

PEN MARCH WIND FARM

Breeding Season Bird Surveys 2020
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1.0 Introduction

1.1 Background

SLR was commissioned by RWE Renewables UK Ltd in March 2019 to undertake a range of baseline ecological and ornithological surveys at the proposed Pen March Wind Farm (the Site). This report presents the results of the 2020 breeding season bird surveys. The results of breeding season bird surveys undertaken in 2019 are reported separately¹.

1.2 Site Description

The Site is located approximately 1km north-east of the suburb of Dowlais Top on the north-eastern fringe of Merthyr Tydfil and 2km north-west of the centre of Rhymney village. The southern boundary of the Site lies approximately 40 m north of the A465 Heads of the Valleys Road (at its closest point). The Site comprises a broadly sloping area of purple moor grass *Molinia caerulea* dominated grassland, with small scattered areas of dense scrub, exposed rock, dry heath and standing open water habitats. The survey area rises from approximately 330m above sea level at the southern extent of the survey area (adjacent to the A465 road) up to approximately 530m in the north of the survey area.

The wider landscape around the Site is typified by grazed moorland habitats, with frequent scattered areas of industrial and residential development to the south, south-east and south-west of the survey area and the Brecon Beacons National Park lying to the north of the survey area.

1.3 Scope of Work

The scope of survey work was based on existing knowledge of the area and took into account current Nature Scot (formerly Scottish Natural Heritage (SNH)) Guidance² (which is also applicable to Wales and represents current industry best practice). The scope of survey work undertaken during the 2020 breeding season is summarised in Table 1-1.

Table 1-1
Scope of Ornithological Survey Work, Breeding Season 2020

Survey Type	Summary Methodology (see Section 2 for further details)
VP surveys	Based on 36 hours of survey between April ³ and August from each of two VPs. Following modelling of areas of potential visibility and taking into consideration likely constraints on the areas in which turbines could be located, two VPs were considered to provide sufficient coverage of possible turbine locations plus appropriate buffer zones. The VPs used were the same as those used for breeding season surveys in 2019 and for non-breeding surveys in 2019-20 and 2020-21.

¹ SLR Consulting. 2019. *Pen March Wind Farm Breeding Season Bird Surveys 2019*. Report for Innogy Renewables UK Ltd, December 2019.

² Scottish Natural Heritage (2017). *Recommended Bird Survey Methods to Inform Impact Assessment of Onshore Wind Farms V2*. Scottish Natural Heritage, Inverness.

³ Surveys were originally planned to commence in late March, but were slightly delayed due to COVID-19 restrictions in place at that time.

Survey Type	Summary Methodology (see Section 2 for further details)
Breeding wader survey	Surveys were based on current NatureScot guidance which includes recommendations set out in Calladine <i>et al.</i> (2009) ⁴ , requiring an adapted Brown & Shepherd ⁵ method with four survey visits, at least seven days apart, between mid-April and early July. Surveys covered all accessible suitable habitat for breeding waders within 500m of possible infrastructure locations.
Breeding raptor survey	Methods followed Hardey <i>et al.</i> (2013) ⁶ . Four visits to all accessible suitable habitat (moorland and crags) were undertaken for hen harrier, merlin, peregrine and short-eared owl within 2km of possible turbine locations between April and July. In addition, potentially suitable habitat (woodland and mature trees), where accessible, was surveyed for breeding red kite within 2km of possible turbine locations between April and August.

1.4 Purpose of this Report

This report outlines the surveys undertaken and methods used. It goes on to summarise the field data obtained and provides descriptions of the legal and conservation status of the species recorded. It also provides a brief comparison of the survey results obtained in 2020 with those obtained in 2019.

The assessment of impacts resulting from the proposed development and the development of mitigation and compensation measures, if required, are beyond the scope of this report and will be covered in a separate Environmental Statement in due course.

1.5 Target Species

Target species for the surveys were defined by legal and/ or conservation status and vulnerability to impacts caused by wind turbines, as defined in current NatureScot Guidance² and also considered the results of the 2019 breeding season bird surveys.

1.5.1 Primary Target Species

All Annex I and/ or Schedule 1 raptor and owl species, including:

- Hen harrier *Circus cyaneus*
- Marsh harrier *Circus aeruginosus*
- Red kite *Milvus milvus*
- Merlin *Falco columbarius*

⁴ Calladine, J., Garner, G., Wernham, C. & Thiel, A. (2009). *The influence of survey frequency on population estimates of moorland breeding birds*. Bird Study, 56: 3, 381-388.

⁵ Brown, A. F & Shepherd, K. B. (1993). *A method for censusing upland breeding waders*. Bird Study 40: 189-195.

⁶ Hardey, J., Crick, H.Q.P., Wernham, C., Riley, H., Etheridge, B., Thompson, D. (2013). *Raptors: A field guide for surveys and monitoring* (3rd Edition). The Stationery Office Edinburgh.

- Peregrine *Falco peregrinus*
- Kestrel *Falco tinnunculus*⁷
- Short-eared owl *Asio flammeus*

All wildfowl species, excluding feral geese and all wader species, including:

- Mallard *Anas platyrhynchos*
- Goosander *Mergus merganser*
- Curlew *Numenius arquata*
- Snipe *Gallinago gallinago*
- Golden plover *Pluvialis apricaria*

1.5.2 Secondary Target Species

Non-Annex I and/ or Schedule 1 raptor species, including:

- Buzzard *Buteo buteo*
- Large gull species (herring gull *Larus argentatus*, lesser black-backed gull *Larus fuscus*)
- Raven *Corvus corax*

⁷ Not Annex I or Schedule 1 but selected as a result of behaviour which makes this species potentially vulnerable to impact from wind farms (e.g. collision mortality).

2.0 Survey Methodology

2.1 Survey Areas, Dates and Personnel

Surveys were undertaken by Martyn Owen MCIEEM (MO) and Richard Moores (RM) from BiOME Consulting, both experienced ornithologists working as sub-consultants to SLR Consulting.

Details of survey dates, times and observers are provided in Appendix 01, and details of weather conditions during surveys are provided in Appendix 02. The ornithology survey areas were as described in Table 1-1 and as shown on **Figure 1** and **Figure 2**. It is noted that the survey areas used in 2020 were slightly larger than those used in 2019 following minor changes to the extent of the developable areas in between the 2019 and 2020 survey periods.

2.2 Flight Activity Surveys

Thirty-six hours of standard flight activity surveys were conducted from each of two VP locations during the 2020 breeding season (April to August), as summarised in Table 2-1. The VP locations were unchanged from those used in 2019 and are shown on **Figure 2** along with their associated areas of visibility at 15m above ground level, i.e. the lowest possible rotor swept height (the viewsheds)).

In order to avoid possible complications during any subsequent collision risk modelling VP watches were timed such that surveys were never undertaken simultaneously from both VPs.

VP watches aimed to quantify the flight activity of primary and secondary target species (as defined in Section 1.5) within the study area.

The main purpose of VP watches is to collect data on primary target species that will enable estimates to be made of:

- The time spent flying over the site;
- The relative use by birds of different parts of the site; and
- The proportion of flying time spent within the provisional upper and lower risk height limits as determined by the potential rotor diameter and rotor hub height.

For each primary target species observation, the following details were recorded:

- Time of observation;
- Duration of flying bout;
- Species, age and sex (where determinable); and
- Time spent within each height band.

Taking into account the possible dimensions of the turbines likely to be used, the height bands used were as follows:

- 1 = <15m
- 2 = 15-30m
- 3 = 30-150m
- 4 = 150-200m
- 5 = >200m

In addition, a summary of observations of secondary target species was recorded at the end of each five-minute period during VP watches to provide an index of flight activity for secondary target species within the site, in accordance with current NatureScot guidance.

Table 2-1
VP Surveys undertaken at Pen March, Breeding Season 2020

VP Number	OS Grid Reference	Hours of Survey Completed					
		April	May	June	July	August	Total
1	SO 09017 11354	12	6	6	6	6	36
2	SO 07915 09699	12	6	6	6	6	36

2.3 Breeding Wader Surveys

Surveys for breeding waders (and other species of conservation concern) were carried out in suitable habitat (i.e. open moorland, grassland and farmland) within 500m of the developable area – all infrastructure (**Figure 1**) as described in Table 1-1.

The four survey visits in 2020 were carried out on the following dates:

- Visit 1: 14th and 15th April
- Visit 2: 5th and 25th May
- Visit 3: 10th and 11th June
- Visit 4: 15th and 19th July

Additional survey effort was undertaken in order to obtain specific information on curlew on the following dates:

- 26th, 27th May and 9th June

Surveys focused on wader species plus other non-wader species of conservation concern. Registrations were marked onto 1:25,000 scale survey maps using standard British Trust for Ornithology (BTO) species and activity codes for use in post-survey analysis.

Birds were considered to be confirmed breeding if:

- They were observed displaying or singing on more than one visit;
- Nests, eggs, or young were located;
- Adults repeatedly alarm called;
- Distraction displays were seen; and/ or
- Territorial disputes were observed.

Birds were considered to be probably or possibly (i.e. unconfirmed) breeding if:

- They were observed displaying or singing on one visit (i.e. possibly breeding) or more than one visit (i.e. probably breeding) (with the exception of obvious passage migrants in spring); or
- A pair of birds was observed in suitable habitat for nesting.

Other records were considered to be of non-breeding birds, failed breeders, birds loafing, feeding or on passage to other areas.

2.4 Breeding Raptor Surveys

Species-specific surveys were undertaken for all raptors likely to occur in the survey area, including red kite, peregrine and merlin, following methods as described in Table 1-1, within 2km of the developable area for turbines (**Figure 1**).

During the surveys all accessible, potentially suitable, raptor breeding habitat within the survey area, including open moorland and moorland/ forest edge (merlin); quarries, rock crags and outcrops (peregrine) and woodland and mature trees (red kite) was covered by walkover and shortened VP watches overlooking suitable habitat. Data collected during VP surveys and moorland breeding bird surveys were also used to define raptor territories within the relevant parts of the survey area.

Survey visits during the 2020 breeding season were carried out as follows:

- April: 14th, 20th and 21st.
- May: 4th and 27th.
- June: 25th and 26th.
- July: 18th.

2.5 Survey Limitations

2.5.1 Site Fire

Over the Easter bank holiday weekend (10th-13th April) there was a large fire across around 20% of the Pen March site area, extending further to the northeast⁸ (approximate area affected shown on **Figure 3**). Although this didn't directly affect any of the breeding bird surveys, the fire may have affected bird distribution and activity within the Site. The habitat within much of the impacted area was dominated by purple moor-grass *Molinia caerulea*, which had low breeding species diversity in 2019 (skylark and meadow pipit only). The fire may however have temporarily increased food resource (i.e. prey availability for carrion feeders such as red kite) and/or provided increased nesting habitat for some ground-nesting species which prefer sparse vegetation cover (e.g. some wader species). Comparison with survey results from 2019 (see Section 3.4) suggests that any effects were not significant, however.

2.5.2 Survey Coverage/ Access/ Timing

Some areas (e.g. woodland) within the survey buffers are on private land with no access. This is not considered to be significant with regard to identifying raptor breeding territories, as generally these areas could be viewed from a distance.

The breeding raptor survey start date of 14th April is later than the first visit recommended by Hardey *et al.* (2013)⁶ for red kite and peregrine (March to early April for both species). In addition, VP surveys were originally planned to commence in late March but were slightly delayed (commencing on 1st April). This was due to the start of the surveys being delayed for a short period due to uncertainty about safe access for survey during the COVID-19 outbreak.

⁸ <https://www.walesonline.co.uk/news/wales-news/arson-brecon-beacons-neath-fires-18093883>

This is not considered significant in terms of identifying breeding territories of red kite or peregrine during the 2020 season, as both these species were active throughout the whole period.

VP survey effort was doubled in April in order to catch up with the required number of hours, therefore the shortfall in March is not considered to be significant.

Kestrel was only recorded as a secondary target species (i.e. using five-minute summaries instead of mapping individual flights) during the July and August vantage point surveys, which was an oversight (partly due to the high number of red kite flights being recorded during these surveys). Surveys have now (in autumn/ winter 2020/2021) resumed recording kestrel as a primary target species. It is still possible to use these five-minute summaries to provide a measure of flight activity and contribute towards assessing collision risk.

Other surveys were carried out within the parameters of current guidelines (both in terms of timings and weather conditions).

With regard to viewshed coverage, there is a gap in the visibility apparent in the centre of the Developable Area for Turbines due to the nature of the terrain (**Figure 2**). For the same reason, there are gaps in the coverage of the 500m buffer of possible turbine locations which is unavoidable. Despite this, it is considered that the vantage point data will be representative of the site as a whole and sufficient to inform a robust assessment of the proposed development.

3.0 Survey Results

3.1 Flight Activity Surveys

Flight activity recorded from VP1 and VP2 by primary target species is summarised in Table 3-1. Primary target species flights from both VPs are shown on **Figures 4 to 8**. Detailed survey data are provided in Appendix 03.

Table 3-1
Number of Primary Target Species Flights from VP1 and VP2 Combined, April – August 2020

Species	Number of flights by month					Total number of flights	Total number of flights potentially at risk height*	Total number of birds recorded in flight	Total number of birds potentially at risk height*
	April	May	June	July	August				
Mallard	5	0	1	0	0	6	0	8	0
Goosander	2	0	1	0	0	3	2	18	7
Red kite	23	5	6	12	20	66	56	86	71
Hen harrier	8	0	0	0	0	8	2	9	3
Merlin	3	0	0	0	0	3	0	3	0
Kestrel	1	0	0	0**	0**	1	1	1	1
Peregrine	2	0	0	0	0	2	2	2	2
Curlew	3	1	14	0	0	18	10	28	15
Golden plover	1	0	0	0	2	3	2	13	2
* precautionary risk height assumed to be between 15m – 200m ** recorded as Secondary Target Species only									

3.1.1 Primary Target Species Accounts

A total of 110 flights by primary target species was recorded between April and August 2020. A breakdown of flight activity by species is presented below:

Mallard

Six mallard flights were recorded, all outside of the Developable Area for Turbines (**Figure 4**). All but one flight was associated with waterbodies (Blaen Rhymney Reservoir and Jepson's Pond). No flights were at potential collision risk height.

Goosander

Three goosander flights were recorded, all outside of the Developable Area for Turbines (**Figure 4**). The maximum flock size recorded was 11 birds in June. Flights were associated with Blaen Rhymney reservoir and Jepson's Pond. Two flights were at potential collision risk height.

Red kite

Red kite was the most frequently recorded primary target species recorded during the flight activity surveys. Flight activity peaked in April (23 flights) and August (20 flights). Out of 66 recorded flights during April to August, 56 were at a height whereby they were potentially at risk of collision (involving 71 birds and lasting for a combined duration of 7,033 seconds). Flights by red kites were recorded throughout the Developable Area for Turbines, with individuals observed foraging, circling over and transiting through the developable area (**Figure 5 (5A April, 5B May, 5C June, 5D July, 5E August)**).

Hen harrier

Eight hen harrier flights were recorded during the flight activity surveys, involving one adult female (seven flights) and a first calendar year male (two flights). Birds were only present on two dates (1st-2nd April 2020) in the north of the Developable Area for Turbines (**Figure 6**). The total flight time recorded was 123 seconds, 78 seconds of which were at potential collision risk height.

Merlin

Three merlin flights were recorded during the flight activity surveys, all within the Developable Area for Turbines (**Figure 6**). All three flights were recorded on 1st April (2 flights) and 2nd April (one flight), presumably all involving the same bird (an adult female). All the recorded flights were of short duration below potential collision risk height.

Kestrel

One kestrel flight was recorded during the flight activity surveys on 16th April, outside of the Developable Area for Turbines (**Figure 6**). Kestrel was also recorded as a secondary species in July and August (during 9 five-minute periods, with a maximum number of 2 birds).

Peregrine

Two peregrine flights were recorded during the flight activity surveys, both within the Developable Area for Turbines (**Figure 6**). An adult female was observed from VP2 on 9th April and one flight of an adult male was observed from VP1 on 16th April. Both recorded flights were observed at least partially at a height considered to be potentially at risk of collision.

Curlew

18 curlew flights were recorded during the flight activity surveys. Most of the flight activity was observed towards the north/ north-east of the Developable Area for Turbines, coinciding with the breeding territories in that area (see Section 3.2) (**Figure 7 (7A April, 7B May, 7C June)**). The majority (n=14) of flights were observed in June, presumably when there was increased flight activity due to defensive behaviour by adult curlews when chicks were present. Ten flights were observed at a height considered to be potentially at risk of collision (for a combined total of 504 seconds).

