 2                    | B 2023 | 1  | 29/04/2023 | 1         | 0-60              | 30                    | 30                                             |
| Red kite                                                      | 2                    | B 2023 | 1  | 29/04/2023 | 1         | 0-60              | 30                    | 30                                             |
| Red kite                                                      | 2                    | B 2023 | 1  | 29/04/2023 | 1         | 0-90              | 210                   | 210                                            |
| Red kite                                                      | 2                    | B 2023 | 3  | 01/05/2023 | 1         | 91-180            | 30                    | 30                                             |
| Red kite                                                      | 2                    | B 2023 | 3  | 01/05/2023 | 1         | 0-180             | 585                   | 585                                            |
| Red kite                                                      | 2                    | B 2023 | 2  | 10/05/2023 | 1         | 0-60              | 60                    | 60                                             |

| Flight activity by target species within the rotor swept area |                      |        |    |            |           |                   |                       |                                                |
|---------------------------------------------------------------|----------------------|--------|----|------------|-----------|-------------------|-----------------------|------------------------------------------------|
| Species                                                       | Modelled survey year | Season | VP | Date       | No. birds | Flight height (m) | Total flight time (s) | Flight time at risk height within viewshed (s) |
| Red kite                                                      | 2                    | B 2023 | 2  | 10/05/2023 | 1         | 0-90              | 360                   | 360                                            |
| Red kite                                                      | 2                    | B 2023 | 2  | 10/05/2023 | 1         | 0-180             | 365                   | 365                                            |
| Red kite                                                      | 2                    | B 2023 | 3  | 02/06/2023 | 1         | 0-60              | 15                    | 15                                             |
| Red kite                                                      | 2                    | B 2023 | 3  | 02/06/2023 | 1         | 0-90              | 75                    | 75                                             |
| Red kite                                                      | 2                    | B 2023 | 3  | 02/06/2023 | 1         | 0-90              | 165                   | 165                                            |
| Red kite                                                      | 2                    | B 2023 | 2  | 07/06/2023 | 1         | 0-60              | 150                   | 150                                            |
| Red kite                                                      | 2                    | B 2023 | 1  | 14/06/2023 | 1         | 0-90              | 150                   | 150                                            |
| Red kite                                                      | 2                    | B 2023 | 3  | 05/07/2023 | 2         | 0-60              | 480                   | 480                                            |
| Red kite                                                      | 2                    | B 2023 | 3  | 05/07/2023 | 1         | 0-60              | 45                    | 45                                             |
| Red kite                                                      | 2                    | B 2023 | 3  | 05/07/2023 | 1         | 0-90              | 105                   | 105                                            |
| Red kite                                                      | 2                    | B 2023 | 3  | 05/07/2023 | 1         | 0-60              | 30                    | 30                                             |
| Red kite                                                      | 2                    | B 2023 | 3  | 05/07/2023 | 1         | 0-90              | 210                   | 210                                            |
| Red kite                                                      | 2                    | B 2023 | 3  | 28/07/2023 | 1         | 0-90              | 345                   | 345                                            |
| Red kite                                                      | 2                    | B 2023 | 3  | 28/07/2023 | 1         | 0-60              | 75                    | 75                                             |
| Red kite                                                      | 2                    | B 2023 | 3  | 28/07/2023 | 1         | 0-60              | 150                   | 150                                            |
| Red kite                                                      | 2                    | B 2023 | 3  | 28/07/2023 | 1         | 0-60              | 60                    | 60                                             |
| Red kite                                                      | 2                    | B 2023 | 2  | 09/08/2023 | 1         | 0-60              | 165                   | 165                                            |
| Red kite                                                      | 2                    | B 2023 | 2  | 09/08/2023 | 1         | 0-60              | 120                   | 120                                            |
| Red kite                                                      | 2                    | B 2023 | 2  | 09/08/2023 | 4         | 0-180             | 1380                  | 1380                                           |
| Red kite                                                      | 2                    | B 2023 | 2  | 09/08/2023 | 1         | 0-180             | 240                   | 240                                            |
| Red kite                                                      | 2                    | B 2023 | 2  | 09/08/2023 | 3         | 0-60              | 225                   | 225                                            |
| Red kite                                                      | 2                    | B 2023 | 2  | 09/08/2023 | 1         | 0-60              | 150                   | 150                                            |
| Red kite                                                      | 2                    | B 2023 | 2  | 09/08/2023 | 1         | 0-60              | 15                    | 15                                             |
| Red kite                                                      | 2                    | B 2023 | 1  | 17/08/2023 | 1         | 0-90              | 300                   | 300                                            |

