

7. Ornithology (Technical Appendices)

Technical Appendix 7.1

Technical Appendix 7.1 - Details of Brown and Shepherd Survey Visits

Note: the survey visits are arranged in date order with the most recent first.

Date (DD/MM/YY)	Time Start	Duration (hrs)	Weather Conditions / Remarks
15/06/2024	07.30hrs	5.5	calm or light northerly air, light rain shower, warm sunny spells, humid
11/05/2024	07.00hrs	6	becoming warm and sunny, gentle southerly breeze
27/04/2024	07.30hrs	5.5	sunny after early frost changing to partial cloud, warm sunny spells but cold under cloud, light northerly air
26/03/2024	08.00hrs	6	cold and cloudy, bright spells, dry, gentle easterly breeze
13/03/2024	08.00hrs	5	cloudy with bright spells, light then moderate southwest breeze
15/02/2024	12.00hrs	5	rain clearing away to sunny spells, mild, light south westerly breeze
08/01/2024	11.30hrs	5.25	partial cloud, long sunny spells, cold (frost all day in shade), light easterly breeze, sunset at 16.18hrs
19/12/2023	08.50hrs	5	bright with sunny spells, moderate northwest breeze, light rain shower
21/11/2023	08.30hrs	5	sunny start then increasing light cloud, mild, light southwest breeze
27/10/2023	08.30hrs	5	early mist then bright spells, light southeast breeze
11/07/2023	08.00hrs	5	warm and humid, light rain shower, light air
20/06/2023	07.30hrs	5	warm and sunny, light southwest breeze
16/05/2023	07.00hrs	5	partial cloud, sunny spells, rain shower, light to moderate northwest breeze
19/04/2023	07.00hrs	5	sunny, light then moderate easterly breeze

Technical Appendix 7.2

Technical Appendix 7.2 - Details of Vantage Point Watches

Note: the watches are arranged in date order with the most recent first.

Date (DD/MM/YY)	VP No.	Time Start	Duration (hrs)	Weather Conditions	Remarks
15/06/2024	1	13.30hrs	3	partial cloud, warm sunny spells but cool under cloud, light air then gentle easterly breeze	-
08/06/2024	1	14.15hrs	3	partial cloud, long sunny spells, moderate to fresh northwest breeze	-
15/05/2024	1	13.00hrs	2	warm and sunny, gentle southeast breeze	-
15/05/2024	1	16.00hrs	3	warm and sunny, gentle or moderate southeast breeze	-
10/05/2024	1	08.30hrs	2	becoming warm and sunny, gentle southerly breeze	-
10/05/2024	1	11.30hrs	3	warm and sunny, gentle southerly breeze	-
27/04/2024	1	14.30hrs	3	partial cloud, sunny spells, cold under cloud, light northerly air then calm	-
26/04/2024	1	17.15hrs	2	sunny, cool, gentle northerly breeze	-
25/04/2024	1	17.00hrs	3	sunny with a gentle northerly breeze	-
17/04/2024	1	12.30hrs	3	sunny with a gentle or moderate northwest breeze	-
17/04/2024	1	17.00hrs	3	sunny with a gentle northwest breeze	-
26/03/2024	1	14.30hrs	3	cloudy and cold, dry, moderate easterly breeze	-
13/03/2024	1	14.00hrs	3	cloudy changing to sunny, moderate or fresh westerly breeze	-
Hours subtotal	1	-	36	-	-
24/02/2024	1	07.45hrs	2	slight ground frost then cold and sunny, calm then gentle northwest breeze, sunrise at 07.31hrs	watch from sunrise
24/02/2024	1	10.40hrs	4	long sunny spells, cold and dry, isolated sleet shower, gentle northwest breeze	-