Golden plover

Three golden plover flights were recorded during the flight activity surveys (shown on **Figure 8**). The flights were presumably of passage birds (11 birds on 1st April and 2 flights of single birds on 13th August). All flights were within the Developable Area for Turbines, two of which were at potential collision risk height (for a combined total of 230 seconds).

3.1.2 Secondary Species Activity

Secondary species activity is summarised in Table 3-2. Buzzard was the most frequently recorded secondary species (in 63 five-minute periods out of a possible 864, with lesser black-backed gull the most numerous (maximum flock size 45)).

Table 3-2
Secondary Species Activity Summary for VP1 and VP2 Combined, April – August 2020

Species	Number of 5 min periods recorded *	Maximum number of birds recorded in any one period	Comments
Common buzzard	63	4	Activity throughout all months, within the Developable Area for Turbines and the survey buffer
Lesser black-backed gull	44	45	Activity throughout all months, birds roosting on factory roofs and commuting to Jepson's Pond, most activity outside the Developable Area for Turbines
Raven	44	5	Activity throughout all months, within the Developable Area for Turbines and the survey buffer
Herring gull	8	20	Activity mostly in April, birds roosting on factory roofs and commuting to Jepson's Pond, outside the Developable Area for Turbines
Kestrel**	9	2	Birds hunting over Site in July & August
* total of 864 five-minute periods during surveys			
**July – August only			

3.2 Breeding Wader Surveys

The following species accounts provide summary details on breeding wader species encountered during the 2020 surveys (all surveys combined).

3.2.1 Curlew

Four confirmed territories were identified within the 500m survey buffer during breeding wader surveys (approximate territory centres are shown on **Figure 9**). Two of the breeding pairs hatched young, with the adults subsequently moving the young northwards uphill (to the east of the Developable Area for Turbines, within the 500m survey buffer). One of these territories was centred within the Developable Area for Turbines. Territories were located as follows:

- Within the Developable Area for Turbines, on the south-eastern slope of Pen March, pair present during May and June surveys;
- c. 200m east of the Developable Area for Turbines boundary, in fields north of Twyn yr Arian, birds present during April, May and June surveys;
- c. 300m east of the Developable Area for Turbines boundary, to the west of Pitwellt Reservoir. Presumably this pair seen with young c.500m to the north, adjacent to the Nant Pitwellt, in June; and
- c. 1.1km east of the Developable Area for Turbines boundary, to the north of Blaen Rhymney Reservoir. Presumably this was the pair later seen with young within 500m of the Developable Area for Turbines, 650m to the north-west (west of the Rhymney River), in June.

3.2.2 Snipe

Displaying snipe were noted at two distinct areas (including one observation of a probable nest site) within the Developable Area for Turbines, indicating that territories were present in those locations, north-east of Pitwellt Pond and on Pen March (as shown on **Figure 9**).

3.2.3 Common sandpiper *Actitis hypoleucos*

One confirmed territory as identified outside of the Developable Area for Turbines, at the northern end of Blaen Rhymney Reservoir (as shown on **Figure 9**).

3.2.4 Lapwing *Vanellus vanellus*

One unconfirmed territory outside of the Developable Area for Turbines, adjacent to the Rhymney River, based on a displaying adult in April (as shown on **Figure 9**). Also recorded in May but there was no evidence of successful breeding.

3.2.5 Little ringed plover *Charadrius dubius*

One bird was recorded on the edge of Blaen Rhymney Reservoir in early May, but as there were no other records was considered to be a passage bird rather than a breeding species at this location.

3.2.6 Incidental records of other species

During the four survey visits the following incidental records were made of other (non-wader) species of conservation concern:

- Wildfowl: goosander and mallard (in the waterbodies outside of the Developable Area for Turbines);
- Raptors: red kite, buzzard and kestrel (foraging in and around the Developable Area for Turbines);
- Gulls: herring gull and lesser black-backed gull (using the reservoirs outside of the Developable Area for Turbines for roosting);
- Cuckoo *Cuculus canorus*: one outside of the Developable Area for Turbines;

- Moorland passerines of conservation concern: skylark *Alauda arvensis* and meadow pipit *Anthus pratensis* (common across the survey area); grasshopper warbler *Locustella naevia*, wheatear *Oenanthe oenanthe*, stonechat *Saxicola rubicola*, grey wagtail *Motacilla cinerea* and reed bunting *Emberiza schoeniclus* (small numbers breeding);
- Woodland/ farmland passerines of conservation concern: redstart *Phoenicurus phoenicurus* (three territories outside of the Developable Area for Turbines); linnet *Linaria cannabina*.
- Swallow *Hirundo rustica* and house martin *Delichon urbicum*: small numbers foraging across the survey area.

3.3 Breeding Raptor Surveys

The following species accounts provide summary details on the primary target raptor species encountered during the 2020 surveys (all surveys combined). The results of the breeding raptor surveys, including the location of the red kite breeding site, can be seen in **Figure 10 (Confidential Appendix 04)**.

3.3.1 Red kite

Activity was frequently recorded during all surveys and was particularly focussed around an area of private woodland within 1km of (but >500m from) the Developable Area for Turbines. As there was no access to this area, it was not possible to confirm that breeding occurred, although based on observations it is likely that breeding took place, but the outcome is unknown.

3.3.2 Kestrel

Kestrel was occasionally recorded foraging over the site, but there was no evidence of breeding by this species within 2km of the developable area in 2020.

3.3.3 Peregrine

The 2019 breeding site¹ was not checked in 2020 as it is well outside the survey area (i.e. 3.5km from the Developable Area for Turbines). One bird was recorded in flight to the north of the 2km survey buffer in late April; and an adult female was seen flying over the two disused quarries to the east of Pontsticill (within the 2km survey buffer) in mid-July. There was no indication of breeding within 2km of the Developable Area for Turbines.

3.3.4 Goshawk

One juvenile female was recorded within 2km near Pontsticill on 18th July only, with no further records or indication of breeding within the survey area. This bird is likely to have originated from outside of the 2km survey buffer, with apparently extensive breeding habitat to the west of Pontsticill Reservoir.

3.3.5 Secondary target species

Buzzard was present within 2km of the Developable Area for Turbines in 2020, with two occupied nests noted in the Cwm Taf Fechan valley.

Sparrowhawk was recorded on one occasion in the Cwm Taf Fechan valley, but there was no evidence of breeding.

3.4 Comparison with 2019 Survey Results

The survey results obtained in breeding season 2019 compared with those obtained in 2020 are summarised in the following section. Note that the survey areas used in 2020 were slightly larger than those used in 2019 (as described in Section 2.1).

3.4.1 Flight Activity Surveys

As noted in Table 3-3, flight activity in both years was broadly comparable, but with increased activity by red kite and curlew in 2020. This is likely due to the presence of a red kite territory in relatively close proximity to the site and an increase in the number of curlew territories from two to four in 2020. Flight activity by all other primary target species was relatively low in both years.

Table 3-3
Flight Activity Surveys 2019-2020 Comparison (Breeding Season)

Species	2019				2020			
	Total number of flights	Total number of flights potentially at risk height*	Total number of birds recorded in flight	Total number of birds potentially at risk height*	Total number of flights	Total number of flights potentially at risk height*	Total number of birds recorded in flight	Total number of birds potentially at risk height*
Mallard	2	0	3	0	6	0	8	0
Goosander	0	0	0	0	3	2	18	7
Red kite	52	44	57	49	66	56	86	71
Marsh harrier	9	1	9	1	0	0	0	0
Hen harrier	2	0	2	0	8	2	9	3
Merlin	0	0	0	0	3	0	3	0
Kestrel	3	3	3	3	1	1	1	1
Peregrine	4	4	4	4	2	2	2	2
Curlew	4	2	4	2	18	10	28	15
Snipe	2	2	2	2	0	0	0	0
Golden plover	0	0	0	0	3	2	13	2
* precautionary risk height assumed to be between 15m – 200m								

3.4.2 Breeding Wader Surveys

As noted in Table 3-4, the number of species and total number of territories recorded increased in 2020 in comparison with 2019. The reasons behind this are not clear.

Table 3-4
Number of Breeding Wader Territories 2019-2020

Species	Number of territories	
	2019	2020
Curlew	Total 2 (outside Developable Area for Turbines within 500m buffer)	Total 4 (1 within Developable Area for Turbines; 3 within 500m buffer)
Snipe	Total 0 (only recorded outside 500m of Developable Area for Turbines)	Total 2 (both within Developable Area for Turbines)
Common sandpiper	Total 0	Total 1 (outside Developable Area for Turbines within 500m buffer)
Lapwing	Total 0	Total 1 (outside Developable Area for Turbines within 500m buffer)

3.4.3 Breeding Raptor Surveys

- Red kite is likely to have attempted to breed within 2km in 2020, but there was no evidence of this occurring in 2019.
- Peregrine was present in both years and bred beyond the 2km survey buffer in 2019 (this site was not included in the 2020 survey).
- Buzzard bred within 2km in 2020 and was also present in 2019.
- Also recorded as non-breeding species during surveys were:
 - Hen harrier (in both 2019 and 2020);
 - Marsh harrier (in 2019);
 - Kestrel (in both 2019 and 2020);
 - Merlin (in 2020);
 - Goshawk (in 2020);
 - Sparrowhawk (in 2020); and
 - Short-eared owl (in 2019).

3.4.4 Potential Effects of the Fire in April 2020

At this stage it is not apparent that the fire in April 2020 had any significant influence on bird activity in the 2020 breeding season, other than potentially creating temporary foraging opportunities for scavenging species such as red kite. Although flight activity by this species was high in 2020, it was also relatively high in 2019. In addition, the highest activity in 2020 was recorded towards the end of the survey period, when any effects resulting from the fire would be expected to have declined.

4.0 Summary and Conclusions

A range of ornithology surveys were carried out at the site of the proposed Pen March Wind Farm during the 2020 breeding season. These were:

- Flight activity (VP) surveys;
- Breeding wader surveys; and
- Breeding raptor surveys.

The following primary target species were recorded during flight activity surveys:

- Mallard
- Goosander
- Red kite
- Hen harrier
- Merlin
- Kestrel
- Peregrine
- Curlew; and
- Golden plover

The most frequent flight activity was by red kite (66 flights recorded), with other target species activity much less frequent. The next most frequently recorded species was curlew (18 flights recorded). All other target species were recorded eight times or less.

Breeding wader surveys recorded four target species:

- Curlew: four confirmed territories, one of which was centred within the Developable Area for Turbines. At least two of the breeding pairs hatched young;
- Snipe: two confirmed territories within the Developable Area for Turbines;
- Common sandpiper: one confirmed territory outside the Developable Area for Turbines; and
- Lapwing: one unconfirmed territory outside of the Developable Area for Turbines.

Breeding raptor surveys recorded the following primary target species and two secondary species:

- Red kite: probably breeding within 1km (but >500m) from the Developable Area for Turbines;
- Kestrel: non-breeding;
- Peregrine: non-breeding;
- Goshawk: non-breeding;
- Buzzard: breeding outside of the Developable Area for Turbines; and
- Sparrowhawk: non-breeding.

Incidental records were made of other species of conservation concern, including:

- Wildfowl: goosander and mallard;
- Gulls: herring gull and lesser black-backed gull;

- Cuckoo;
- Moorland passerines of conservation concern: skylark, meadow pipit, grasshopper warbler, wheatear, stonechat, grey wagtail and reed bunting;
- Woodland/ farmland passerines of conservation concern: redstart and linnet.
- Swallow and house martin.

Flight activity by target species was broadly comparable in 2020 compared with 2019, but with increased activity by red kite and curlew in 2020. This is likely due to the presence of a red kite territory in relatively close proximity to the site and an increase in the number of curlew territories from two to four in 2020. The number of territories for other wader species also increased between 2019 and 2020, the reasons for which are not clear. Other than for red kite the results of the breeding raptor surveys were broadly comparable between 2019 and 2020. The fire in April 2020 is not considered to have significantly affected bird distribution or activity.

4.1 Legal and Conservation Status of Target Species Recorded

Table 4-1 summarises the legal and conservation status of the primary target species recorded during the range of ornithology surveys mentioned above.

Table 4-1
Legal and Conservation Status of Target Species

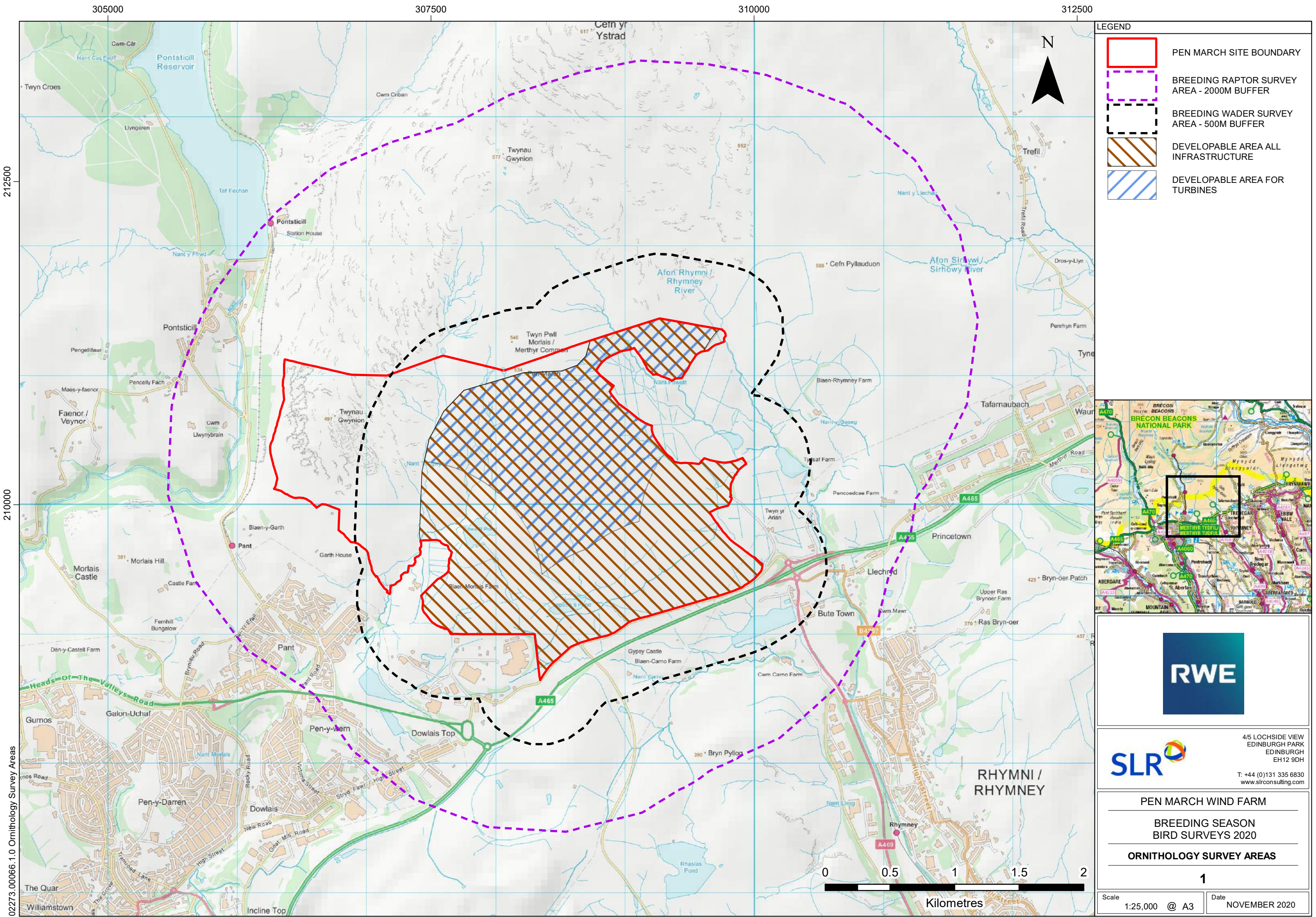
Species	Legal & Conservation Status in Wales
Mallard	General WCA; BoCC4 Amber; BoCCW3 Amber
Goosander	General WCA; BoCC4 Green; BoCCW3 Green
Red kite	Schedule 1 & 1A; Annex 1; BoCC4 Amber; BoCCW3 Amber
Goshawk	Schedule 1; BoCC4 Green; BoCCW3 Green
Hen harrier	Schedule 1 & 1A; Annex 1; BoCC4 Red; BoCCW3 Red; Sec7
Kestrel	General WCA; BoCC4 Amber; BoCCW3 Green; Sec7
Peregrine	Schedule 1; Annex 1; BoCC4 Green; BoCCW3 Green
Merlin	Schedule 1; BoCC4 Red; BoCCW3 Green
Curlew	General WCA; BoCC4 Red; BoCCW3 Red; Sec7
Snipe	General WCA; BoCC4 Amber; BoCCW3 Amber
Common sandpiper	General WCA; BoCC4 Amber; BoCCW3 Red
Golden plover	General WCA; Annex 1; BoCC4 Green; BoCCW3 Red; Sec7
Lapwing	General WCA; BoCC4 Red; BoCCW3 Red; Sec7
Key	General WCA - the species is afforded general protection by the Wildlife and Countryside Act 1981 (as amended); Schedule 1 & 1A - the species is listed in Schedule 1 or 1A of the Wildlife and Countryside Act 1981 (as amended); Annex 1 – the species is listed in Annex 1 of the EC Birds Directive;

Species	Legal & Conservation Status in Wales
	BoCC4 status (green, amber or red) – indicates the current Birds of Conservation Concern status category⁹; BoCCW3 status (green, amber or red) – indicates the current Birds of Conservation Concern Wales status category (published in 2016)¹⁰; and Sec7: Section 7 of the Environment (Wales) Act 2016 (species of principal importance for conserving biodiversity in Wales).