| Flight activity by target species within the rotor swept area |                      |        |    |            |           |                   |                       |                                                |
|---------------------------------------------------------------|----------------------|--------|----|------------|-----------|-------------------|-----------------------|------------------------------------------------|
| Species                                                       | Modelled survey year | Season | VP | Date       | No. birds | Flight height (m) | Total flight time (s) | Flight time at risk height within viewshed (s) |
| Red kite                                                      | 2                    | B 2023 | 1  | 17/08/2023 | 1         | 0-60              | 75                    | 75                                             |
| Red kite                                                      | 2                    | B 2023 | 3  | 18/08/2023 | 1         | 0-90              | 370                   | 370                                            |
| Red kite                                                      | 2                    | B 2023 | 3  | 18/08/2023 | 1         | 0-60              | 30                    | 30                                             |
| Red kite                                                      | 2                    | B 2023 | 3  | 18/08/2023 | 1         | 0-90              | 100                   | 100                                            |
| Red kite                                                      | 2                    | B 2023 | 1  | 21/08/2023 | 1         | 0-60              | 45                    | 45                                             |
| Red kite                                                      | 2                    | B 2023 | 1  | 21/08/2023 | 1         | 0-60              | 15                    | 15                                             |
| Red kite                                                      | 2                    | B 2023 | 1  | 21/08/2023 | 1         | 0-60              | 45                    | 45                                             |
| Red kite                                                      | 2                    | B 2023 | 1  | 21/08/2023 | 1         | 0-180             | 315                   | 315                                            |
| Red kite                                                      | 2                    | B 2023 | 1  | 21/08/2023 | 1         | 91-180            | 180                   | 180                                            |
| Red kite                                                      | 2                    | B 2023 | 3  | 24/08/2023 | 1         | 0-90              | 585                   | 585                                            |
| Red kite                                                      | 2                    | B 2023 | 3  | 24/08/2023 | 3         | 0-90              | 3240                  | 3240                                           |
| Red kite                                                      | 2                    | B 2023 | 3  | 24/08/2023 | 3         | 0-180             | 1140                  | 1140                                           |
| Red kite                                                      | 2                    | B 2023 | 3  | 24/08/2023 | 1         | 0-90              | 75                    | 75                                             |
| Red kite                                                      | 2                    | B 2023 | 3  | 24/08/2023 | 1         | 0-60              | 840                   | 840                                            |
| Red kite                                                      | 2                    | B 2023 | 3  | 24/08/2023 | 2         | 0-60              | 1620                  | 1620                                           |
| Red kite                                                      | 2                    | B 2023 | 3  | 24/08/2023 | 1         | 0-90              | 120                   | 120                                            |
| Red kite                                                      | 2                    | B 2023 | 3  | 04/09/2023 | 1         | 0-60              | 60                    | 60                                             |
| Red kite                                                      | 2                    | B 2023 | 3  | 04/09/2023 | 1         | 0-90              | 700                   | 700                                            |
| Red kite                                                      | 2                    | B 2023 | 3  | 04/09/2023 | 1         | 0-60              | 150                   | 150                                            |
| Red kite                                                      | 2                    | B 2023 | 3  | 04/09/2023 | 1         | 0-60              | 225                   | 225                                            |
| Red kite                                                      | 2                    | B 2023 | 3  | 04/09/2023 | 1         | 0-60              | 45                    | 45                                             |
| Red kite                                                      | 2                    | B 2023 | 3  | 04/09/2023 | 1         | 0-90              | 90                    | 90                                             |
| Red kite                                                      | 2                    | B 2023 | 1  | 15/09/2023 | 1         | 0-180             | 210                   | 210                                            |
| Red kite                                                      | 2                    | B 2023 | 3  | 04/10/2023 | 1         | 0-60              | 30                    | 30                                             |

| Flight activity by target species within the rotor swept area |                      |            |    |            |           |                   |                       |                                                |
|---------------------------------------------------------------|----------------------|------------|----|------------|-----------|-------------------|-----------------------|------------------------------------------------|
| Species                                                       | Modelled survey year | Season     | VP | Date       | No. birds | Flight height (m) | Total flight time (s) | Flight time at risk height within viewshed (s) |
| Red kite                                                      | 2                    | B 2023     | 3  | 04/10/2023 | 2         | 0-60              | 300                   | 300                                            |
| Red kite                                                      | 2                    | B 2023     | 3  | 04/10/2023 | 2         | 0-60              | 120                   | 120                                            |
| Red kite                                                      | 2                    | B 2023     | 3  | 04/10/2023 | 2         | 0-180             | 300                   | 300                                            |