Date (DD/MM/YY)	VP No.	Time Start	Duration (hrs)	Weather Conditions	Remarks
12/02/2024	1	08.20hrs	2	cold and sunny, gentle then moderate southwest breeze	-
12/02/2024	1	11.10hrs	3.5	partial cloud, sunny spells, fresh to strong southwest breeze, dry but rain arriving by end of watch	-
15/01/2024	1	10.00hrs	3	cold and bright, sunny spells, light snow flurries, gentle northerly breeze	-
15/01/2024	1	14.00hrs	3	snow shower clearing then cold and bright, gentle northwest breeze, sunset at 16.30hrs	watch till after sunset
08/01/2024	1	08.45hrs	1.5	clear and frosty, calm then gentle easterly breeze, sunrise at 08.50hrs	watch from sunrise
05/12/2023	1	08.30hrs	3	light air frost then cold and sunny, gentle southeast breeze, sunrise at 08.35hrs	watch from sunrise
05/12/2023	1	12.30hrs	4	sunny and cold, gentle southeast breeze, frost patches all day in shade, sunset at 16.01hrs, calm and clear after sunset	watch till after sunset
24/11/2023	1	13.15hrs	2.5	bright and cold, gentle northerly breeze, sunset at 16.11hrs, sky clear after sunset	watch till after sunset
09/11/2023	1	13.45hrs	3	light cloud, bright spells, gentle southwest breeze then calm, sunset at 16.35hrs	watch till after sunset
08/11/2023	1	08.30hrs	3	sunny, gentle northwest breeze	-
08/11/2023	1	12.30hrs	3	sunny spells, moderate westerly breeze, rain shower	-
27/10/2023	1	14.30hrs	3	partial cloud, sunny spells, gentle southeast breeze	-
23/10/2023	1	12.00hrs	3	sunny changing to cloudy, moderate then fresh southeast breeze	-
02/10/2023	1	10.00hrs	3	light cloud, sunny spells, light then moderate southwest breeze	-
29/09/2023	1	08.00hrs	3	partial cloud, sunny spells, fresh to strong south westerly breeze	-
29/09/2023	1	13.00hrs	3	long sunny spells, strong southwest breeze	-
Hours	1	-	52.5	-	-

Date (DD/MM/YY)	VP No.	Time Start	Duration (hrs)	Weather Conditions	Remarks
subtotal					
29/08/2023	1	07.00hrs	3	sunny with a gentle westerly breeze; sunrise at 06.30hrs	-
29/08/2023	1	11.00hrs	3	light cloud changing to sunny, moderate westerly breeze, light rain shower	-
29/08/2023	1	14.30hrs	2.5	sunny, moderate westerly breeze	-
16/08/2023	1	13.00hrs	4	cloudy changing to warm sunny spells, light north easterly breeze	-
16/08/2023	1	18.00hrs	3	sunny changing to light cloud, gentle northeast breeze	-
29/07/2023	1	08.00hrs	3	partial cloud, sunny spells, rain shower, light then moderate southwest breeze	-
29/07/2023	1	12.00hrs	4	partial cloud, long sunny spells, moderate to fresh southwest breeze	-
20/06/2023	1	13.30hrs	3	warm and sunny, light southwest breeze	-
19/06/2023	1	08.00hrs	2	sunny spells, becoming warm, light southwest breeze	-
19/06/2023	1	10.45hrs	3	warm and sunny, light southwest breeze	-
16/05/2023	1	13.00hrs	3	fine and sunny, moderate northwest breeze	-
19/04/2023	1	13.00hrs	3	light cloud, moderate easterly breeze	-
14/04/2023	1	09.00hrs	3	partial cloud, sunny spells, light north westerly breeze	-
14/04/2023	1	13.00hrs	3	sunny spells, light north westerly breeze, rain shower	-
Hours subtotal	1	-	42.5	-	-

Technical Appendix 7.3

Technical Appendix 7.3 - Details of Vantage Point Location

VP No.	Irish National Grid (ING)	X	Y	Direction of View	Viewing Arc (degrees)	Viewing Extent (km)	Area Visible (ha)
1	C 74025 25505	274025	425505	northeast	180	2.0	207.9

Note: the vantage point is located outside the Site boundary and just outside the 500 m extent buffer area on adjacent land with access permissions. The area visible is buffered to the 500 m extent turbine envelope.

Technical Appendix 7.4

Technical Appendix 7.4 - Summary of Wider Area Checks

Date	Time Start	Duration (hrs)	Coverage / Remarks
19/04/2023	16.00hrs	2	Cam Forest (North)
16/05/2023	16.00hrs	2	Cam Forest (North)
19/06/2023	14.30hrs	3	Cam Forest (North)
11/07/2023	13.00hrs	3	vicinity of Keady Mountain
01/05/2024	14.00hrs	6	Cam Forest (North), Springwell Forest (West)
08/05/2024	12.30hrs	5	Cam Forest (North)
10/05/2024	15.15hrs	2	Cam Forest (North)
31/05/2024	13.00hrs	6	Cam Forest (North), Springwell Forest (West)
08/06/2024	08.30hrs	5	Cam Forest (North), Springwell Forest (West)
01/07/2024	16.00hrs	2	Cam Forest (North)