⁹ Eaton MA, Aebischer NJ, Brown AF, Hearn RD, Lock L, Musgrove AJ, Noble DG, Stroud DA and Gregory RD (2015) Birds of Conservation Concern 4: the population status of birds in the United Kingdom, Channel Islands and Isle of Man. *British Birds* 108, 708–746.

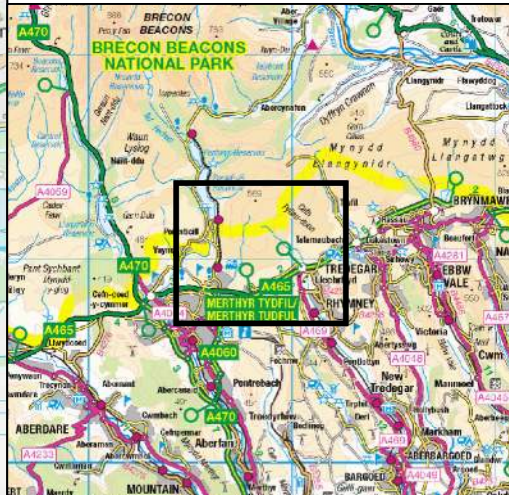
¹⁰ https://www.rspb.org.uk/globalassets/downloads/documents/wales/state-of-birds-wales-2018_bilingual.pdf

FIGURES



LEGEND

- PEN MARCH SITE BOUNDARY
- BREEDING RAPTOR SURVEY AREA - 2000M BUFFER
- BREEDING WADER SURVEY AREA - 500M BUFFER
- DEVELOPABLE AREA ALL INFRASTRUCTURE
- DEVELOPABLE AREA FOR TURBINES



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4/5 LOCHSIDE VIEW
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PEN MARCH WIND FARM

**BREEDING SEASON
BIRD SURVEYS 2020**

ORNITHOLOGY SURVEY AREAS

1

Scale 1:25,000 @ A3 Date NOVEMBER 2020

02273.00066.1.0 Ornithology Survey Areas

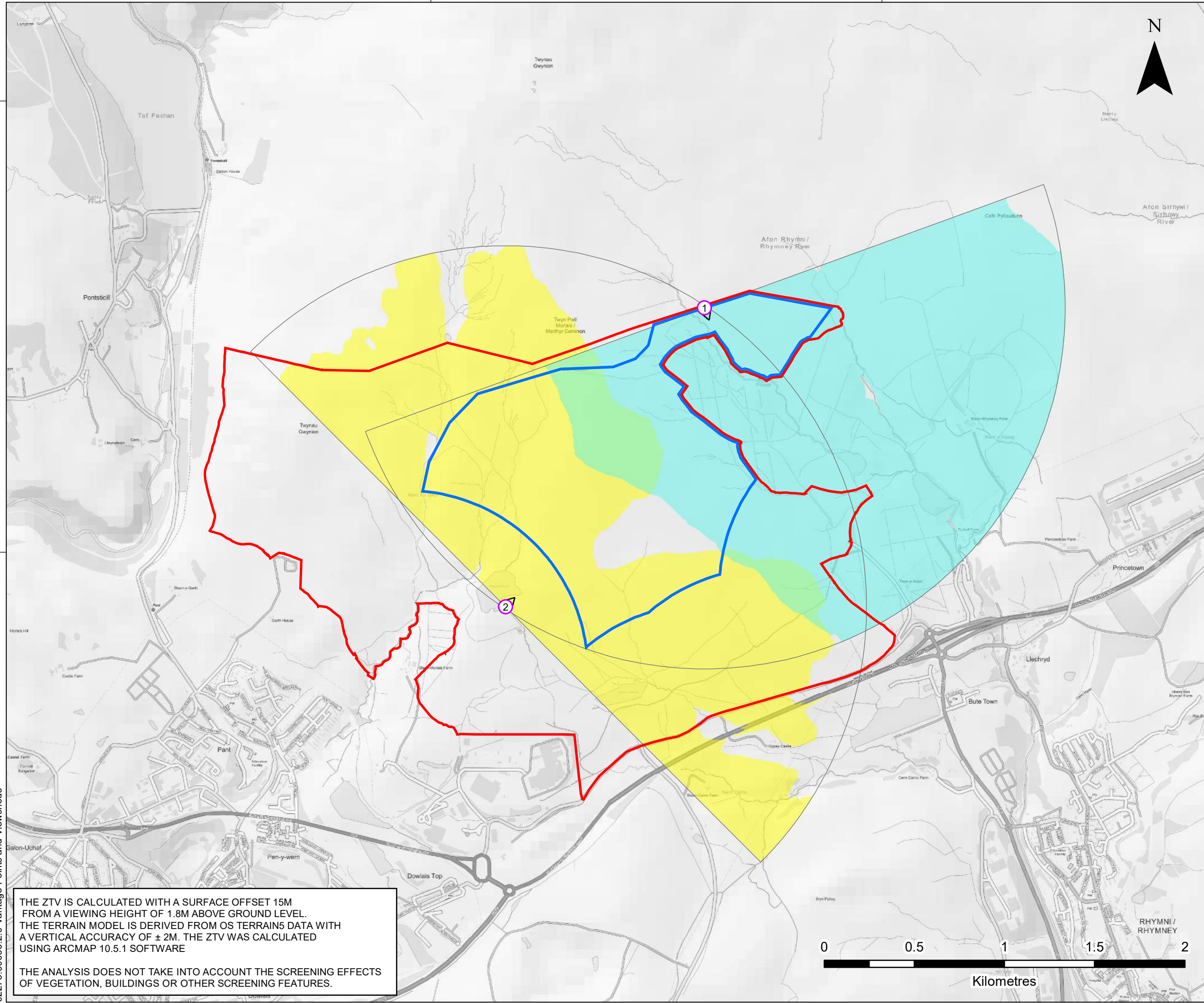
307500

310000

212500

210000

02273.00066.2.0 Vantage Points and Viewsheds



LEGEND

- PEN MARCH SITE BOUNDARY
- DEVELOPABLE AREA FOR TURBINES
- PEN MARCH VANTAGE POINT MAP

ZONES OF THEORETICAL VISIBILITY

VP01 VP02

4/5 LOCHSIDE VIEW
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PEN MARCH WIND FARM

**BREEDING SEASON
BIRD SURVEYS 2020**

VANTAGE POINTS AND VIEWSHEDS

2

Scale 1:20,000 @ A3 Date NOVEMBER 2020

THE ZTV IS CALCULATED WITH A SURFACE OFFSET 15M FROM A VIEWING HEIGHT OF 1.8M ABOVE GROUND LEVEL. THE TERRAIN MODEL IS DERIVED FROM OS TERRAIN5 DATA WITH A VERTICAL ACCURACY OF ± 2 M. THE ZTV WAS CALCULATED USING ARCMAP 10.5.1 SOFTWARE

THE ANALYSIS DOES NOT TAKE INTO ACCOUNT THE SCREENING EFFECTS OF VEGETATION, BUILDINGS OR OTHER SCREENING FEATURES.



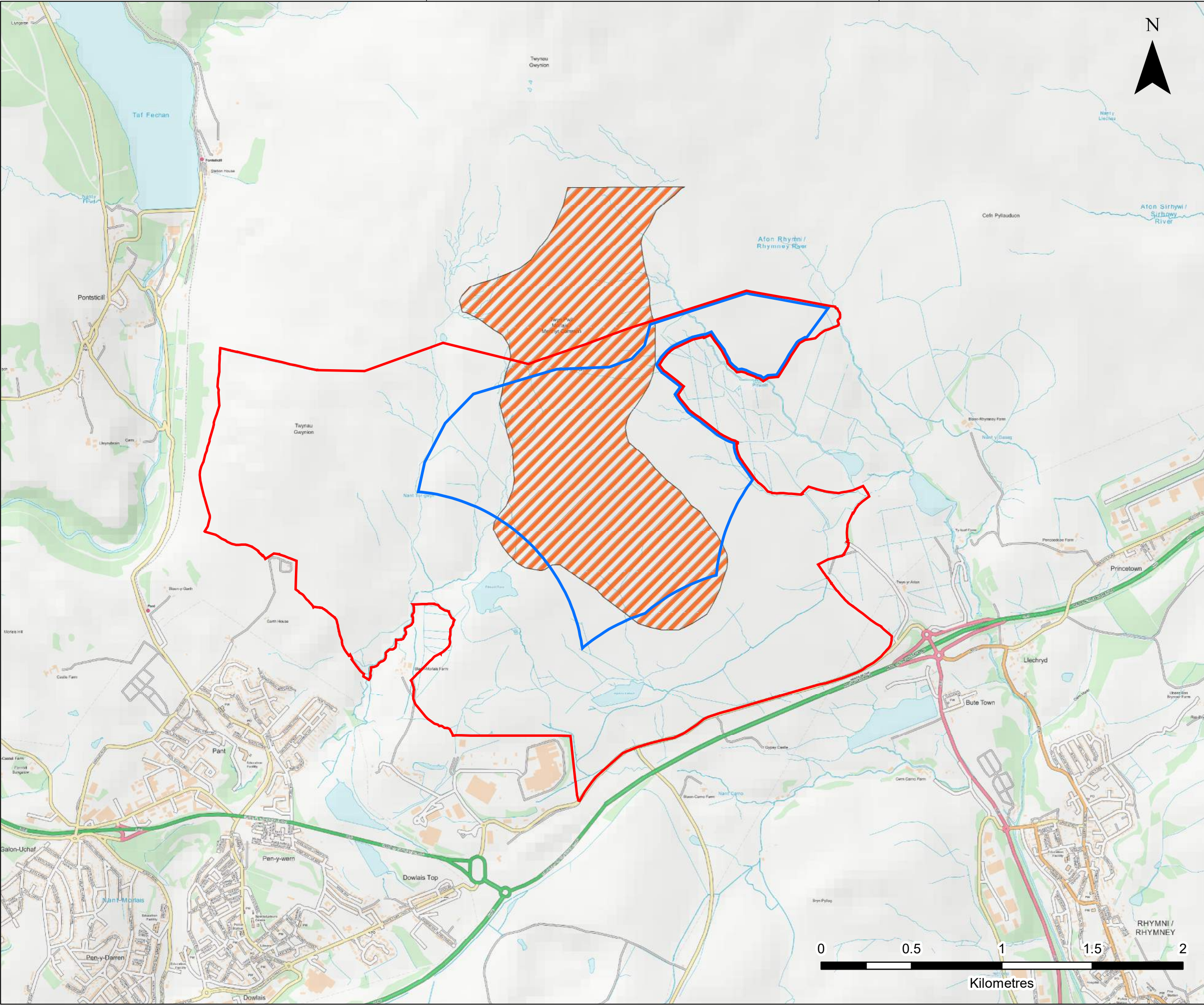
307500

310000

212500

210000

02273.00066.3.0 Approximate Extent of Fire



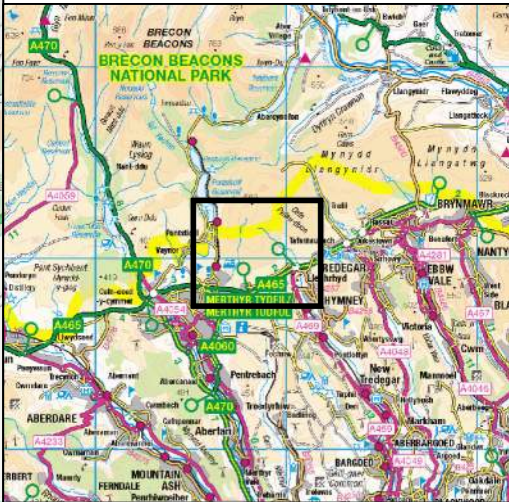
LEGEND

PEN MARCH SITE BOUNDARY

DEVELOPABLE AREA FOR TURBINES

APPROXIMATE EXTENT OF FIRE IN APRIL 2020

NOTE THAT FIRE EXTENDED FURTHER NORTH THAN SHOWN HERE



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PEN MARCH WIND FARM

BREEDING SEASON
BIRD SURVEYS 2020

APPROXIMATE EXTENT OF
FIRE IN APRIL 2020

3

Scale

1:20,000 @ A3

Date

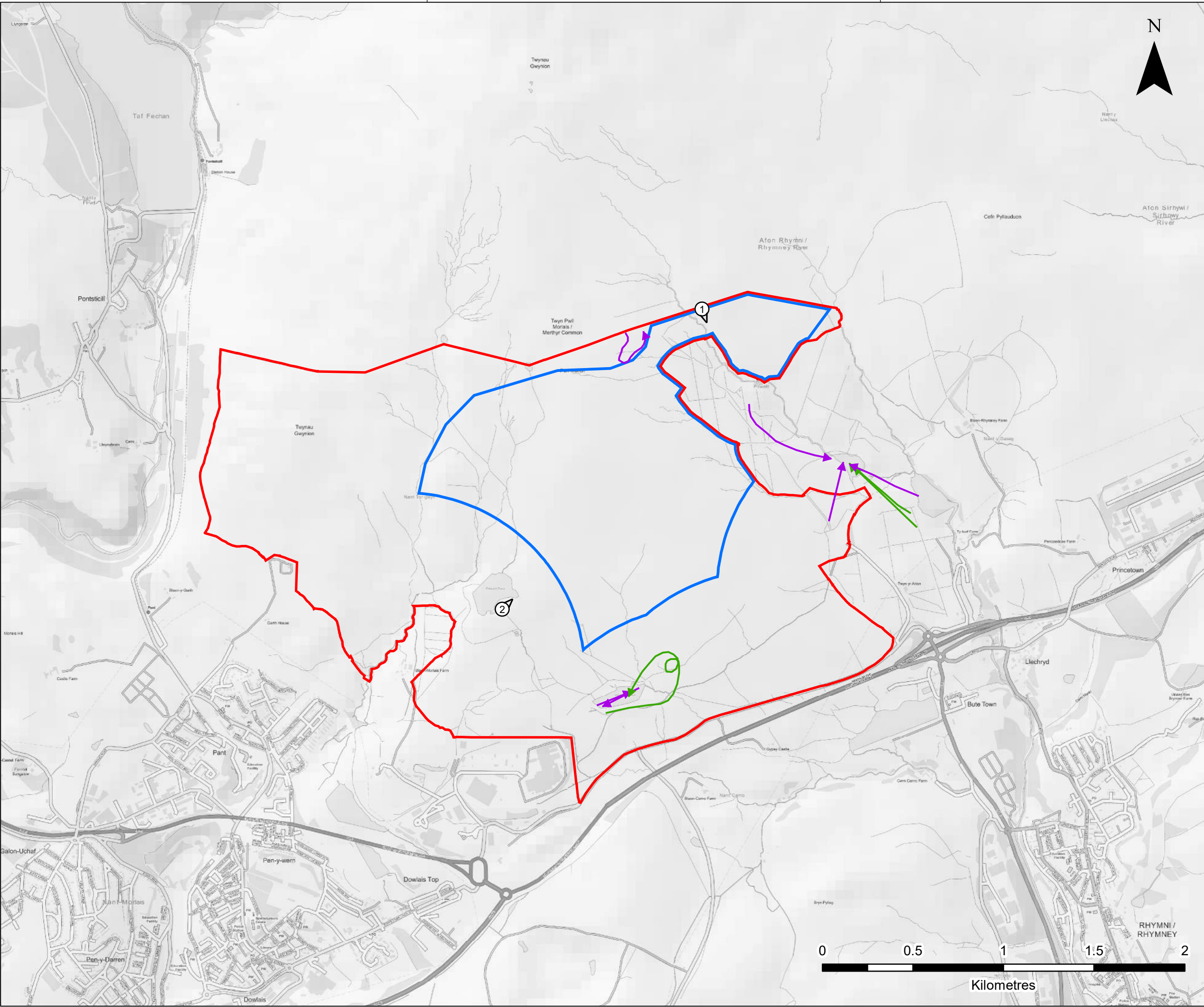
NOVEMBER 2020

02273.00066.4.0 Flight Activity Survey Results - Wildfowl

307500 310000

212500

210000



LEGEND

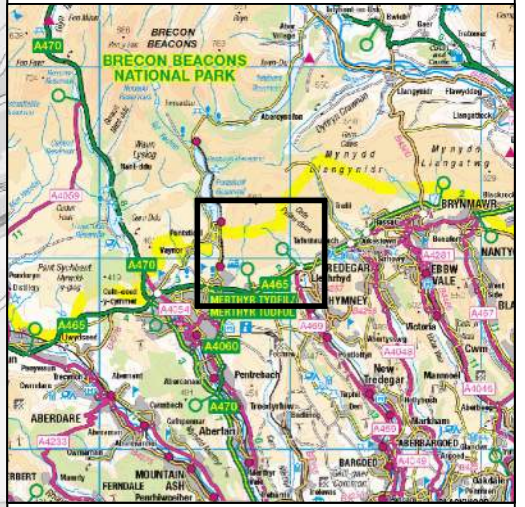
PEN MARCH SITE BOUNDARY

DEVELOPABLE AREA FOR TURBINES

FLIGHTLINE (COLOUR DENOTES SPECIES)

