APPENDIX 9.1

WFD COMPLIANCE REPORT

VOLUME III

APPENDICES TO
ENVIRONMENTAL IMPACT ASSESSMENT REPORT

RFI Response July 2025

WFD Cycle 2

Catchment Upper Shannon

Subcatchment Shannon[Upper]_SC_060

Code 26C_7

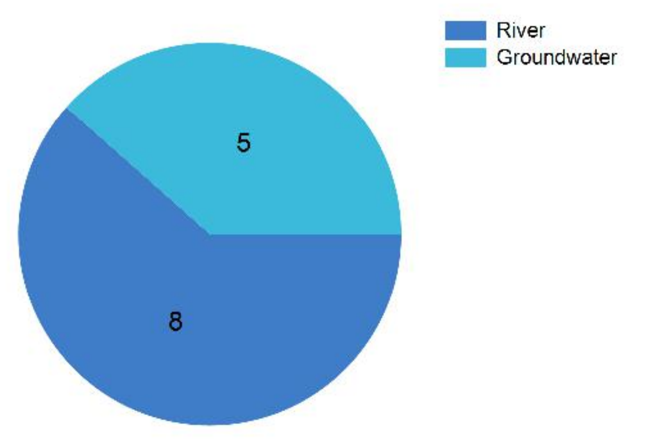
Generated on: 20 Sep 2022

Assessment Purpose

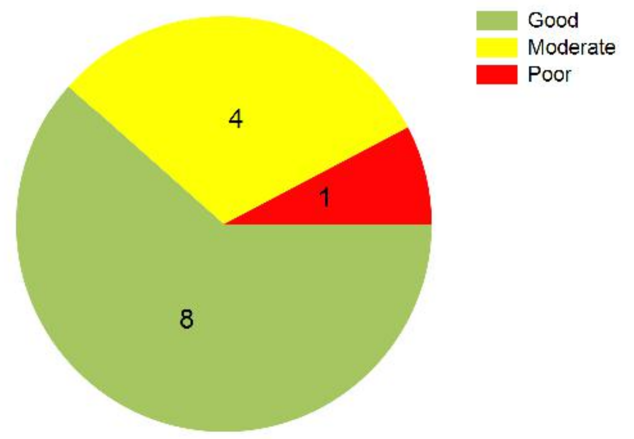
This assessment has been produced as part of the national characterisation programme undertaken for the Water Framework Directive river basin management planning. It has been led by the EPA, with input from Local Authorities and other public bodies.

The characterisation assessments are automatically generated from the information stored in the WFD Application. The assessments may change as information is updated in the WFD application. Users should ensure that they have the most up to date information by downloading the latest assessment before use.

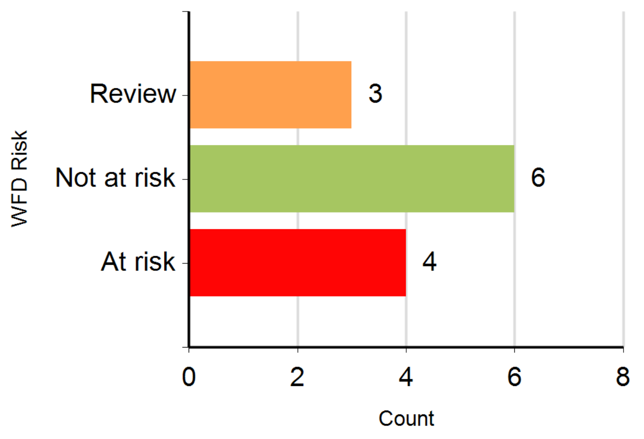
Waterbodies



Water Quality Status



WFD Risk



Water Quality - High Ecological Status

No Data Available

Evaluation of PrioritySubcatchment Issues

Four out of seven river water bodies within the subcatchment are At Risk: Fallan_010 and Shannon (Upper)_090 due to Moderate ecological status; Camlin_070 due to Poor ecological status status and; Camlin_060 due to elevated concentrations of phosphate and ammonia.

On Camlin_060 the significant pressures are urban wastewater, diffuse urban and agriculture. On Camlin_070 the significant pressures, resulting in siltation and elevated concentrations of ammonia, are a combination of physical habitat modifications due to animal access, and urban wastewater and diffuse urban sources of pollution. On Fallan_010, animal access and forestry activities have resulted in excess siltation in the water body. Siltation is also the significant issue on Shannon (Upper)_090 and the significant pressures are agriculture, predominantly animal access.