Technical Appendix 7.5

Technical Appendix 7.5 - IEEM Probability Table

The IEEM probability scale used in the Assessment of Effects is given below:

- Certain / near-certain - probability estimated at 95% or higher
- Likely - probability estimated at above 50% but below 95%
- Unlikely - probability estimated at above 5% but below 50%
- Highly unlikely - probability estimated at less than 5%

Technical Appendix 7.6

Technical Appendix 7.6 - Summary of Baseline for Breeding Birds

Species (BTO Code)	No. Breeding Pairs or Territorial Males	Breeding Status ¹	Remarks
Mallard (MA)	2	Probable	at small pond in buffer area
Moorhen (MH)	1	Probable	at small pond in buffer area
Grey heron (H.)	0	-	non-breeding transient
Lesser black-backed gull	0	-	non-breeding transient
Great black-backed gull	0	-	non-breeding transient
Snipe (SN)	1	Probable	-
Woodpigeon (WP)	2+	Confirmed	woodland species
Cuckoo (CK)	1+	Probable	Singing male(s)
Skylark (S.)	6	Confirmed	-
Swift (SI)	0	-	non-breeding transient
House Martin (HM)	0	-	non-breeding transient
Sand martin (SM)	12	Confirmed	small colony at disused quarry adjacent to the Site and A37 road
Swallow (SL)	0	-	non-breeding transient
Meadow pipit (MP)	20+	Confirmed	-
Grey wagtail (PW)	1	Confirmed	at culvert on A37
Pied wagtail (PW)	1	Confirmed	at disused quarry
Dipper (DI)	1	Confirmed	at culvert on A37
Wren (WR)	6+	Confirmed	woodland species
Stonechat (SC)	2	Confirmed	-
Robin (R.)	4+	Confirmed	woodland species
Wheatear (W.)	0	-	Non-breeding transient
Blackbird (B.)	2+	Probable	woodland species

¹ Breeding status has been defined following published British Trust for Ornithology guidance

Species (BTO Code)	No. Breeding Pairs or Territorial Males	Breeding Status ¹	Remarks
Song thrush (ST)	1+	Probable	woodland species
Mistle thrush (M.)	3+	Confirmed	woodland species
Grasshopper warbler (GH)	4	probable	singing males
Willow warbler (WW)	10	confirmed	woodland species
Blackcap (BC)	1+	Probable	territory in rhododendron trees by A37 road
Goldcrest (GC)	1+	probable	woodland species
Coal tit (CT)	2+	Probable	woodland species
Great tit (GT)	1+	Probable	woodland species
Magpie (MG)	1+	Confirmed	-
Jackdaw (JD)	2+	Probable	at buildings
Hood crow (HC)	3+	Confirmed	nests at forest edges
Starling (SG)	0	Probable	non-breeding transient
Chaffinch (CH)	6+	Confirmed	woodland species
Goldfinch (GO)	0	-	non-breeding transient
Siskin (SK)	1+	Probable	woodland species
Crossbill (CB)	0	-	non-breeding transient
Redpoll (LR)	2	Probable	-
Reed bunting (RB)	6	Confirmed	-

Technical Appendix 7.7

Technical Appendix 7.7 - Details of Snipe Observations

Species (BTO)	Date	Count	Methodology	Remarks
SN	19/04/2023	1	Brown and Shepherd Survey	calling from ground
SN	16/05/2023	1	Brown and Shepherd Survey	calling from ground
SN	11/05/2024	1	Brown and Shepherd Survey	calling from ground

Technical Appendix 7.8

Technical Appendix 7.8 - Details of Brown and Shepherd Survey Observations (Breeding Period)