GOOSANDER

MALLARD



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PEN MARCH WIND FARM

**BREEDING SEASON
BIRD SURVEYS 2020**

**FLIGHT ACTIVITY SURVEY RESULTS
WILDFOWL (MALLARD, GOOSANDER)**

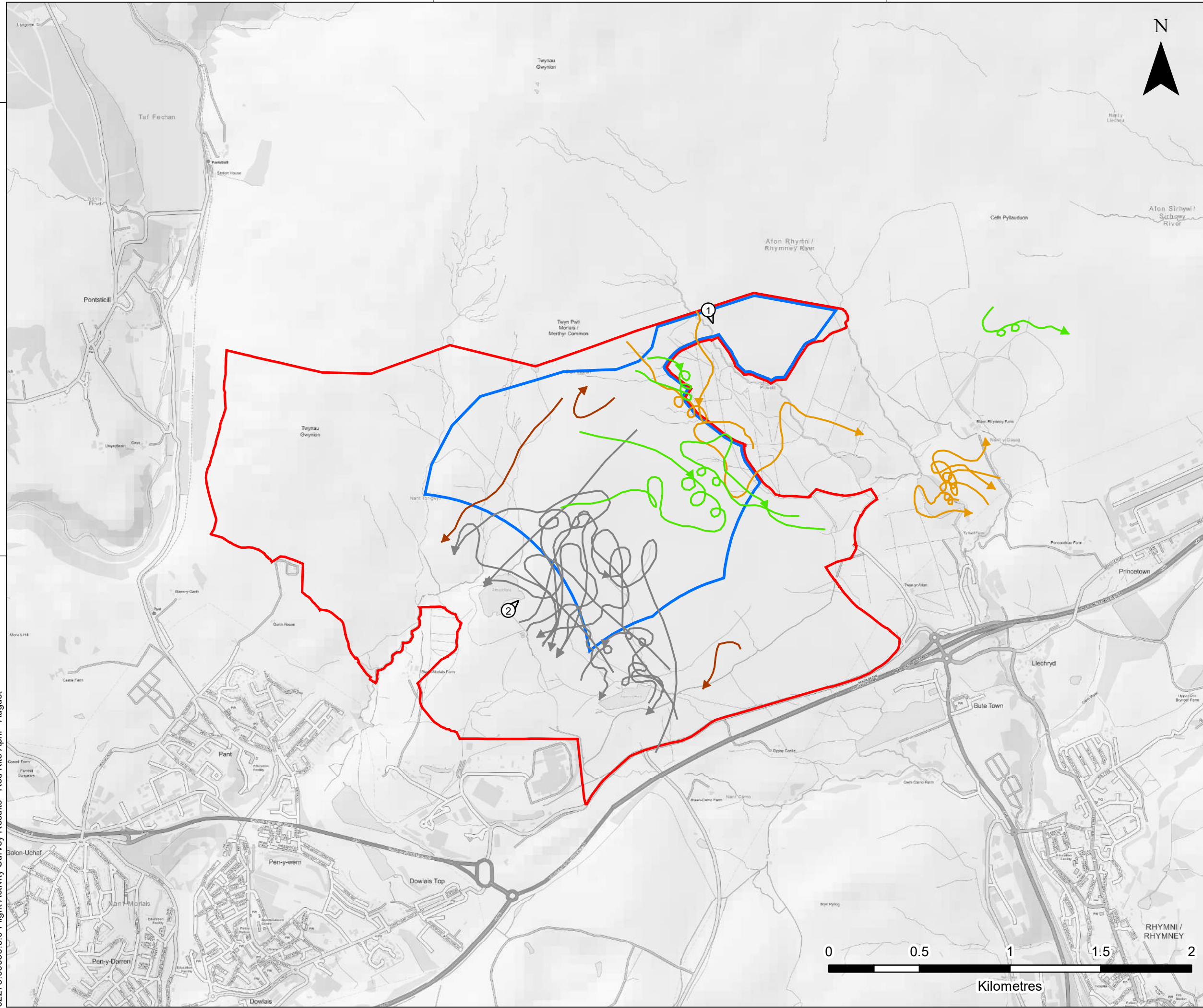
4

Scale
1:20,000 @ A3

Date
NOVEMBER 2020

02273.00066.5.0 Flight Activity Survey Results - Red Kite April - August

307500 310000



LEGEND

PEN MARCH SITE BOUNDARY

DEVELOPABLE AREA FOR TURBINES

FLIGHTLINE (COLOUR DENOTES SURVEY DATE)

01/04/2020

02/04/2020

09/04/2020

16/04/2020

4/5 LOCHSIDE VIEW
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**BREEDING SEASON
BIRD SURVEYS 2020**

**FLIGHT ACTIVITY SURVEY RESULTS
RED KITE - APRIL**

5A

Scale
1:20,000 @ A3

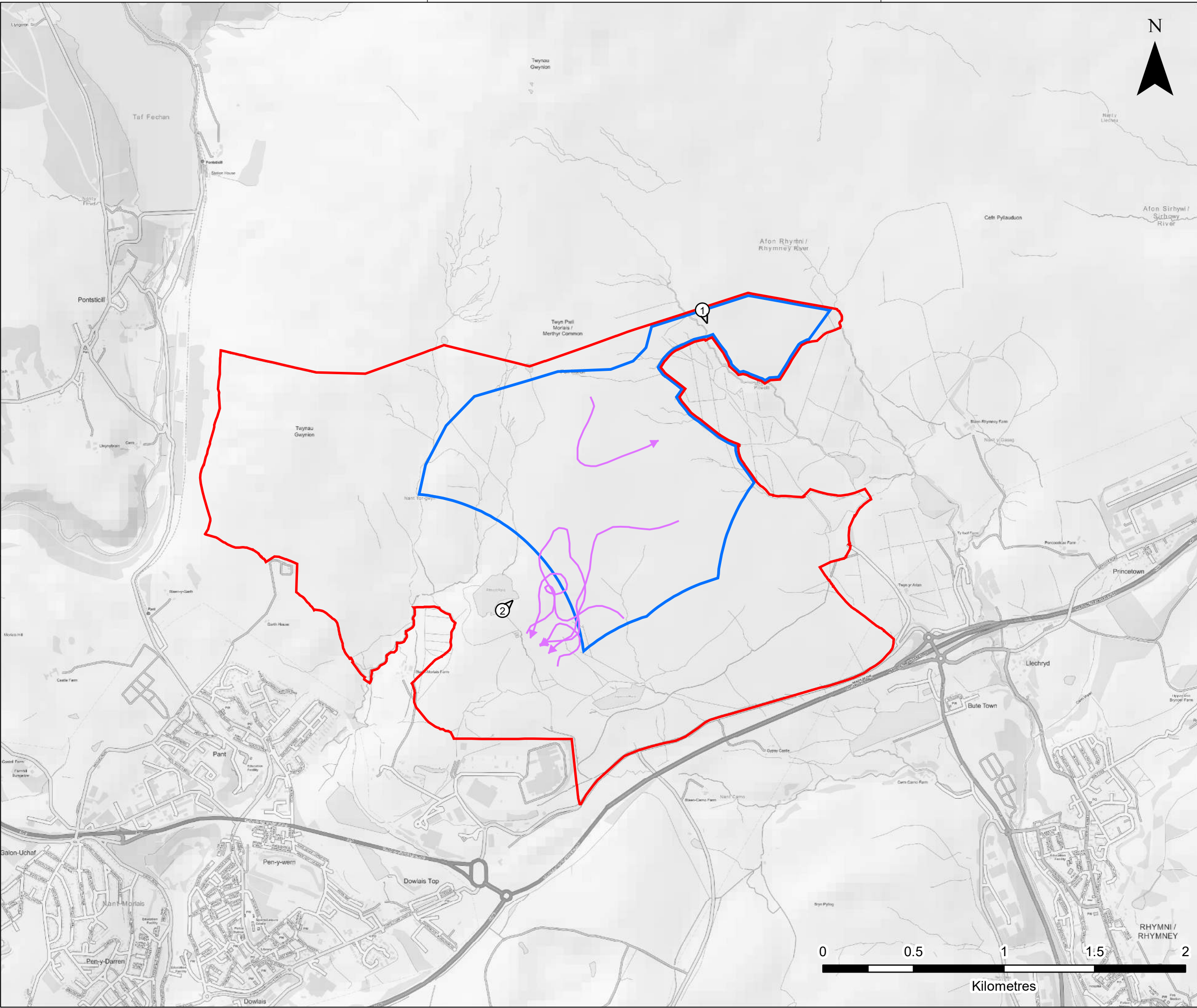
Date
NOVEMBER 2020

02273.00066.5.0 Flight Activity Survey Results - Red Kite April - August

307500 310000

212500

210000



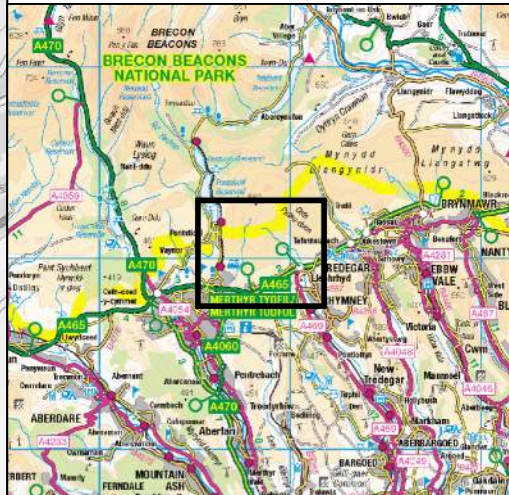
LEGEND

PEN MARCH SITE BOUNDARY

DEVELOPABLE AREA FOR TURBINES

FLIGHTLINE (COLOUR DENOTES SURVEY DATE)

13/05/2020



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**BREEDING SEASON
BIRD SURVEYS 2020**

**FLIGHT ACTIVITY SURVEY RESULTS
RED KITE - MAY**

5B

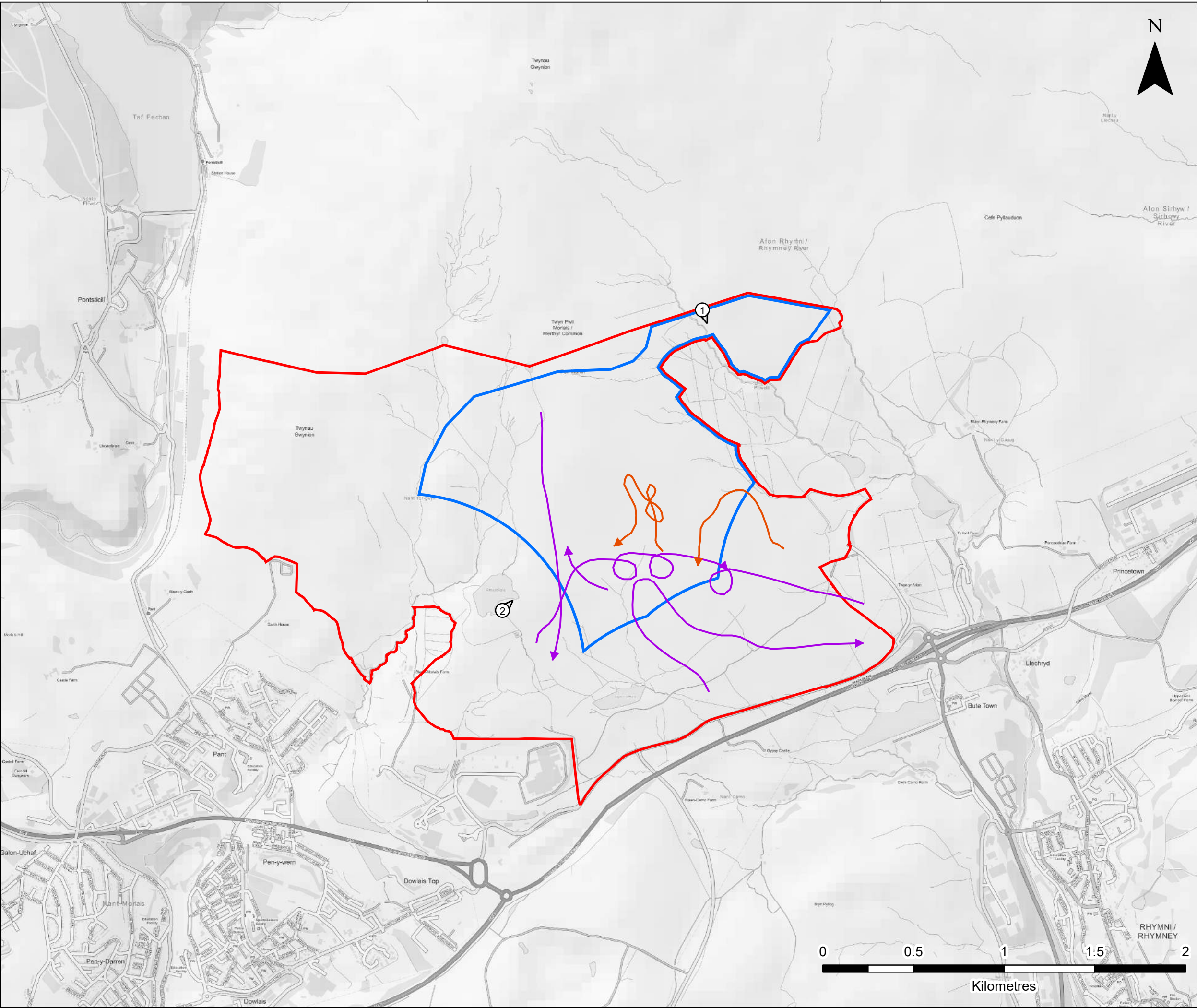
Scale 1:20,000 @ A3 Date NOVEMBER 2020

02273.00066.5.0 Flight Activity Survey Results - Red Kite April - August

307500 310000

212500

210000



LEGEND

PEN MARCH SITE BOUNDARY

DEVELOPABLE AREA FOR TURBINES

FLIGHTLINE (COLOUR DENOTES SURVEY DATE)