Map Subcatchment Risk

River And Lake Waterbodies: WFD Risk

The following river and lake waterbodies are in the subcatchment.

Code	Name	Type	WFD Risk	Significant Pressure
IE_SH_26C010900	CAMLIN_060	River	At risk	Yes
IE_SH_26C011000	CAMLIN_070	River	At risk	Yes
IE_SH_26F010040	FALLAN_010	River	At risk	Yes
IE_SH_26S021530	SHANNON (Upper)_090	River	At risk	Yes
IE_26C_AWB_RCMLW	Royal Canal Main Line (Upper Shannon C)	River	Not at risk	No
IE_SH_26C010800	CAMLIN_050	River	Not at risk	No
IE_SH_26C200300	CLOONCOOSE STREAM_010	River	Not at risk	Yes
IE_SH_26F010200	FALLAN_020	River	Not at risk	Yes

Map Subcatchment Water Quality Status

River And Lake Waterbodies: Water Quality Status

The water quality status of river and lake waterbodies in the subcatchment is as follows.

Name	2007-09	2010-12	2010-15	2013-18
CAMLIN_050	Moderate	Good	Good	Good
CAMLIN_060	Unassigned	Unassigned	Unassigned	Moderate
CAMLIN_070	Poor	Poor	Poor	Poor
CLOONCOOSE STREAM_010	Good	Good	Good	Moderate
FALLAN_010	Moderate	Moderate	Moderate	Moderate
FALLAN_020	Moderate	Good	Good	Good
Royal Canal Main Line (Upper Shannon C)	Moderate	Good	Good	Good
SHANNON (Upper)_090	Moderate	Moderate	Moderate	Moderate

Potentially Dependent Transitional and Coastal Waterbodies

The Transitional and Coastal waterbodies listed below intersect spatially with river and lake waterbodies in the subcatchment …

Code	Name	Type	Local Authority	WFD Risk

Potentially Dependent Groundwater Waterbodies

The groundwaters listed below interset spatially with river and lake waterbodies in the subcatchment …

Code	Name	Type	Local Authority	WFD Risk
IE_SH_G_091	Funshinagh	Groundwater	Roscommon County Council	At risk
IE_SH_G_091	Funshinagh	Groundwater	Roscommon County Council	Review
IE_SH_G_110	Inny	Groundwater	Westmeath County Council	Not at risk
IE_SH_G_110	Inny	Groundwater	Westmeath County Council	Review
IE_SH_G_149	Longford Ballinalee	Groundwater	Longford County Council	Not at risk
IE_SH_G_149	Longford Ballinalee	Groundwater	Longford County Council	Review
IE_SH_G_151	Historic Waste Facility (S22-02489)	Groundwater	Longford County Council	Not at risk
IE_SH_G_192	Newtown Forbes	Groundwater	Longford County Council	Not at risk

Protected Areas intersecting River and Lake Waterbodies

The Protected Areas listed below intersect spatially with river and lake waterbodies in the subcatchment …

Code	Name	Type	Waterbody Name	Association Type
IEPA1_SH_G_091	Funshinagh	Drinking Water	SHANNON (Upper)_090	Within Protected Area
IEPA1_SH_G_149	Longford Ballinalee	Drinking Water	CAMLIN_050	Within Protected Area
IEPA1_SH_G_149	Longford Ballinalee	Drinking Water	CAMLIN_060	Within Protected Area
IEPA1_SH_G_149	Longford Ballinalee	Drinking Water	CLOONCOOSE STREAM_010	Within Protected Area
IEPA1_SH_G_149	Longford Ballinalee	Drinking Water	FALLAN_010	Within Protected Area
IEPA1_SH_G_149	Longford Ballinalee	Drinking Water	FALLAN_020	Within Protected Area
IEPA1_SH_G_151	Historic Waste Facility (S22-02489)	Drinking Water	CAMLIN_050	Within Protected Area
IEPA1_SH_G_151	Historic Waste Facility (S22-02489)	Drinking Water	CLOONCOOSE STREAM_010	Within Protected Area
IEPA1_SH_G_192	Newtown Forbes	Drinking Water	CAMLIN_050	Within Protected Area
IEPA1_SH_G_192	Newtown Forbes	Drinking Water	CAMLIN_060	Within Protected Area
IEPA1_SH_G_192	Newtown Forbes	Drinking Water	CAMLIN_070	Within Protected Area
IEPA1_SH_G_192	Newtown Forbes	Drinking Water	FALLAN_020	Within Protected Area
IEPA1_SH_G_192	Newtown Forbes	Drinking Water	SHANNON (Upper)_090	Within Protected Area
IERI_SH_1994_0002	Camlin (River)	Nutrient Sensitive Area	CAMLIN_060	Overlapping / partly within Protected Area
IERI_SH_1994_0002	Camlin (River)	Nutrient Sensitive Area	CAMLIN_070	Overlapping / partly within Protected Area
IERI_SH_2010_0002	Shannon (River)	Nutrient Sensitive Area	SHANNON (Upper)_090	Overlapping / partly within Protected Area