Species (BTO Code)	Survey Date / Species Count (blank = zero count); [] = transient species							
	19/04/23	16/05/23	20/06/23	11/07/23	26/03/24	27/04/24	11/05/24	15/06/24
Mallard (MA)	2							
Moorhen (MH)	1		1			1		
Grey heron (H.)	1			1				
Lesser black-backed gull				[2]				[4]
Great black-backed gull	[1]			[1]			[1]	
Snipe (SN)	1	1			2		1	
Woodpigeon (WP)	2						2	
Cuckoo (CK)		1				1	1	
Skylark (S.)	4	4	5	[10]	2	4	6	6
Swift (SI)				[2]				[6]
House Martin (HM)				[20]				[50]
Sand martin (SM)	10	10	10	[20]			12	[30]
Swallow (SL)	10	10	10	[20]			12	[30]
Meadow pipit (MP)	16	18	18	[45]	6	20	20	25
Grey wagtail (PW)		1	1					1
Pied wagtail (PW)		1	1					1
Dipper (DI)					1			
Wren (WR)	3	2	4			6	4	2
Stonechat (SC)	1	1	2	[6]		2	2	1
Robin (R.)	4		2				2	
Wheatear (W.)						[2]	[1]	
Blackbird (B.)	1	1					1	2
Song thrush (ST)		1						

Species (BTO Code)	Survey Date / Species Count (blank = zero count); [] = transient species							
	19/04/23	16/05/23	20/06/23	11/07/23	26/03/24	27/04/24	11/05/24	15/06/24
Mistle thrush (M.)	2	2	2		3	2	2	
Grasshopper warbler (GH)	1	1				2	1	3
Willow warbler (WW)	9	10	9			10	8	10
Blackcap (BC)		1	1					1
Goldcrest (GC)		1	1					
Coal tit (CT)	2	2	2					
Great tit (GT)		1	1					
Magpie (MG)		1	1				1	
Jackdaw (JD)	2		2				2	2
Hood crow (HC)					3			
Raven (RN)	1	1	1			1	1	
Starling (SG)				[100]				[20]
Chaffinch (CH)	5	4	3				4	
Goldfinch (GO)								[10]
Siskin (SK)	1	1						
Crossbill (CB)								[1]
Redpoll (LR)	1	2				1	2	1
Reed bunting (RB)	4	4	3			6	4	4

Technical Appendix 7.9

Technical Appendix 7.9 - Summary of Baseline for Non-Breeding Birds

Species (BTO Code)	No. of Surveys Species Observed (N=6)	Maximum Count	Remarks
Mallard (MA)	3	6	at small ponds within the buffer area
Heron (H.)	2	1	-
Moorhen (MH)	2	1	at small ponds within the buffer area
Buzzard (BZ)	3	2	Nov, Jan and Feb
Sparrowhawk (SH)	2	1	Oct and Jan
Kestrel (K.)	2	1	Dec and Mar
Golden plover (GP)	1	2	Mar
Snipe (SN)	4	6	-
Jack snipe (JS)	2	1	Nov and Feb
Woodpigeon (WP)	5	12	woodland species
Skylark (S.)	1	1	Mar
Meadow pipit (MP)	3	10	-
Grey wagtail (GL)	2	1	-
Pied wagtail (PW)	2	2	-
Wren (WR)	4	3	woodland species
Waxwing (WX)	1	2	in hawthorn hedge by A37 (Feb)
Robin (R.)	2	1	woodland species
Stonechat (SC)	3	2	-
Fieldfare (FF)	1	12	-
Song thrush (ST)	2	2	-
Mistle thrush (M.)	3	4	-
Goldcrest (GC)	3	2	woodland species
Coal tit (CT)	4	6	woodland species
Blue tit (BT)	1	2	woodland species
Great tit (GT)	1	2	woodland species
Magpie MG)	3	2	-

Species (BTO Code)	No. of Surveys Species Observed (N=6)	Maximum Count	Remarks
Jackdaw (JD)	3	6	-
Hooded crow (HC)	6	6	-
Raven (RN)	6	6	-
Chaffinch (CH)	3	2	woodland species
Redpoll (LR)	2	10	woodland species
Siskin (SK)	2	35	woodland species
Crossbill (CB)	1	2	woodland species
Reed bunting (RB)	3	3	-

Technical Appendix 7.10

Technical Appendix 7.10 - Details of Brown and Shepherd Survey Observations (Non-Breeding Period)

Species Code)	(BTO	Survey Date / Species Count (blank = zero count)					
		27/10/2023	21/11/2023	19/12/2023	08/01/2024	15/02/2024	13/03/2024
H.				1	1		
MH		1		1			
MA				2		2	6
HH							
SH		1			1		
BZ			1		1	2	
K.				1			1
ML							
RG							
Q.							
GP							2
L.							
JS			1			1	
SN		6	4	6			3
WK							
BH							
CM							
LB							
HG							
GB							
WP			10	12	10	6	12
SI							
S.							1
SM							
SL							
HM							
MP		10		4		4	