| Red kite                                                      | 2                    | B 2023     | 3  | 04/10/2023 | 1         | 0-180             | 210                   | 210                                            |
| Red kite                                                      | 2                    | B 2023     | 3  | 04/10/2023 | 2         | 0-60              | 240                   | 240                                            |
| Red kite                                                      | 2                    | B 2023     | 3  | 04/10/2023 | 2         | 0-90              | 600                   | 600                                            |
| Red kite                                                      | 2                    | B 2023     | 3  | 04/10/2023 | 7         | 0-90              | 3255                  | 3255                                           |
| Red kite                                                      | 2                    | B 2023     | 3  | 04/10/2023 | 3         | 0-60              | 180                   | 180                                            |
| Red kite                                                      | 2                    | B 2023     | 3  | 04/10/2023 | 3         | 0-180             | 1260                  | 1260                                           |
| Red kite                                                      | 2                    | B 2023     | 3  | 04/10/2023 | 4         | 0-60              | 660                   | 660                                            |
| Red kite                                                      | 2                    | B 2023     | 1  | 06/10/2023 | 2         | 0-60              | 240                   | 240                                            |
| Red kite                                                      | 2                    | B 2023     | 1  | 06/10/2023 | 4         | 0-90              | 1440                  | 1440                                           |
| Red kite                                                      | 2                    | B 2023     | 1  | 06/10/2023 | 1         | 0-90              | 75                    | 75                                             |
| Red kite                                                      | 2                    | B 2023     | 1  | 06/10/2023 | 5         | 0-90              | 600                   | 600                                            |
| Red kite                                                      | 2                    | B 2023     | 1  | 06/10/2023 | 3         | 0-60              | 540                   | 540                                            |
| Red kite                                                      | 2                    | B 2023     | 1  | 06/10/2023 | 7         | 0-60              | 1890                  | 1890                                           |
| Red kite                                                      | 2                    | B 2023     | 2  | 10/10/2023 | 3         | 91-180            | 270                   | 270                                            |
| Red kite                                                      | 2                    | B 2023     | 2  | 10/10/2023 | 1         | 0-60              | 120                   | 120                                            |
| Lapwing                                                       | 1                    | B 2022     | 2  | 10/05/2022 | 3         | 0-60              | 180                   | 180                                            |
| Lapwing                                                       | 1                    | B 2022     | 2  | 23/06/2022 | 4         | 0-60              | 240                   | 240                                            |
| Lapwing                                                       | 1                    | B 2022     | 3  | 01/07/2022 | 4         | 0-60              | 240                   | 240                                            |
| Lapwing                                                       | 1                    | B 2022     | 2  | 19/07/2022 | 3         | 61-90             | 90                    | 90                                             |
| Lapwing                                                       | 2                    | NB 2022/23 | 1  | 15/12/2022 | 34        | 0-60              | 2040                  | 2040                                           |
| Lapwing                                                       | 2                    | NB 2022/23 | 1  | 15/12/2022 | 3         | 0-60              | 45                    | 45                                             |

| Flight activity by target species within the rotor swept area |                      |            |    |            |           |                   |                       |                                                |
|---------------------------------------------------------------|----------------------|------------|----|------------|-----------|-------------------|-----------------------|------------------------------------------------|
| Species                                                       | Modelled survey year | Season     | VP | Date       | No. birds | Flight height (m) | Total flight time (s) | Flight time at risk height within viewshed (s) |
| Lapwing                                                       | 2                    | NB 2022/23 | 1  | 15/12/2022 | 10        | 0-60              | 150                   | 150                                            |
| Lapwing                                                       | 2                    | NB 2022/23 | 1  | 15/12/2022 | 18        | 0-60              | 810                   | 810                                            |
| Lapwing                                                       | 2                    | NB 2022/23 | 1  | 15/12/2022 | 11        | 0-60              | 495                   | 495                                            |
| Lapwing                                                       | 2                    | NB 2022/23 | 1  | 15/12/2022 | 20        | 0-60              | 900                   | 900                                            |
| Lapwing                                                       | 2                    | NB 2022/23 | 1  | 15/12/2022 | 4         | 0-60              | 120                   | 120                                            |
| Lapwing                                                       | 2                    | NB 2022/23 | 1  | 15/12/2022 | 5         | 0-60              | 225                   | 225                                            |
| Lapwing                                                       | 2                    | NB 2022/23 | 1  | 15/12/2022 | 4         | 0-60              | 120                   | 120                                            |
| Lapwing                                                       | 2                    | NB 2022/23 | 1  | 15/12/2022 | 4         | 0-60              | 120                   | 120                                            |