Pressures

Below is a list of all significant pressures identified in the subcatchment.

Code	Name	WFD Risk	Pressure Category	Pressure Sub Category	Created In
IE_SH_26C011000	CAMLIN_070	At risk	Urban Run-off	Diffuse Sources Run-Off	WFD Cycle 2
IE_SH_26C010900	CAMLIN_060	At risk	Urban Run-off	Diffuse Sources Run-Off	WFD Cycle 2
IE_SH_26S021530	SHANNON (Upper)_090	At risk	Hydromorphology	Dams, barriers, locks, weirs	WFD Cycle 2
IE_SH_26S021530	SHANNON (Upper)_090	At risk	Agriculture	Agriculture	WFD Cycle 2
IE_SH_26C010900	CAMLIN_060	At risk	Urban Waste Water	Combined Sewer Overflows	WFD Cycle 2
IE_SH_26F010040	FALLAN_010	At risk	Agriculture	Agriculture	WFD Cycle 2
IE_SH_26C011000	CAMLIN_070	At risk	Hydromorphology	Land Drainage	WFD Cycle 2
IE_SH_26F010040	FALLAN_010	At risk	Forestry	Clearfelling	WFD Cycle 2
IE_SH_26C010900	CAMLIN_060	At risk	Hydromorphology	Dams, barriers, locks, weirs	WFD Cycle 2
IE_SH_26C010900	CAMLIN_060	At risk	Agriculture	Pasture	WFD Cycle 2

Further Characterisation Actions

The following further characterisation actions have been identified. These are necessary to help understand more fully issues in the subcatchment and their likely cause.

Code	Name	Action	Responsible Organisation	Created In
IE_SH_26S021530	SHANNON (Upper)_090	IA7 Multiple Sources in Multiple Areas	Longford County Council	WFD Cycle 2
IE_SH_26S021530	SHANNON (Upper)_090	IA1 Provision of Information	Environmental Protection Agency	WFD Cycle 2
IE_SH_26C011000	CAMLIN_070	IA6 Multiple Sources in Large Urban Area	Local Authority Waters Programme (LAWPRO)	WFD Cycle 2
IE_SH_26C010900	CAMLIN_060	IA6 Multiple Sources in Large Urban Area	Local Authority Waters Programme (LAWPRO)	WFD Cycle 2
IE_SH_26F010040	FALLAN_010	IA7 Multiple Sources in Multiple Areas	Longford County Council	WFD Cycle 2

APPENDIX 9.2

LABORATORY REPORTS

VOLUME III

APPENDICES TO ENVIRONMENTAL IMPACT ASSESSMENT REPORT

RFI Response July 2025

Element Materials Technology
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Zone 3
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Deeside
CH5 2UA

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RECEIVED: 09/07/2025

IE Consulting
Innovation Centre
Green Road
Carlow
Co Carlow
Ireland
R93 W248

UKAS TESTING 4225

Attention :	Joanne Mackey
Date :	28th August, 2024
Your reference :	IE2978
Our reference :	Test Report 24/13964 Batch 1
Location :	Cloonanny Windfarm
Date samples received :	15th August, 2024
Status :	Final Report
Issue :	202408281307

Three samples were received for analysis on 15th August, 2024 of which three were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.
All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

The greenhouse gas emissions generated (in Carbon – Co2e) to obtain the results in this report are estimated as:

Scope 1&2 emissions - 4.996 kg of CO2

Scope 1&2&3 emissions - 11.806 kg of CO2

Authorised By:

Bruce Leslie
Project Manager

Element Materials Technology

Client Name: IE Consulting
Reference: IE2978
Location: Cloonanny Windfarm
Contact: Joanne Mackey
EMT Job No: 24/13964

Report : Liquid

Liquids/products: V=40ml vial, G=glass bottle, P=plastic bottle
$H=H_2SO_4$, Z=ZnAc, N=NaOH, $HN=HN0_3$

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	1-5	6-10	11-15								LOD/LOR	Units	Method No.
Sample ID	SW1	SW2	SW3										
Depth													
COC No / misc													
Containers	H HN P BOD G	H HN P BOD G	H HN P BOD G										
Sample Date	12/08/2024 17:00	13/08/2024 13:00	12/08/2024 17:30										
Sample Type	Surface Water	Surface Water	Surface Water										
Batch Number	1	1	1										
Date of Receipt	15/08/2024	15/08/2024	15/08/2024										
Total Phosphorus	251	232	212								<5	ug/l	TM30/PM14
EPH (C8-C40) (EH_1D_Total) #	<10	<10	<10								<10	ug/l	TM5/PM30
Sulphate as SO4 #	17.0	14.6	11.8								<0.5	mg/l	TM38/PM0
Chloride #	17.9	20.1	14.7								<0.3	mg/l	TM38/PM0
Nitrate as NO3 #	5.0	6.4	1.2								<0.2	mg/l	TM38/PM0
Ortho Phosphate as P #	0.17	0.15	<0.03								<0.03	mg/l	TM38/PM0
Ammoniacal Nitrogen as NH4 #	0.18	0.08	0.08								<0.03	mg/l	TM38/PM0
Total Alkalinity as CaCO3 #	202	228	210								<1	mg/l	TM75/PM0
BOD (Settled) #	<3 AA	<3 AA	<3 AA								<1	mg/l	TM58/PM0
Electrical Conductivity @25C #	448	501	499								<2	uS/cm	TM76/PM0
pH #	8.17	8.18	8.10								<0.01	pH units	TM73/PM0
Total Suspended Solids #	10	<10	66								<10	mg/l	TM37/PM0
Turbidity	6.8	6.3	32.3								<0.1	NTU	TM34/PM0

Please include all sections of this report if it is reproduced
All solid results are expressed on a dry weight basis unless stated otherwise.

Element Materials Technology — **Notification of Deviating Samples**

Client Name: IE Consulting
Reference: IE2978
Location: Cloonanny Windfarm
Contact: Joanne Mackey

Matrix : Liquid

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analysis	Reason
24/13964	1	SW1		1-5	BOD	Sample holding time exceeded
24/13964	1	SW2		6-10	BOD	Sample holding time exceeded
24/13964	1	SW3		11-15	BOD	Sample holding time exceeded

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating. Only analyses which are accredited are recorded as deviating if set criteria are not met.
It is a requirement under ISO 17025 that we inform clients if samples are deviating i.e. outside what is expected. A deviating sample indicates that the sample 'may' be compromised but not necessarily will be compromised. The result is still accredited and our analytical reports will still show accreditation on the relevant analytes.

EMT Job No.: 24/13964

SOILS and ASH

Please note we are only MCERTS accredited (UK soils only) for sand, loam and clay and any other matrix is outside our scope of accreditation.

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation has been performed on clay, sand and loam, only samples that are predominantly these matrices, or combinations of them will be within our MCERTS scope. If samples are not one of a combination of the above matrices they will not be marked as MCERTS accredited.

It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary. Asbestos samples are retained for 6 months.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Limits of detection for analyses carried out on as received samples are not moisture content corrected. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C. Ash samples are dried at 35°C ±5°C.

Where Mineral Oil is quoted, this refers to Total Aliphatics C10-C40.

Where a CEN 10:1 ZERO Headspace VOC test has been carried out, a 10:1 ratio of water to wet (as received) soil has been used.

% Asbestos in Asbestos Containing Materials (ACMs) is determined by reference to HSG 264 The Survey Guide - Appendix 2 : ACMs in buildings listed in order of ease of fibre release.