Species Code)	(BTO Survey Date / Species Count (blank = zero count))					
	27/10/2023	21/11/2023	19/12/2023	08/01/2024	15/02/2024	13/03/2024
GL	1		1			
PW			1		2	
WR	3	3	2		2	
WX					2	
D.						
R.	1		1			
SC	2		2	2		
WC						
W.						
RZ						
B.				1		
FF	12					
ST	2			1		
RE						
M.	4			4	2	
GH						
SW						
WH						
WW						
BC						
GC		1		2	1	
CT	5	2	3	6		
BT		2				
GT	2					
LT						
MG	2		1	2		
RO						
JD				2	4	6
HC	6	6	2	4	4	6
RN	4	6	4	2	2	4

Species (BTO Code)	Survey Date / Species Count (blank = zero count)					
	27/10/2023	21/11/2023	19/12/2023	08/01/2024	15/02/2024	13/03/2024
SG						
CH	2		1		2	
GO						
SK	35		6			
LI						
TW						
LR	2		10			
CR			2			
BF						
SB						
RB	4		2	3		

Technical Appendix 7.11

Technical Appendix 7.11 - Details of Observations of Annex-1 Raptor Species

Note: ‘total durations’ and ‘durations at risk height’ are for the purposes of estimating collision risk and are for the area within the 500 m extent turbine envelope. Durations were not recorded for birds observed outside this area.

Species (BTO Code)	Date	VP No.	Time	No. Birds	Total Duration (s)	Duration at Risk Height (s)	Remarks
WE	19/06/2023	1	12.30hrs	1	300	150	circling and flapping flight, within Dunbeg Wind Farm array then widely over Site before departing to northwest
HH	09/11/2023	1	16.40hrs	1	280	0	adult male foraging near VP, flushed a flock of 45 golden plovers
HH	15/06/2024	1	10.30hrs	1	300	0	adult female, foraging close to (c. 100 m) Dunbeg Wind Farm array, mobbed by small birds (observation during Brown and Shepherd survey)
PE	10/05/2024	1	14.00hrs	1	310	106	foraging over southern part of buffer area
PE	26/03/2024	1	14.35hrs	1	135	0	soaring widely over area, partly within Dunbeg turbine array
PE	29/09/2023	1	10.30hrs	1	122	51	flying over site
PE	29/07/2023	1	13.05hrs	1	90	90	flying near VP
PE	14/04/2023	1	10.15hrs	1	180	75	soaring widely over area, partly within Dunbeg turbine array

Technical Appendix 7.12

Technical Appendix 7.12 - Details of Observations of Non Annex-1 Raptor Species

Note: ‘total durations’ and ‘durations at risk height’ are for the purposes of estimating collision risk and are for the area within the 500 m extent turbine envelope. Durations were not recorded for birds observed outside this area.

Species (BTO Code)	Date	VP No.	Time	No. Birds	Total Duration (s)	Duration at Risk Height (s)	Remarks
BZ	15/05/2024	1	17.15hrs	1	90	21	foraging over site near VP
BZ	10/05/2024	1	10.00hrs	2	120	120	soaring over site
BZ	10/05/2024	1	12.30hrs	1	0	0	foraging over adjacent part Dunbeg array
BZ	26/04/2024	1	18.50hrs	1	65	65	circling over site
BZ	25/04/2024	1	19.05hrs	1	0	0	foraging within Dunbeg array
BZ	17/04/2024	1	13.00hrs	2	80	80	pair soaring over site
BZ	17/04/2024	1	14.10hrs	1	130	44	foraging over site
BZ	17/04/2024	1	19.25hrs	1	30	10	along forest edge
BZ	13/03/2024	1	14.20hrs	1	0	0	travelling flight through Dunbeg array, mobbed by ravens
BZ	13/03/2024	1	15.30hrs	1	165	0	travelling flight over site
BZ	24/02/2024	1	09.30hrs	1	0	0	soaring above Dunbeg array
BZ	24/02/2024	1	11.15hrs	1	0	0	western side of Dunbeg array
BZ	24/02/2024	1	11.30hrs	2	0	0	pair soaring over valley, north side of A37
BZ	24/02/2024	1	12.15hrs	1	45	16	along forest edge
BZ	24/02/2024	1	12.30hrs	5	300	0	soaring together to north of VP
BZ	24/02/2024	1	14.05hrs	1	125	125	foraging over site near VP
BZ	27/10/2023	1	15.05hrs	1	0	0	circling just beyond Dunbeg array
BZ	23/10/2023	1	13.05hrs	1	135	46	foraging over Site