| Lapwing                                                       | 2                    | NB 2022/23 | 1  | 15/12/2022 | 8         | 0-60              | 240                   | 240                                            |
| Lapwing                                                       | 2                    | NB 2022/23 | 1  | 15/12/2022 | 1         | 0-60              | 30                    | 30                                             |
| Lapwing                                                       | 2                    | NB 2022/23 | 1  | 15/12/2022 | 4         | 0-60              | 120                   | 120                                            |
| Lapwing                                                       | 2                    | NB 2022/23 | 1  | 15/12/2022 | 4         | 0-60              | 120                   | 120                                            |
| Lapwing                                                       | 2                    | NB 2022/23 | 1  | 15/12/2022 | 5         | 0-60              | 225                   | 225                                            |
| Lapwing                                                       | 2                    | NB 2022/23 | 1  | 15/12/2022 | 22        | 0-60              | 990                   | 990                                            |
| Lapwing                                                       | 2                    | NB 2022/23 | 1  | 15/12/2022 | 12        | 0-60              | 180                   | 180                                            |
| Lapwing                                                       | 2                    | B 2023     | 3  | 14/03/2023 | 2         | 0-60              | 90                    | 90                                             |
| Lapwing                                                       | 2                    | B 2023     | 3  | 14/03/2023 | 4         | 0-60              | 180                   | 180                                            |
| Lapwing                                                       | 2                    | B 2023     | 3  | 14/03/2023 | 2         | 0-60              | 60                    | 60                                             |
| Lapwing                                                       | 2                    | B 2023     | 3  | 04/04/2023 | 2         | N/A               | 0                     | 0                                              |
| Lapwing                                                       | 2                    | B 2023     | 3  | 04/04/2023 | 2         | 0-60              | 60                    | 60                                             |
| Lapwing                                                       | 2                    | B 2023     | 3  | 04/04/2023 | 4         | 0-90              | 180                   | 180                                            |
| Lapwing                                                       | 2                    | B 2023     | 3  | 04/04/2023 | 1         | 0-60              | 45                    | 45                                             |
| Lapwing                                                       | 2                    | B 2023     | 3  | 04/04/2023 | 1         | 0-90              | 30                    | 30                                             |
| Lapwing                                                       | 2                    | B 2023     | 3  | 04/04/2023 | 2         | 0-90              | 270                   | 270                                            |

| Flight activity by target species within the rotor swept area                    |                      |        |    |            |           |                   |                       |                                                |
|----------------------------------------------------------------------------------|----------------------|--------|----|------------|-----------|-------------------|-----------------------|------------------------------------------------|
| Species                                                                          | Modelled survey year | Season | VP | Date       | No. birds | Flight height (m) | Total flight time (s) | Flight time at risk height within viewshed (s) |
| Lapwing                                                                          | 2                    | B 2023 | 3  | 04/04/2023 | 3         | 0-60              | 315                   | 315                                            |
| Merlin                                                                           | 1                    | B 2022 | 2  | 16/04/2022 | 1         | 0-60-             | 20                    | 20                                             |
| Merlin                                                                           | 1                    | B 2022 | 2  | 16/04/2022 | 1         | 0-60              | 10                    | 10                                             |
| Merlin                                                                           | 1                    | B 2022 | 2  | 01/05/2022 | 1         | 0-60              | 30                    | 30                                             |
| Merlin                                                                           | 1                    | B 2022 | 2  | 02/07/2022 | 1         | 0-60              | 30                    | 30                                             |
| Merlin                                                                           | 2                    | B 2023 | 3  | 14/03/2023 | 1         | 0-60              | 45                    | 45                                             |
| Merlin                                                                           | 2                    | B 2023 | 2  | 09/08/2023 | 1         | 0-60              | 45                    | 45                                             |
| Peregrine                                                                        | 2                    | B 2023 | 3  | 24/08/2023 | 1         | 0-90              | 45                    | 45                                             |
| *Season is defined as Breeding season (B) and non-breeding/wintering season (NB) |                      |        |    |            |           |                   |                       |                                                |

| Species       | Total flight time (s) |
|---------------|-----------------------|
| Barn owl      | 75                    |
| Golden plover | 120                   |
| Grey heron    | 927                   |
| Hen harrier   | 160                   |
| Kestrel       | 765                   |
| Lapwing       | 8,910                 |
| Merlin        | 180                   |
| Peregrine     | 45                    |
| Red kite      | 59,415                |
| Teal          | 1,980                 |