09/06/2020

22/06/2020

4/5 LOCHSIDE VIEW
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**BREEDING SEASON
BIRD SURVEYS 2020**

**FLIGHT ACTIVITY SURVEY RESULTS
RED KITE - JUNE**

5C

Scale
1:20,000 @ A3

Date
NOVEMBER 2020

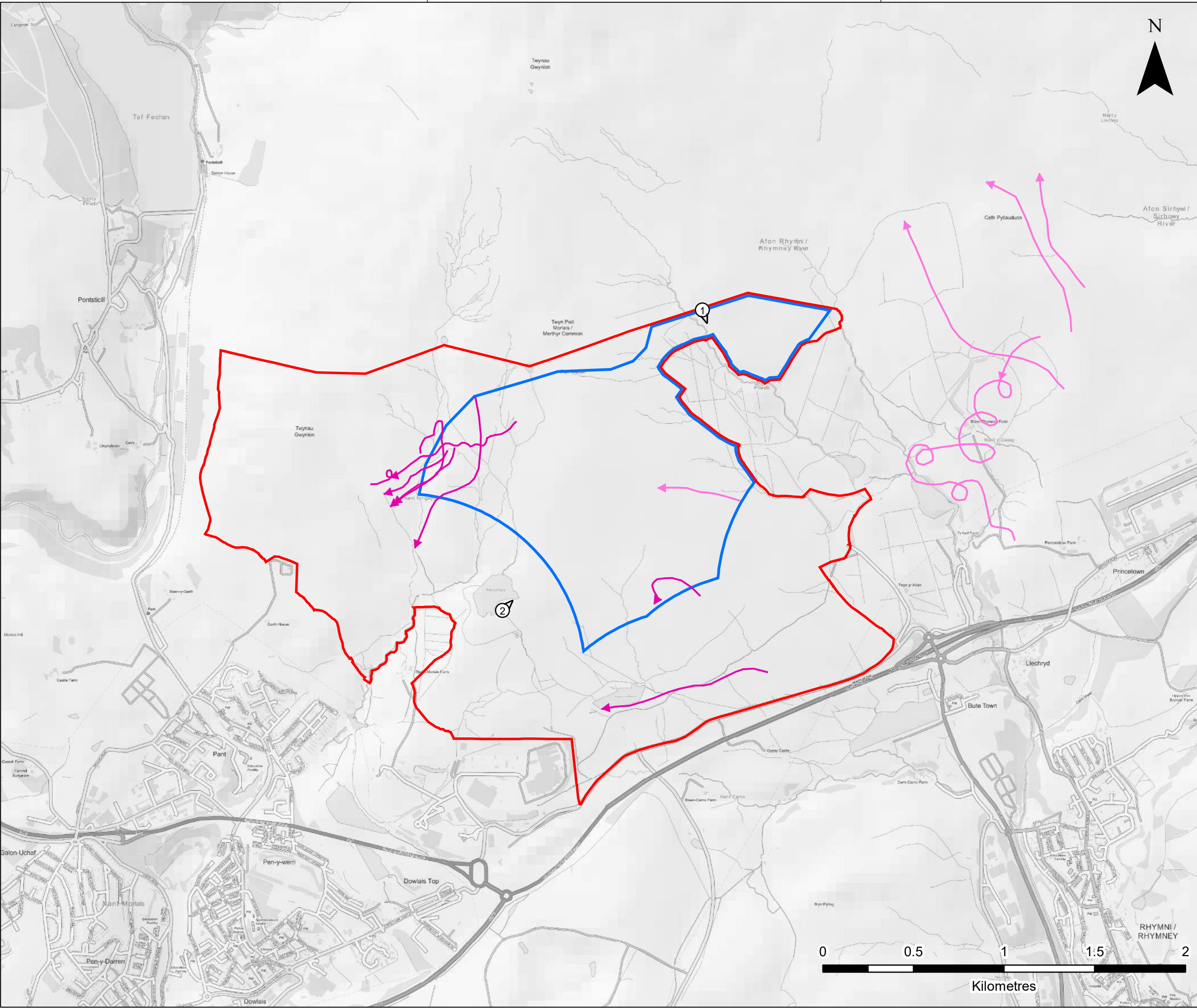
02273.00066.5.0 Flight Activity Survey Results - Red Kite April - August

307500

310000

212500

210000



LEGEND

PEN MARCH SITE BOUNDARY

DEVELOPABLE AREA FOR TURBINES

FLIGHTLINE (COLOUR DENOTES SURVEY DATE)

13/07/2020

14/07/2020

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**BREEDING SEASON
BIRD SURVEYS 2020**

**FLIGHT ACTIVITY SURVEY RESULTS
RED KITE - JULY**

5D

Scale
1:20,000 @ A3

Date
NOVEMBER 2020

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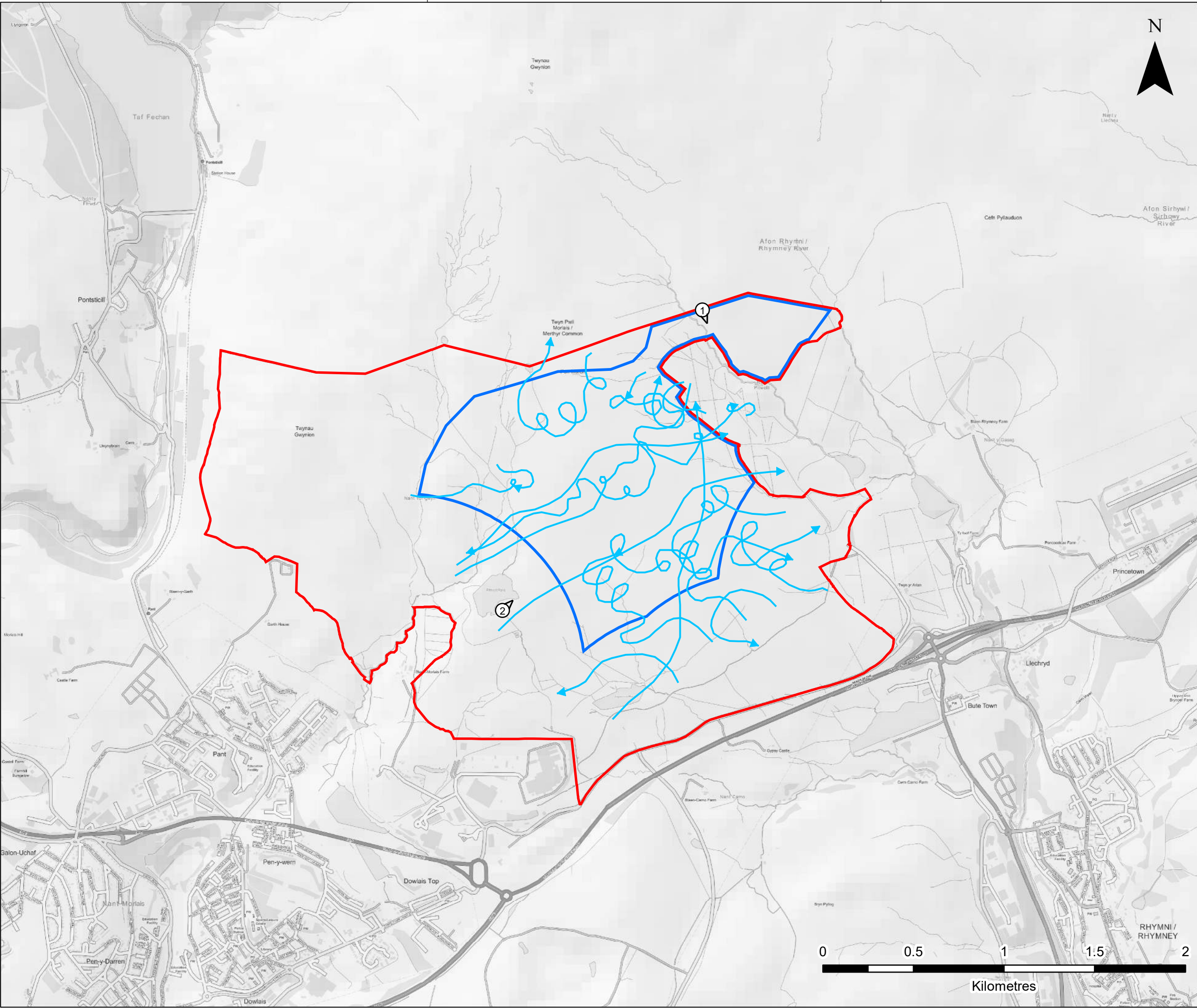
02273.00066.5.0 Flight Activity Survey Results - Red Kite April - August

307500

310000

212500

210000



LEGEND

PEN MARCH SITE BOUNDARY

DEVELOPABLE AREA FOR TURBINES

FLIGHTLINE (COLOUR DENOTES SURVEY DATE)

12/08/2020

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**BREEDING SEASON
BIRD SURVEYS 2020**

**FLIGHT ACTIVITY SURVEY RESULTS
RED KITE - AUGUST**

5E

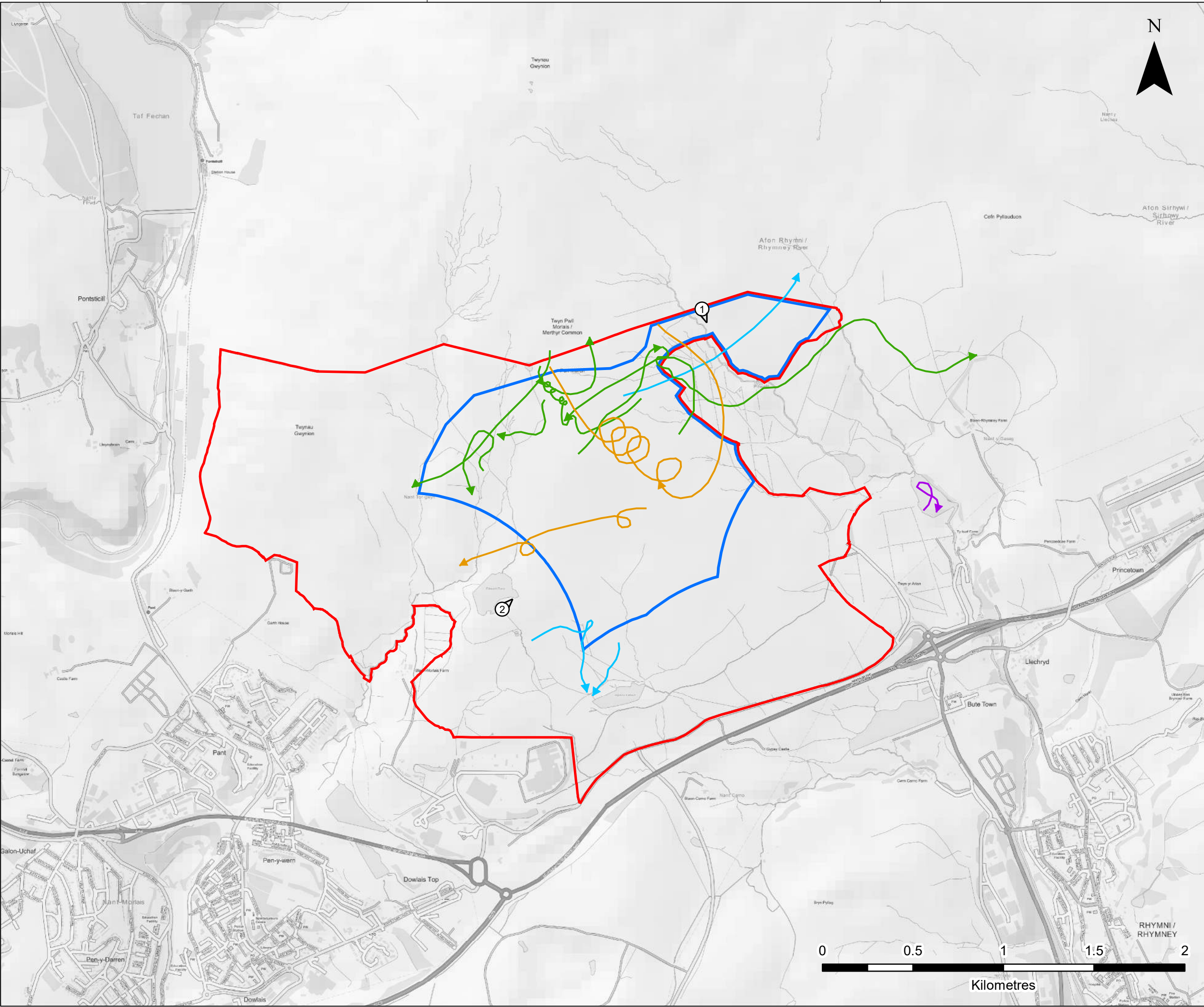
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02273.00066 6.0 Flight Activity Survey Results - Raptors

307500 310000



LEGEND

PEN MARCH SITE BOUNDARY

DEVELOPABLE AREA FOR TURBINES

FLIGHTLINE (COLOUR DENOTES SPECIES)

HEN HARRIER

KESTREL

MERLIN

PEREGRINE

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**BREEDING SEASON
BIRD SURVEYS 2020**

**FLIGHT ACTIVITY SURVEY RESULTS
RAPTORS (HEN HARRIER, KESTREL,
MERLIN, PEREGRINE)**

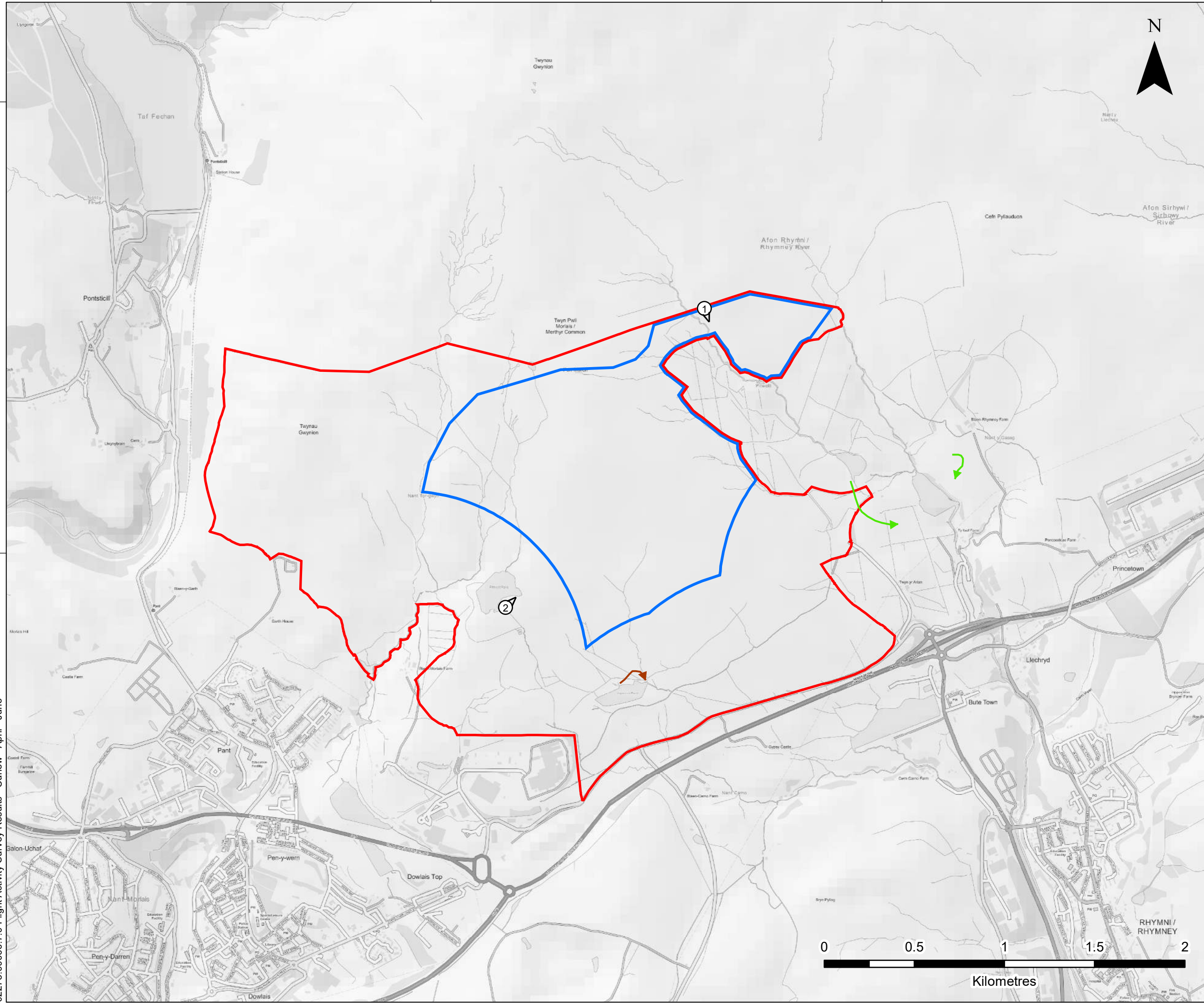
6

Scale
1:20,000 @ A3

Date
NOVEMBER 2020

02273.00066.7.0 Flight Activity Survey Results - Curlew - April - June

307500 310000



LEGEND

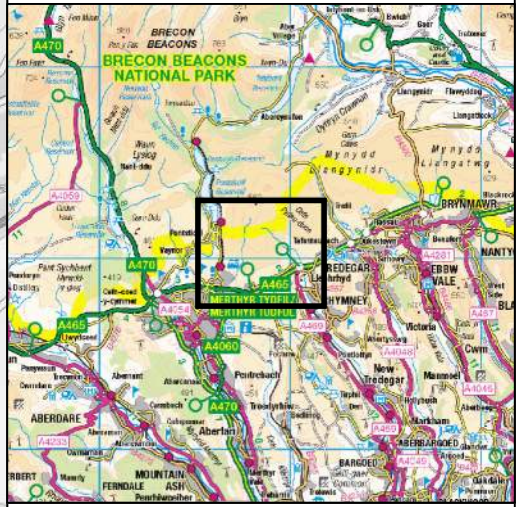
PEN MARCH SITE BOUNDARY

DEVELOPABLE AREA FOR TURBINES

FLIGHTLINE (COLOUR DENOTES SURVEY DATE)