Species (BTO Code)	Date	VP No.	Time	No. Birds	Total Duration (s)	Duration at Risk Height (s)	Remarks
BZ	29/09/2023	1	1.00hrs	1	0	0	circling, partly within Dunbeg turbine array
BZ	29/08/2023	1	13.30hrs	1	105	105	foraging over site
BZ	16/08/2023	1	16.25hrs	13	0	0	flock of 13 juvenile buzzards soaring
BZ	19/06/2023	1	10.50hrs	1	160	0	flying along edge of forestry
BZ	19/06/2023	1	11.50hrs	1	35	0	flying along edge of forestry
BZ	19/06/2023	1	12.35hrs	1	0	0	foraging within Dunbeg array
BZ	16/05/2023	1	14.05hrs	1	100	100	foraging over Site opposite VP then moved away to south
BZ	16/05/2023	1	15.15hrs	1	0	0	foraging within Dunbeg array
BZ	14/04/2023	1	10.50hrs	1	0	0	circling, partly within Dunbeg turbine array
K.	10/05/2024	1	14.10hrs	1	600	0	foraging over site
K.	17/04/2024	1	15.15hrs	1	150	51	foraging over site
K.	17/04/2024	1	18.30hrs	1	0	0	foraging within Dunbeg array
K.	26/03/2024	1	14.35hrs	1	0	0	travelling flight through Dunbeg array
K.	13/03/2024	1	14.05hrs	1	200	68	foraging over site and adjacent part Dunbeg array
K.	13/03/2024	1	15.50hrs	1	300	0	foraging over site near VP
K.	24/02/2024	1	11.45hrs	1	600	0	soaring high over site then to southeast
K.	24/02/2024	1	14.35hrs	1	180	120	foraging over site
K.	15/01/2024	1	12.45hrs	1	0	0	hunting from small spruce trees within Dunbeg array
K.	24/11/2023	1	13.30hrs	1	0	0	foraging within Dunbeg array

Species (BTO Code)	Date	VP No.	Time	No. Birds	Total Duration (s)	Duration at Risk Height (s)	Remarks
K.	02/10/2023	1	11.00hrs	1	300	0	flying low to south past VP
K.	29/09/2023	1	10.30hrs	1	180	61	foraging over site
K.	29/09/2023	1	11.00hrs	1	0	0	foraging within Dunbeg array
K.	29/08/2023	1	13.15hrs	2	300	102	foraging over Site opposite VP then moved away to south
K.	20/06/2023	1	14.00hrs	1	600	0	over northern part of Site and western edge of Dunbeg array
K.	19/04/2023	1	15.10hrs	1	600	0	foraging over Site opposite VP then moved away to south
SH	19/06/2023	1	11.00hrs	1	-	-	male, flew into forest with prey
SH	08/11/2023	1	11.20hrs	1	-	-	female, circling

Technical Appendix 7.13

Technical Appendix 7.13 - Details of Observations of Secondary Species

Species	Date	Time	No. Birds	Median Height (m)	Remarks
curlew	26/03/2024	15.10hrs	1	100	approached high from west then continued east through middle of Dunbeg array
golden plover	02/10/2023	10.50hrs	1+	n/a	calls overhead
golden plover	08/11/2023	12.35hrs	50	100	circling near VP
great black-backed gull	13/03/2024	15.55hrs	1	50	travelling flight
great black-backed gull	26/03/2024	14.40hrs	2	100	flew east around Dunbeg array
great black-backed gull	24/02/2024	11.00hrs	2	100	flying west
great black-backed gull	05/12/2023	10.00hrs	4	100	flying west
lesser black-backed gull	29/07/2023	13.50hrs	1	50	flying west
lesser black-backed gull	27/04/2024	16.15hrs	6	50	flock circling and flying west
lesser black-backed gull	17/04/2024	18.05hrs	2	100	flying west
lesser black-backed gull	26/03/2024	14.45hrs	1	100	flew east around Dunbeg array
lesser black-backed gull	16/08/2023	18.30hrs	8	100	flock flying east
swallow	16/08/2023	15.45hrs	20	20	feeding widely over site
fieldfare	05/12/2023	16.15hrs	50	10	flying to roost in trees

Technical Appendix 7.14

Technical Appendix 7.14 - Details of Collision Risk Model

Note: the Collision Risk Model (CRM) has been completed for raptor species that are regularly occurring within the target area. For hen harrier there were insufficient observations to warrant collision risk modelling being undertaken. The CRM has been completed using the observations for the 15 month baseline period from April 2023 to June 2024 inclusive. Considering the results of the baseline surveys as a whole (including in particular the results of the wider area surveys) then it is considered that the 15 month baseline period is likely to be representative of activity by the relevant target species.