## ANNEX B: COLLISION RISK MODELLING ANALYSIS SUMMARY

| Species       | Year | Daytime bird density | Predicted number of rotor transits | Single transit risk average | Collision rates before avoidance | Avoidance rate modelled (%) | Collision rates with avoidance (1 year) | Collision rates with avoidance (35 year) | Average collision rates with avoidance (1 year) | Average collision rates with avoidance (35 year) |
|---------------|------|----------------------|------------------------------------|-----------------------------|----------------------------------|-----------------------------|-----------------------------------------|------------------------------------------|-------------------------------------------------|--------------------------------------------------|
| Barn owl      | 1    | 1.09E-05             | 2                                  | 5.95%                       | 0.105                            | 98                          | 0.002                                   | 0.073                                    | 0.001                                           | 0.037                                            |
|               | 2    | 0.000                | 0                                  | 5.95%                       | 0.000                            |                             | 0.000                                   | 0.000                                    |                                                 |                                                  |
| Golden plover | 1    | 0.000                | 0                                  | 3.31%                       | 0.000                            | 98                          | 0.000                                   | 0.000                                    | 0.001                                           | 0.047                                            |
|               | 2    | 1.64E-05             | 5                                  | 3.31%                       | 0.136                            |                             | 0.003                                   | 0.095                                    |                                                 |                                                  |
| Hen harrier   | 1    | 0.000                | 0                                  | 5.66%                       | 0.000                            | 99                          | 0.000                                   | 0.000                                    | 0.000                                           | 0.014                                            |
|               | 2    | 1.22E-05             | 2                                  | 5.66%                       | 0.080                            |                             | 0.001                                   | 0.028                                    |                                                 |                                                  |
| Kestrel       | 1    | 0.000                | 0                                  | 4.77%                       | 0.000                            | 95                          | 0.000                                   | 0.000                                    | 0.010                                           | 0.338                                            |
|               | 2    | 8.8E-05              | 10                                 | 4.77%                       | 0.386                            |                             | 0.019                                   | 0.676                                    |                                                 |                                                  |
| Lapwing       | 1    | 0.000                | 33                                 | 3.98%                       | 1.127                            | 98                          | 0.023                                   | 0.789                                    | 0.012                                           | 0.434                                            |
|               | 2    | 1.64E-05             | 3                                  | 3.98%                       | 0.112                            |                             | 0.002                                   | 0.078                                    |                                                 |                                                  |
| Merlin        | 1    | 1.18E-05             | 2                                  | 3.83%                       | 0.075                            | 98                          | 0.002                                   | 0.053                                    | 0.001                                           | 0.047                                            |
|               | 2    | 1.02E-05             | 2                                  | 3.83%                       | 0.058                            |                             | 0.001                                   | 0.041                                    |                                                 |                                                  |
| Peregrine     | 1    | 0.000                | 0                                  | 4.38%                       | 0.000                            | 98                          | 0.000                                   | 0.000                                    | 0.000                                           | 0.008                                            |
|               | 2    | 3.43E-06             | 1                                  | 4.38%                       | 0.023                            |                             | 0.000                                   | 0.016                                    |                                                 |                                                  |
| Red kite      | 1    | 0.001                | 142                                | 5.99%                       | 7.219                            | 99                          | 0.072                                   | 2.527                                    | 0.196                                           | 6.875                                            |
|               | 2    | 0.006                | 630                                | 5.99%                       | 32.069                           |                             | 0.321                                   | 11.224                                   |                                                 |                                                  |
| Teal          | 1    | 0.000                | 79                                 | 3.41%                       | 2.283                            | 98                          | 0.046                                   | 1.598                                    | 0.023                                           | 0.799                                            |
|               | 2    | 0.000                | 0                                  | 3.41%                       | 0.000                            |                             | 0.000                                   | 0.000                                    |                                                 |                                                  |