01/04/2020

16/04/2020



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**BREEDING SEASON
BIRD SURVEYS 2020**

**FLIGHT ACTIVITY SURVEY RESULTS
CURLEW - APRIL**

7A

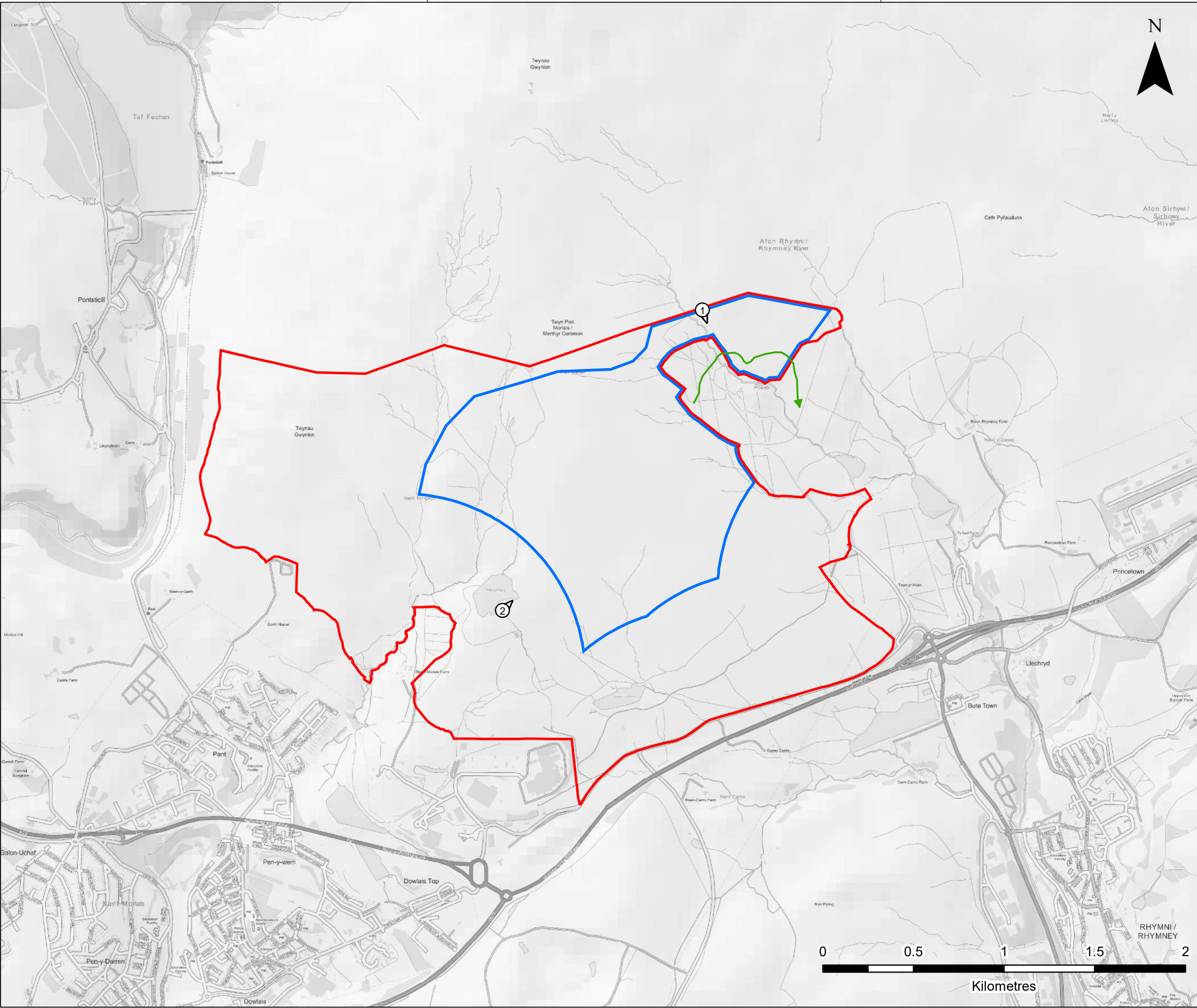
Scale
1:20,000 @ A3

Date
NOVEMBER 2020

02273.00066.7.0 Flight Activity Survey Results - Curlew - April - June

307500

310000



LEGEND

PEN MARCH SITE BOUNDARY

DEVELOPABLE AREA FOR TURBINES

FLIGHTLINE (COLOUR DENOTES SURVEY DATE)

26/05/2020

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BIRD SURVEYS 2020**

**FLIGHT ACTIVITY SURVEY RESULTS
CURLEW - MAY**

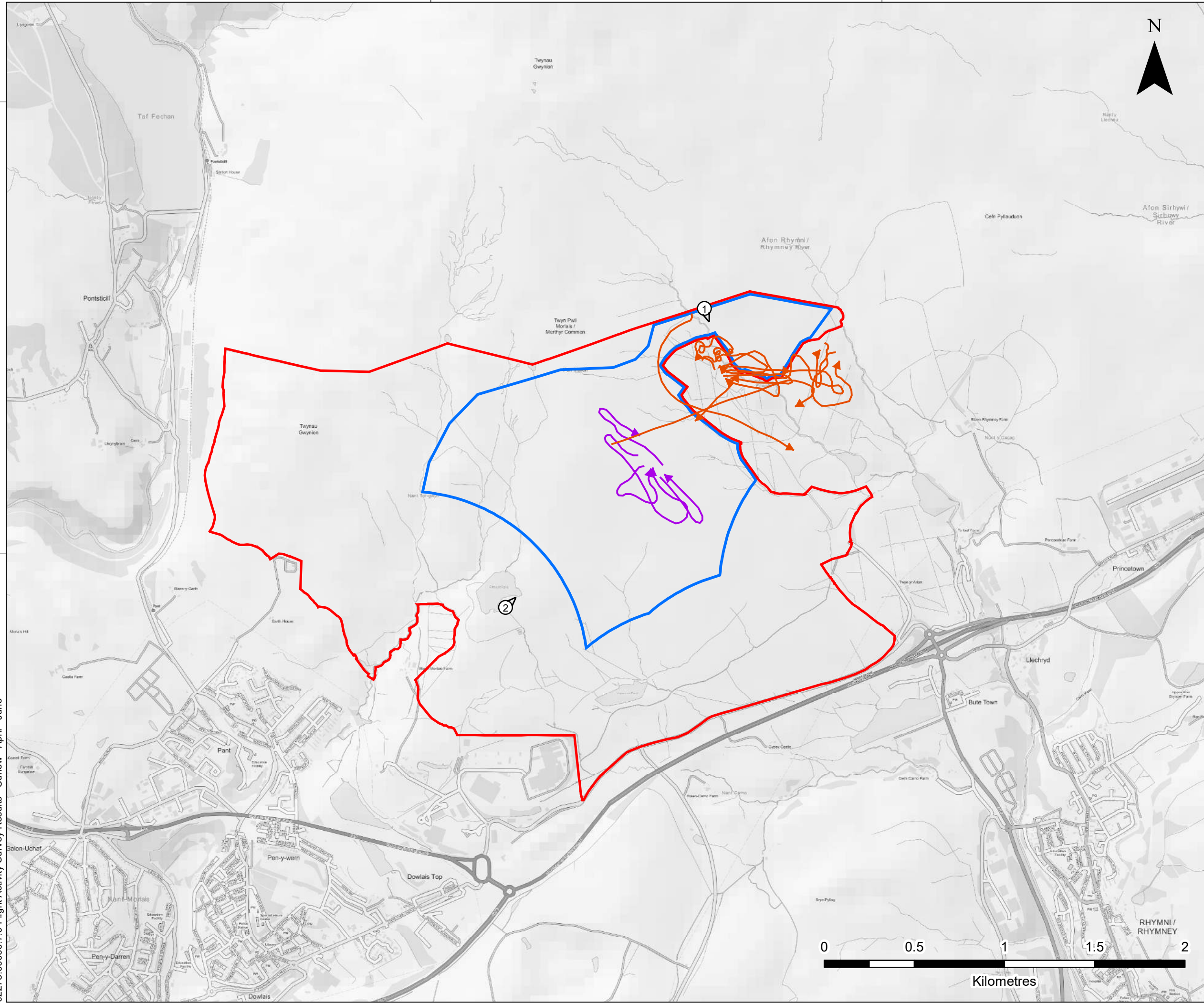
7B

Scale
1:20,000 @ A3

Date
NOVEMBER 2020

02273.00066.7.0 Flight Activity Survey Results - Curlew - April - June

307500 310000



LEGEND

PEN MARCH SITE BOUNDARY

DEVELOPABLE AREA FOR TURBINES

FLIGHTLINE (COLOUR DENOTES SURVEY DATE)

09/06/2020

22/06/2020

4/5 LOCHSIDE VIEW
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**BREEDING SEASON
BIRD SURVEYS 2020**

**FLIGHT ACTIVITY SURVEY RESULTS
CURLEW - JUNE**

7C

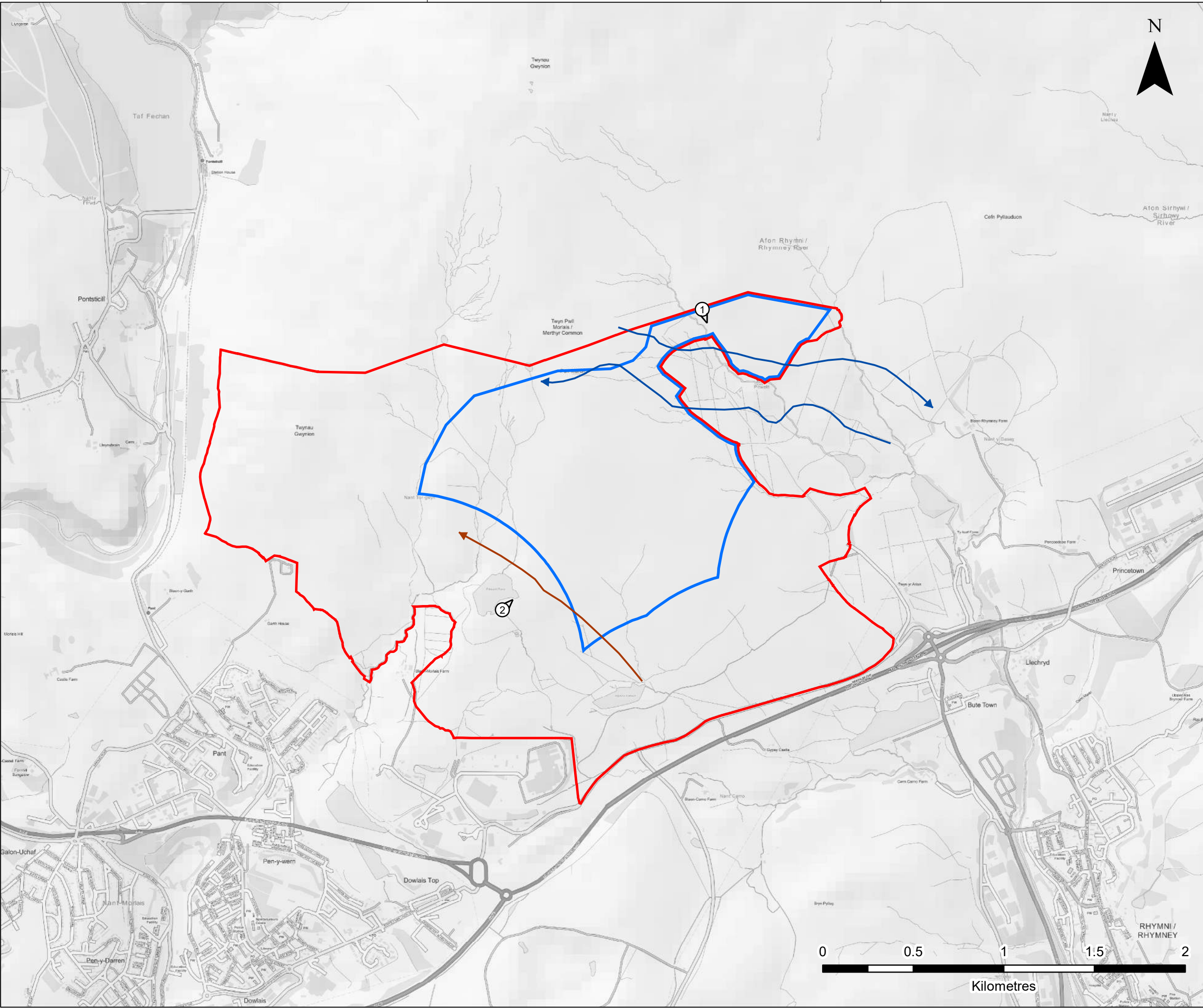
Scale
1:20,000 @ A3

Date
NOVEMBER 2020

02273.00066 8.0 Flight Activity Survey Results - Golden Plover

307500

310000



LEGEND

PEN MARCH SITE BOUNDARY

DEVELOPABLE AREA FOR TURBINES

FLIGHTLINE (COLOUR DENOTES SURVEY DATE)

01/04/2020

13/08/2020

4/5 LOCHSIDE VIEW
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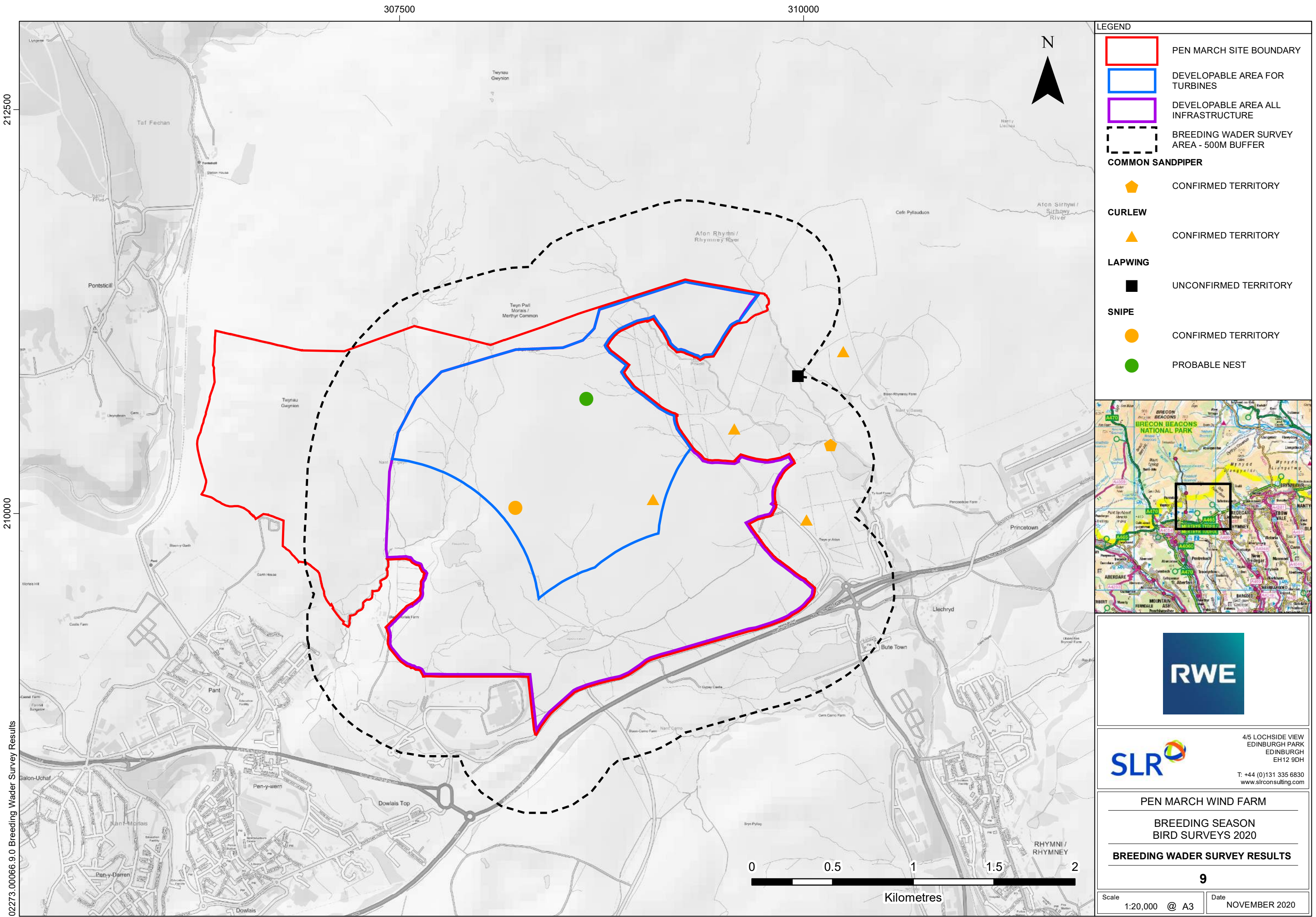
**BREEDING SEASON
BIRD SURVEYS 2020**