Wind Farm Parameters

Table A - Wind Farm Parameters Input to the Collision Risk Model

Parameter	Input Value	Remarks
Size of wind farm envelope	1	Optional input (a value of 1 or more must be entered) - this value has no effect on collision risk
Number of turbines	4	
Rotor diameter (m)	117	
Hub height (m)	91.4	
Rotor depth (m)	-	Optional input
Rotor chord (m)	4	
Rotor pitch (degrees)	4	
Rotation period (seconds)	3.43	17.5 RPM
Turbine operation time (%)	88.1	Based on time stamps within operational envelope (3m/s – 32m/s) times the assumed technical availability of 97%

Bird Parameters

The bird parameters input to the CRM are given in Table B. In line with SNH guidance², flight speeds and wing-spans are taken from Alerstam *et al.*³ Bird lengths are taken from Forsman⁴, which is the standard published reference for raptor identification in Europe. [Note: some input values are rounded by the CRM spreadsheet.]

Table B - Bird Parameters Input to the Collision Risk Model

Species	Wing-span (m)	Length (m)	Flight speed (m / s)
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² SNH (2014): Flight Speeds and Biometrics for Collision Risk Modelling (SNH Guidance Note, October 2014)

³ Alerstam, T. *et al.* (2007): Flight Speeds Among Bird Species - Allometric and Phylogenetic Effects (PLoS Biol. 5)

⁴ Forsman, D. (1999): The Raptors of Europe and the Middle East - A Handbook of Field Identification (Poyser)

Species	Wing-span (m)	Length (m)	Flight speed (m / s)
Buzzard	1.24	0.54	12.5 (range 11.6 - 13.3)
Kestrel	0.73	0.32	10.1
Peregrine	1.02	0.44	12.1

Band Used To Define Risk Height

The band used to define risk height in the CRM is for a 91.4 m hub height combined with a 117 m rotor diameter:

- Maximum height 149.9 m (rounded to 150 m in the CRM);
- Minimum height 32.9 m (rounded to 30 m in the CRM).

Durations at Risk Height

Total flight durations and durations at risk height input to the CRM are taken from Technical Appendices 7.11 and 7.12 and are summarized in Table C. For kestrels (due to aspects of their flight behaviour in particular frequent height changes and prolonged bouts of hovering) it was not usually practicable to record durations to the nearest second and birds were then logged using the five-minute activity-period summaries: it was assumed that a bird was present within the target area for all of each five-minute period in which it was logged (in most instances this will have been a reasonable assumption) e.g. for a kestrel logged in one five-minute period the total duration is then recorded as 300 seconds. Heights were recorded as a range (minimum and maximum) and from this it is possible to estimate durations at collision risk height (as a % overlap with the rotor-swept area).

Table C - Total Durations and Durations at Risk Height

Species	Total Durations	Durations at Risk Height (s)
Peregrine	837	322
Buzzard	1685	732
Kestrel	4010	402

Watch Data

Table D - Watch Data Input to the Collision Risk Model

Vantage Point	Area Visible at Risk Height (ha)	Observation Time (hours)
VP1	207.9	131

Summary of Collision Risk Model Results

The results of the CRM are summarized in Table E. The avoidance rates for each species follow the published SNH guidance⁵. For all species it has been assumed that birds are potentially present within the survey area year-round for an average day-length of 12 hours.

Table E - Summary of Results of the Collision Risk Model

Species	Days Assumed Present	Hours Assumed Present	Avoidance Rate	Equivalent Collision Rate
Peregrine	365	12	98%	one bird every 33.1 years
Buzzard	365	12	98%	one bird every 13.4 years
Kestrel	365	12	95%	one bird every 13.6 years

⁵ SNH (2016): Avoidance rates for the SNH onshore wind farm Collision Risk Model (SNH Guidance Note, October 2016)