**FLIGHT ACTIVITY SURVEY RESULTS
GOLDEN PLOVER**

8

Scale
1:20,000 @ A3

Date
NOVEMBER 2020



APPENDIX 01

Survey dates, times and observers

Table A1-1: Details of VP surveys undertaken from Vantage Point 1

Date	Start Time	End Time	No. hours	Surveyor (s)
02/04/20	06:20	09:20	3	MO
02/04/20	09:50	12:50	3	MO
16/04/20	10:05	13:05	3	MO
16/04/20	13:45	16:45	3	MO
26/05/20	10:30	13:30	3	MO
26/05/20	14:00	17:00	3	MO
22/06/20	13:30	16:30	3	MO
22/06/20	17:00	20:00	3	MO
14/07/20	08:15	11:15	3	RM
14/07/20	15:00	18:00	3	RM
13/08/20	07:55	10:55	3	RM
13/08/20	11:55	14:55	3	RM
TOTAL HOURS			36	

Table A1-2: Details of VP surveys undertaken from Vantage Point 2

Date	Start Time	End Time	No. hours	Surveyor (s)
01/04/20	13:45	16:45	3	MO
01/04/20	17:15	20:15	3	MO
09/04/20	13:05	16:05	3	MO
09/04/20	16:40	19:40	3	MO
13/05/20	11:05	14:05	3	MO
13/05/20	14:45	17:45	3	MO
09/06/20	14:30	17:30	3	MO
09/06/20	18:05	21:05	3	MO
13/07/20	10:10	13:10	3	RM
13/07/20	14:10	17:10	3	RM
12/08/20	10:35	13:35	3	RM
12/08/20	14:35	17:35	3	RM
TOTAL HOURS			36	

Table A1-3: Details of breeding raptor surveys

Date	Start Time	End Time	No. hours (hr:min)	Surveyor (s)
14/04/20	08:45	16:00	07:15	MO
20/04/20	08:30	15:10	06:40	MO
21/04/20	08:00	15:00	07:00	MO
04/05/20	08:30	17:00	08:30	MO
27/05/20	09:00	17:00	08:00	MO
25/06/20	08:00	16:10	08:10	MO
26/06/20	07:25	15:00	07:35	MO
18/07/20	06:30	17:10	10:40	MO
TOTAL HOURS			63:50	

Table A1-4: Details of breeding wader surveys

Date	Start Time	End Time	No. hours	Surveyor (s)
14/04/20	06:30	08:00	01:30	MO
15/04/20	06:35	12:20	05:45	MO
05/05/20	06:10	12:00	05:50	MO
25/05/20	06:00	11:15	05:15	MO
26/05/20	18:00	21:00	03:00	MO
27/05/20	05:30	08:00	02:30	MO
09/06/20	08:10	10:00	01:50	MO
10/06/20	05:50	12:05	06:15	MO
11/06/20	07:15	11:10	03:55	MO
15/07/20	06:00	12:20	06:20	MO
19/07/20	07:10	11:05	03:55	MO
TOTAL HOURS			46:05	

APPENDIX 02

Weather data

Table A2-1: Weather data collected during flight activity surveys undertaken at VP1

Date	Survey start	Survey end	Hour	Wind Speed	Wind Direction	Rain	Cloud cover	Cloud height	Visibility	Snow	Frost	Temp (°C)
02/04/2020	06:20	09:20	1	3	WNW	0	7	2	2	0	0	5
02/04/2020	06:20	09:20	2	2	WNW	0	4	2	2	0	0	7
02/04/2020	06:20	09:20	3	1	WNW	0	5	2	2	0	0	7
02/04/2020	06:20	09:20	4	2	WNW	0	6	2	2	0	0	8
02/04/2020	09:50	12:50	1	2	NW	1	7	2	2	0	0	7
02/04/2020	09:50	12:50	2	2	NW	0	6	2	2	0	0	7
02/04/2020	09:50	12:50	3	3	NW	0	5	2	2	0	0	7
02/04/2020	09:50	12:50	4	2	NW	0	7	2	2	0	0	7
16/04/2020	10:05	13:05	1	2	NE	0	4	2	2	0	0	11
16/04/2020	10:05	13:05	2	2	E	0	3	2	2	0	0	12
16/04/2020	10:05	13:05	3	1	E	0	4	2	2	0	0	14

Date	Survey start	Survey end	Hour	Wind Speed	Wind Direction	Rain	Cloud cover	Cloud height	Visibility	Snow	Frost	Temp (°C)
16/04/2020	10:05	13:05	4	1	E	0	5	2	2	0	0	14
16/04/2020	13:45	16:45	1	1	E	0	5	2	2	0	0	14
16/04/2020	13:45	16:45	2	2	E	0	4	2	2	0	0	15
16/04/2020	13:45	16:45	3	1	E	0	4	2	2	0	0	15
16/04/2020	13:45	16:45	4	1	E	0	3	2	2	0	0	16
26/05/2020	10:30	13:30	1	1	SW	0	6	2	2	0	0	16
26/05/2020	10:30	13:30	2	1	SW	0	7	2	2	0	0	17
26/05/2020	10:30	13:30	3	2	SW	0	5	2	2	0	0	17
26/05/2020	10:30	13:30	4	2	SW	0	5	2	2	0	0	17
26/05/2020	14:00	17:00	1	2	W	0	7	2	2	0	0	19
26/05/2020	14:00	17:00	2	1	W	0	7	2	2	0	0	20
26/05/2020	14:00	17:00	3	1	W	0	5	2	2	0	0	20

Date	Survey start	Survey end	Hour	Wind Speed	Wind Direction	Rain	Cloud cover	Cloud height	Visibility	Snow	Frost	Temp (°C)
26/05/2020	14:00	17:00	4	1	W	0	6	2	2	0	0	20
22/06/2020	13:30	16:30	1	3	WSW	0	2	2	2	0	0	20
22/06/2020	13:30	16:30	2	3	WSW	0	3	2	2	0	0	20
22/06/2020	13:30	16:30	3	4	WSW	0	6	2	2	0	0	20
22/06/2020	17:00	20:00	1	3	SW	0	7	2	2	0	0	19
22/06/2020	17:00	20:00	2	4	SW	0	6	2	2	0	0	20
22/06/2020	17:00	20:00	3	3	SW	0	4	2	2	0	0	20
22/06/2020	17:00	20:00	4	3	SW	0	4	2	2	0	0	20
14/07/2020	08:15	11:15	1	2	WNW	0	7	2	2	0	0	13
14/07/2020	08:15	11:15	2	2	WNW	0	8	2	2	0	0	14
14/07/2020	08:15	11:15	3	1-2	WNW	0	7	2	2	0	0	14
14/07/2020	15:00	18:00	1	3	WNW	0	8	2	2	0	0	14

Date	Survey start	Survey end	Hour	Wind Speed	Wind Direction	Rain	Cloud cover	Cloud height	Visibility	Snow	Frost	Temp (°C)
14/07/2020	15:00	18:00	2	3	WNW	0	6	2	2	0	0	13
14/07/2020	15:00	18:00	3	3	WNW	0	7	2	2	0	0	13
13/08/2020	07:55	10:55	1	2	NE	0	8	1	2	0	0	19
13/08/2020	07:55	10:55	2	2	NE	0	8	1	2	0	0	19
13/08/2020	07:55	10:55	3	1-2	NE	0	8	1	2	0	0	20
13/08/2020	11:55	14:55	1	2	NE	0	8	2	2	0	0	20
13/08/2020	11:55	14:55	2	2	NE	0	8	2	2	0	0	20
13/08/2020	11:55	14:55	3	2	NE	0	8	2	2	0	0	20
Rain/ Precipitation			Cloud Cover			Visibility			Lying Snow		Frost	
None	0		Expressed in oktas (n/8)			Poor (<1km)	0		None	0	None	0
Drizzle	1		Cloud Height			Moderate (1-3km)	1		On site	1	Ground	1
Light showers/snow	2		Height of cloud above			Good (>3km)	2		On higher ground	2	All day	2
Heavy showers/snow	3		average height of viewshed									
Heavy rain/snow	4		<150m				0					
			150-500m				1					

Date	Survey start	Survey end	Hour	Wind Speed	Wind Direction	Rain	Cloud cover	Cloud height	Visibility	Snow	Frost	Temp (°C)
			>500m	2								

Table A2-2: Weather data from flight activity surveys undertaken at VP2

Date	Survey start	Survey end	Hour	Wind Speed	Wind Direction	Rain	Cloud cover	Cloud height	Visibility	Snow	Frost	Temp (°C)
01/04/2020	13:45	16:45	1	3	NW	0	8	2	2	0	0	7
01/04/2020	13:45	16:45	2	3	NW	0	8	2	2	0	0	7
01/04/2020	13:45	16:45	3	2	NW	0	8	2	2	0	0	6
01/04/2020	13:45	16:45	4	3	NW	0	8	2	2	0	0	6
01/04/2020	17:15	20:15	1	3	NW	0	8	2	2	0	0	6
01/04/2020	17:15	20:15	2	2	NW	0	8	2	2	0	0	5
01/04/2020	17:15	20:15	3	3	NW	0	8	2	2	0	0	5
01/04/2020	17:15	20:15	4	3	NW	0	8	2	2	0	0	5
09/04/2020	13:05	16:05	1	1	NW	0	1	2	2	0	0	18
09/04/2020	13:05	16:05	2	1	NW	0	1	2	2	0	0	20
09/04/2020	13:05	16:05	3	2	NW	0	1	2	2	0	0	20
09/04/2020	13:05	16:05	4	2	NW	0	1	2	2	0	0	20
09/04/2020	16:40	19:40	1	2	NW	0	1	2	2	0	0	20
09/04/2020	16:40	19:40	2	1	NW	0	2	2	2	0	0	16

Date	Survey start	Survey end	Hour	Wind Speed	Wind Direction	Rain	Cloud cover	Cloud height	Visibility	Snow	Frost	Temp (°C)
09/04/2020	16:40	19:40	3	2	NW	0	1	2	2	0	0	15
09/04/2020	16:40	19:40	4	2	NW	0	1	2	2	0	0	15
13/05/2020	11:05	14:05	1	2	NE	0	8	2	2	0	0	8
13/05/2020	11:05	14:05	2	3	NE	0	7	2	2	0	0	9
13/05/2020	11:05	14:05	3	3	NE	0	8	2	2	0	0	9
13/05/2020	11:05	14:05	4	2	NE	0	8	2	2	0	0	9
13/05/2020	14:45	17:45	1	3	NE	0	8	2	2	0	0	10
13/05/2020	14:45	17:45	2	4	NE	0	8	2	2	0	0	11
13/05/2020	14:45	17:45	3	3	ENE	0	8	2	2	0	0	10
13/05/2020	14:45	17:45	4	3	ENE	0	8	2	2	0	0	10
09/06/2020	14:30	17:30	1	1	W	0	5	2	2	0	0	15
09/06/2020	14:30	17:30	2	2	W	0	6	2	2	0	0	14
09/06/2020	14:30	17:30	3	2	W	0	7	2	2	0	0	15
09/06/2020	14:30	17:30	4	2	W	0	7	2	2	0	0	15
09/06/2020	18:05	21:05	1	1	W	0	6	2	2	0	0	15
09/06/2020	18:05	21:05	2	2	W	0	7	2	2	0	0	14
09/06/2020	18:05	21:05	3	1	W	0	6	2	2	0	0	14
09/06/2020	18:05	21:05	4	1	W	0	6	2	2	0	0	13
13/07/2020	10:10	13:10	1	3	WSW	0	8	1	2	0	0	15

Date	Survey start	Survey end	Hour	Wind Speed	Wind Direction	Rain	Cloud cover	Cloud height	Visibility	Snow	Frost	Temp (°C)
13/07/2020	10:10	13:10	2	3	WSW	2	8	1	2	0	0	15
13/07/2020	10:10	13:10	3	3	WSW	2	8	0	2	0	0	14
13/07/2020	14:10	17:10	1	4	WSW	1	8	0	0	0	0	13
13/07/2020	14:10	17:10	2	4	WSW	2	8	0	1	0	0	12
13/07/2020	14:10	17:10	3	4	WSW	0	8	0	1	0	0	13
12/08/2020	10:35	13:35	1	2	E	0	2	2	2	0	0	25
12/08/2020	10:35	13:35	2	2	E	0	1	2	2	0	0	26
12/08/2020	10:35	13:35	3	2	E	0	2	2	2	0	0	27
12/08/2020	14:35	17:35	1	1	E	0	1	2	2	0	0	27
12/08/2020	14:35	17:35	2	2	E	0	1	2	2	0	0	27
12/08/2020	14:35	17:35	3	2	ENE	0	1	2	2	0	0	28

Table A2-3: Weather data for breeding wader and raptor surveys

Date	Survey start	Survey end	Hour	Wind Speed	Wind Direction	Rain	Cloud cover	Cloud height	Visibility	Snow	Frost	Temp (°C)
14/04/2020	06:30	08:00	1	1	E	0	1	2	2	0	0	6
14/04/2020	06:30	08:00	2	1	E	0	1	2	2	0	0	6
14/04/2020	08:45	16:00	1	1	E	0	1	2	2	0	0	7
14/04/2020	08:45	16:00	2	0		0	0	2	2	0	0	11

Date	Survey start	Survey end	Hour	Wind Speed	Wind Direction	Rain	Cloud cover	Cloud height	Visibility	Snow	Frost	Temp (°C)
14/04/2020	08:45	16:00	3	1	E	0	1	2	2	0	0	14
14/04/2020	08:45	16:00	4	1	E	0	1	2	2	0	0	14
14/04/2020	08:45	16:00	5	1	E	0	0	2	2	0	0	16
14/04/2020	08:45	16:00	6	1	E	0	0	2	2	0	0	16
14/04/2020	08:45	16:00	7	1	E	0	0	2	2	0	0	17
14/04/2020	08:45	16:00	8	1	E	0	1	2	2	0	0	17
15/04/2020	06:35	12:20	1	0	E	0	1	2	2	0	1	4
15/04/2020	06:35	12:20	2	1	E	0	1	2	2	0	0	6
15/04/2020	06:35	12:20	3	1	E	0	2	2	2	0	0	6
15/04/2020	06:35	12:20	4	0	E	0	1	2	2	0	0	8
15/04/2020	06:35	12:20	5	0	E	0	0	2	2	0	0	10
15/04/2020	06:35	12:20	6	1	E	0	0	2	2	0	0	12
15/04/2020	06:35	12:20	7	1	E	0	0	2	2	0	0	13
20/04/2020	08:30	15:10	1	3	E	0	1	2	2	0	0	14
20/04/2020	08:30	15:10	2	3	E	0	0	2	2	0	0	14
20/04/2020	08:30	15:10	3	3	E	0	0	2	2	0	0	16
20/04/2020	08:30	15:10	4	3	E	0	1	2	2	0	0	16
20/04/2020	08:30	15:10	5	2	E	0	1	2	2	0	0	16
20/04/2020	08:30	15:10	6	3	E	0	0	2	2	0	0	16

Date	Survey start	Survey end	Hour	Wind Speed	Wind Direction	Rain	Cloud cover	Cloud height	Visibility	Snow	Frost	Temp (°C)
20/04/2020	08:30	15:10	7	3	E	0	1	2	2	0	0	16
21/04/2020	08:00	15:00	1	2	NE	0	1	2	2	0	0	10
21/04/2020	08:00	15:00	2	3	NE	0	2	2	2	0	0	13
21/04/2020	08:00	15:00	3	2	NE	0	3	2	2	0	0	13
21/04/2020	08:00	15:00	4	2	NE	0	2	2	2	0	0	14
21/04/2020	08:00	15:00	5	2	NE	0	1	2	2	0	0	16
21/04/2020	08:00	15:00	6	2	NE	0	1	2	2	0	0	16
21/04/2020	08:00	15:00	7	3	NE	0	1	2	2	0	0	16
04/05/2020	08:30	17:00	1	1	NE	0	2	2	2	0	0	13
04/05/2020	08:30	17:00	2	2	NE	0	1	2	2	0	0	14
04/05/2020	08:30	17:00	3	2	NE	0	1	2	2	0	0	14
04/05/2020	08:30	17:00	4	3	NE	0	2	2	2	0	0	15
04/05/2020	08:30	17:00	5	2	NE	0	3	2	2	0	0	15
04/05/2020	08:30	17:00	6	2	NE	0	2	2	2	0	0	15
04/05/2020	08:30	17:00	7	3	NE	0	1	2	2	0	0	16
05/05/2020	06:10	12:00	1	3	E	0	1	2	2	0	0	6
05/05/2020	06:10	12:00	2	3	E	0	3	2	2	0	0	7
05/05/2020	06:10	12:00	3	4	E	0	3	2	2	0	0	7
05/05/2020	06:10	12:00	4	3	E	0	4	2	2	0	0	8

Date	Survey start	Survey end	Hour	Wind Speed	Wind Direction	Rain	Cloud cover	Cloud height	Visibility	Snow	Frost	Temp (°C)
05/05/2020	06:10	12:00	5	4	E	0	3	2	2	0	0	10
05/05/2020	06:10	12:00	6	4	E	0	3	2	2	0	0	10
05/05/2020	06:10	12:00	7	3	E	0	3	2	2	0	0	10
25/05/2020	06:00	11:15	1	1	W	0	1	2	2	0	0	12
25/05/2020	06:00	11:15	2	1	W	0	2	2	2	0	0	13
25/05/2020	06:00	11:15	3	0		0	2	2	2	0	0	15
25/05/2020	06:00	11:15	4	1	W	0	1	2	2	0	0	16
25/05/2020	06:00	11:15	5	1	W	0	2	2	2	0	0	17
25/05/2020	06:00	11:15	6	1	W	0	2	2	2	0	0	18
26/05/2020	18:00	21:00		0-1	W	0	1-2	2	2	0	0	19-16
27/05/2020	05:30	08:00		1-2	NE	0	1	2	2	0	0	16-18
27/05/2020	09:00	17:00	1	1	NE	0	1	2	2	0	0	16
27/05/2020	09:00	17:00	2	1	NE	0	2	2	2	0	0	18
27/05/2020	09:00	17:00	3	2	NE	0	2	2	2	0	0	18
27/05/2020	09:00	17:00	4	1	NE	0	1	2	2	0	0	19
27/05/2020	09:00	17:00	5	1	E	0	2	2	2	0	0	20
27/05/2020	09:00	17:00	6	1	E	0	1	2	2	0	0	21
27/05/2020	09:00	17:00	7	2	E	0	2	2	2	0	0	21
27/05/2020	09:00	17:00	8	1	E	0	2	2	2	0	0	20

Date	Survey start	Survey end	Hour	Wind Speed	Wind Direction	Rain	Cloud cover	Cloud height	Visibility	Snow	Frost	Temp (°C)
09/06/2020	08:10	10:00		1	W	0	6	2	2	0	0	15
10/06/2020	05:50	12:05	1	1	SW	0	6	2	2	0	0	8
10/06/2020	05:50	12:05	2	1	SW	1	7	2	2	0	0	9
10/06/2020	05:50	12:05	3	1	SW	1	7	2	2	0	0	9
10/06/2020	05:50	12:05	4	1	SW	0	7	2	2	0	0	10
10/06/2020	05:50	12:05	5	2	SW	0	7	2	2	0	0	10
10/06/2020	05:50	12:05	6	1	SW	1	8	2	2	0	0	12
10/06/2020	05:50	12:05	7	1	SW	0	6	2	2	0	0	12
11/06/2020	07:15	11:10	1	3	NE	0	6	2	2	0	0	10
11/06/2020	07:15	11:10	2	2	ENE	0	6	2	2	0	0	11
11/06/2020	07:15	11:10	3	3	ENE	0	7	2	2	0	0	11
11/06/2020	07:15	11:10	4	3	ENE	0	8	2	2	0	0	12
11/06/2020	07:15	11:10	5	3	ENE	1	8	2	2	0	0	11
25/06/2020	08:00	16:10	1	1	NE	0	1	2	2	0	0	20
25/06/2020	08:00	16:10	2	1	NE	0	1	2	2	0	0	22
25/06/2020	08:00	16:10	3	1	NE	0	0	2	2	0	0	22
25/06/2020	08:00	16:10	4	0		0	1	2	2	0	0	23
25/06/2020	08:00	16:10	5	0		0	1	2	2	0	0	26
25/06/2020	08:00	16:10	6	1	NE	0	1	2	2	0	0	26

Date	Survey start	Survey end	Hour	Wind Speed	Wind Direction	Rain	Cloud cover	Cloud height	Visibility	Snow	Frost	Temp (°C)
25/06/2020	08:00	16:10	7	1	NE	0	1	2	2	0	0	26
26/06/2020	07:25	15:00	1	2	SW	0	7	2	2	0	0	17
26/06/2020	07:25	15:00	2	1	SW	0	8	2	2	0	0	18
26/06/2020	07:25	15:00	3	1	SW	0	8	2	2	0	0	18
26/06/2020	07:25	15:00	4	2	SW	0	7	2	2	0	0	18
26/06/2020	07:25	15:00	5	2	SW	0	6	2	2	0	0	19
26/06/2020	07:25	15:00	6	2	SW	0	6	2	2	0	0	19
26/06/2020	07:25	15:00	7	1	SW	0	6	2	2	0	0	19
26/06/2020	07:25	15:00	8	2	SW	0	7	2	2	0	0	19
15/07/2020	06:00	12:20	1	3	NW	0	7	2	2	0	0	14
15/07/2020	06:00	12:20	2	2	WNW	0	6	2	2	0	0	16
15/07/2020	06:00	12:20	3	2	NW	0	7	2	2	0	0	16
15/07/2020	06:00	12:20	4	2	NW	0	7	2	2	0	0	17
15/07/2020	06:00	12:20	5	3	N	0	5	2	2	0	0	16
15/07/2020	06:00	12:20	6	2	N	0	6	2	2	0	0	17
15/07/2020	06:00	12:20	7	2	N	0	6	2	2	0	0	17
18/07/2020	06:30	17:10	1	0	S	0	6	2	2	0	0	12
18/07/2020	06:30	17:10	2	1	S	0	5	2	2	0	0	14
18/07/2020	06:30	17:10	3	1	S	0	5	2	2	0	0	14

Date	Survey start	Survey end	Hour	Wind Speed	Wind Direction	Rain	Cloud cover	Cloud height	Visibility	Snow	Frost	Temp (°C)
18/07/2020	06:30	17:10	4	2	SW	0	4	2	2	0	0	14
18/07/2020	06:30	17:10	5	1	S	0	4	2	2	0	0	17
18/07/2020	06:30	17:10	6	1	S	0	5	2	2	0	0	17
18/07/2020	06:30	17:10	7	1	S	0	5	2	2	0	0	18
18/07/2020	06:30	17:10	8	1	S	0	5	2	2	0	0	18
19/07/2020	07:10	11:05	1	2	SW	0	4	2	2	0	0	13
19/07/2020	07:10	11:05	2	2	SW	0	3	2	2	0	0	16
19/07/2020	07:10	11:05	3	3	SW	0	3	2	2	0	0	17
19/07/2020	07:10	11:05	4	3	SW	0	3	2	2	0	0	17
19/07/2020	07:10	11:05	5	2	SW	0	4	2	2	0	0	17

APPENDIX 03

Flight activity survey data

Date	VP_code	Surveyor	FlightID	Species	NumBirds	ObsTime	Time at risk height (s)	Comments
01/04/2020	2	MO	123	HH	1	14:29	0	
01/04/2020	2	MO	124	HH	1	14:40	0	
01/04/2020	2	MO	125	CU	4	14:51	0	
01/04/2020	2	MO	126	HH	1	15:01	0	sparring with BZ
01/04/2020	2	MO	127	MA	1	15:13	0	
01/04/2020	2	MO	128	ML	1	15:21	0	
01/04/2020	2	MO	129	KT	1	15:30	0	
01/04/2020	2	MO	130	KT	1	15:32	0	
01/04/2020	2	MO	131	GP	11	15:44	0	v low and fast
01/04/2020	2	MO	132	HH	1	16:02	0	
01/04/2020	2	MO	133	MA	1	17:21	0	
01/04/2020	2	MO	134	HH	1	17:46	15	Briefly harassed by BZ
01/04/2020	2	MO	135	KT	1	18:04	0	
01/04/2020	2	MO	136	ML	1	18:36	0	
01/04/2020	2	MO	137	GD	6	19:49	30	
02/04/2020	1	MO	138	CG	2	06:31	0	
02/04/2020	1	MO	139	GD	1	06:45	15	2 SECS @ 15-30M, 4 SECS @ <15M
02/04/2020	1	MO	140	MA	1	07:10	0	
02/04/2020	1	MO	141	ML	1	07:41	0	

Date	VP_code	Surveyor	FlightID	Species	NumBirds	ObsTime	Time at risk height (s)	Comments
02/04/2020	1	MO	142	KT	1	07:50	0	
02/04/2020	1	MO	143	HH	1	09:01	0	
02/04/2020	1	MO	144	HH	1	09:59	0	
02/04/2020	1	MO	145	HH	2	10:00	30	Male flushed female from ground. Female carrying grass. Both flew together to earth
02/04/2020	1	MO	146	KT	1	11:21	45	
02/04/2020	1	MO	147	KT	1	11:30	105	Soaring above deciduous woodland
02/04/2020	1	MO	148	KT	1	12:02	60	Soaring above deciduous woodland
02/04/2020	1	MO	149	KT	1	12:10	75	
09/04/2020	2	MO	150	KT	1	13:14	30	
09/04/2020	2	MO	151	KT	1	13:36	105	
09/04/2020	2	MO	152	KT	1	13:51	60	
09/04/2020	2	MO	153	KT	1	14:00	135	Briefly joined by another
09/04/2020	2	MO	154	KT	2	14:33	195	
09/04/2020	2	MO	155	KT	1	14:45	105	
09/04/2020	2	MO	156	PE	1	15:06	30	
09/04/2020	2	MO	157	KT	1	15:29	45	
09/04/2020	2	MO	158	KT	1	16:55	30	
09/04/2020	2	MO	159	KT	1	17:20	45	

Date	VP_code	Surveyor	FlightID	Species	NumBirds	ObsTime	Time at risk height (s)	Comments
09/04/2020	2	MO	160	KT	1	17:34	75	
09/04/2020	2	MO	161	KT	1	17:49	0	
09/04/2020	2	MO	162	CG	2	18:00	0	
16/04/2020	1	MO	163	KT	6	10:21	60	Appeared over ridge, pressure feeding on carcam out of view
16/04/2020	1	MO	164	CU	1	11:30	0	
16/04/2020	1	MO	165	PE	1	12:06	105	stooped at MP then soaring
16/04/2020	1	MO	166	MA	1	13:51	0	
16/04/2020	1	MO	167	K.	1	14:06	30	Continued foraging outside VA
16/04/2020	1	MO	168	KT	1	14:19	45	
16/04/2020	1	MO	169	MA	3	14:34	0	
16/04/2020	1	MO	170	KT	1	15:02	150	
16/04/2020	1	MO	171	CU	2	16:04	0	
16/04/2020	1	MO	172	KT	1	16:30	210	
13/05/2020	2	MO	173	KT	1	11:16	45	
13/05/2020	2	MO	174	KT	1	12:04	30	
13/05/2020	2	MO	175	KT	1	15:07	60	
13/05/2020	2	MO	176	KT	1	15:39	15	
13/05/2020	2	MO	177	KT	1	16:59	15	

Date	VP_code	Surveyor	FlightID	Species	NumBirds	ObsTime	Time at risk height (s)	Comments
26/05/2020	1	MO	178	CU	1	10:51	15	Agitated call, briefly joined by female then landed out of view
09/06/2020	2	MO	179	KT	1	15:07	0	appeared over ridge then dropped out of view
09/06/2020	2	MO	180	KT	1	15:26	30	
09/06/2020	2	MO	181	KT	2	16:16	105	
09/06/2020	2	MO	182	CU	1	16:31	30	female briefly also present
09/06/2020	2	MO	183	CU	1	16:34	75	display then joined female on ground
09/06/2020	2	MO	184	CU	1	16:39	30	
09/06/2020	2	MO	185	KT	1	17:00	0	
09/06/2020	2	MO	186	CU	1	17:06	45	
22/06/2020	1	MO	187	KT	1	13:36	45	
22/06/2020	1	MO	188	CU	2	13:42	45	Alarm calls. Chicks present
22/06/2020	1	MO	189	CU	3	13:59	45	
22/06/2020	1	MO	190	MA	1	14:03	0	
22/06/2020	1	MO	191	CU	1	14:10	0	
22/06/2020	1	MO	192	CU	1	14:13	30	Chased off RN
22/06/2020	1	MO	193	KT	1	14:32	135	
22/06/2020	1	MO	194	CU	2	15:11	30	
22/06/2020	1	MO	195	CU	1	16:03	0	Chased off C. joined by female

Date	VP_code	Surveyor	FlightID	Species	NumBirds	ObsTime	Time at risk height (s)	Comments
22/06/2020	1	MO	196	CU	2	17:25	45	Chasing off C.
22/06/2020	1	MO	197	CU	1	17:40	0	
22/06/2020	1	MO	198	GD	11	17:59	0	
22/06/2020	1	MO	199	CU	2	18:26	45	
22/06/2020	1	MO	200	CU	1	19:06	0	
13/07/2020	2	RM	201	KT	3	10:22	75	
13/07/2020	2	RM	202	KT	1	11:02	45	
13/07/2020	2	RM	203	KT	1	11:26	60	
13/07/2020	2	RM	204	KT	1	12:50	0	landed on ground
13/07/2020	2	RM	205	KT	1	14:30	135	
13/07/2020	2	RM	206	KT	1	14:55	60	
13/07/2020	2	RM	207	KT	1	15:48	30	
14/07/2020	1	RM	208	KT	1	09:39	45	
14/07/2020	1	RM	209	KT	1	10:14	75	
14/07/2020	1	RM	210	KT	1	10:39	195	
14/07/2020	1	RM	211	KT	1	16:19	195	
14/07/2020	1	RM	212	KT	1	16:25	0	
12/08/2020	2	RM	213	KT	1	10:52	105	
12/08/2020	2	RM	214	KT	2	10:58	90	

Date	VP_code	Surveyor	FlightID	Species	NumBirds	ObsTime	Time at risk height (s)	Comments
12/08/2020	2	RM	215	KT	1	11:04	180	
12/08/2020	2	RM	216	KT	1	11:08	45	
12/08/2020	2	RM	217	KT	1	11:14	60	
12/08/2020	2	RM	218	KT	1	11:19	225	
12/08/2020	2	RM	219	KT	3	11:26	15	
12/08/2020	2	RM	220	KT	1	12:01	75	
12/08/2020	2	RM	221	KT	1	12:22	150	
12/08/2020	2	RM	222	KT	1	13:10	180	
12/08/2020	2	RM	223	KT	1	14:49	210	
12/08/2020	2	RM	224	KT	1	15:15	75	
12/08/2020	2	RM	225	KT	1	16:04	240	
12/08/2020	2	RM	226	KT	1	17:10	75	
13/08/2020	1	RM	227	KT	1	08:35	30	
13/08/2020	1	RM	228	KT	1	10:36	0	
13/08/2020	1	RM	229	KT	1	11:55	120	
13/08/2020	1	RM	230	KT	2	13:36	165	
13/08/2020	1	RM	231	KT	2	14:04	105	
13/08/2020	1	RM	232	KT	2	14:19	210	
13/08/2020	1	RM	233	GP	1	14:41	75	

Date	VP_code	Surveyor	FlightID	Species	NumBirds	ObsTime	Time at risk height (s)	Comments
13/08/2020	1	RM	234	GP	1	14:46	75	

CONFIDENTIAL APPENDIX 04

Breeding raptor survey results

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