Sufficient amount of sample must be received to carry out the testing specified. Where an insufficient amount of sample has been received the testing may not meet the requirements of our accredited methods, as such accreditation may be removed.

Negative Neutralization Potential (NP) values are obtained when the volume of NaOH (0.1N) titrated (pH 8.3) is greater than the volume of HCl (1N) to reduce the pH of the sample to 2.0 - 2.5. Any negative NP values are corrected to 0.

The calculation of Pyrite content assumes that all oxidisable sulphides present in the sample are pyrite. This may not be the case. The calculation may be an overesitimate when other sulphides such as Barite (Barium Sulphate) are present.

WATERS

Please note we are not a UK Drinking Water Inspectorate (DWI) Approved Laboratory .

ISO17025 accreditation applies to surface water and groundwater and usually one other matrix which is analysis specific, any other liquids are outside our scope of accreditation.

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

Where Mineral Oil is quoted, this refers to Total Aliphatics C10-C40.

STACK EMISSIONS

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation for Dioxins and Furans and Dioxin like PCBs has been performed on XAD-2 Resin, only samples which use this resin will be within our MCERTS scope.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

DEVIATING SAMPLES

All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. The temperature of sample receipt is recorded on the confirmation schedules in order that the client can make an informed decision as to whether testing should still be undertaken.

SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

DILUTIONS

A dilution suffix indicates a dilution has been performed and the reported result takes this into account. No further calculation is required.

BLANKS

Where analytes have been found in the blank, the sample will be treated in accordance with our laboratory procedure for dealing with contaminated blanks.

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a requirement of our Accreditation Body for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.
Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.
Laboratory records are kept for a period of no less than 6 years.

REPORTS FROM THE SOUTH AFRICA LABORATORY

Any method number not prefixed with SA has been undertaken in our UK laboratory unless reported as subcontracted.

Measurement Uncertainty

Measurement uncertainty defines the range of values that could reasonably be attributed to the measured quantity. This range of values has not been included within the reported results. Uncertainty expressed as a percentage can be provided upon request.

Customer Provided Information

Sample ID and depth is information provided by the customer.

Age of Diesel

The age of release estimation is based on the nC17/pristane ratio only as prescribed by Christensen and Larsen (1993) and Kaplan, Galperin, Alimi et al., (1996).
Age estimation should be treated with caution as it can be influenced by site specific factors of which the laboratory are not aware.

Tentatively Identified Compounds (TICs)

Where Tentatively Identified Compounds (TICs) are reported, up to 10 Tentatively Identified Compounds will be listed where there is found to be a greater than 80% match with the NIST library. The reported concentration is determined semi-quantitively, with a matrix specific limit of detection. Note, other compounds may be present but are not reported.

ABBREVIATIONS and ACRONYMS USED

#	ISO17025 (UKAS Ref No. 4225) accredited - UK.
SA	ISO17025 (SANAS Ref No.T0729) accredited - South Africa
B	Indicates analyte found in associated method blank.
DR	Dilution required.
M	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
>>	Results above quantitative calibration range. The result should be considered the minimum value and is indicative only. The actual result could be significantly higher.
*	Analysis subcontracted to an Element Materials Technology approved laboratory.
CO	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
TB	Trip Blank Sample
OC	Outside Calibration Range
AA	x3 Dilution

RECEIVED: 09/07/2025

HWOL ACRONYMS AND OPERATORS USED

HS	Headspace Analysis.
EH	Extractable Hydrocarbons - i.e. everything extracted by the solvent.
CU	Clean-up - e.g. by florisil, silica gel.
1D	GC - Single coil gas chromatography.
Total	Aliphatics & Aromatics.
AL	Aliphatics only.
AR	Aromatics only.
2D	GC-GC - Double coil gas chromatography.
#1	EH_Total but with humics mathematically subtracted
#2	EU_Total but with fatty acids mathematically subtracted
_	Operator - underscore to separate acronyms (exception for +).
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total
MS	Mass Spectrometry.

EMT Job No: 24/13964

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM30	Water samples are extracted with solvent using a magnetic stirrer to create a vortex.	Yes			
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP 6010B, Rev.2, Dec.1996; Modified EPA Method 3050B, Rev.2, Dec.1996	PM14	Preparation of waters and leachates for metals by ICP OES/ICP MS. Samples are filtered for Dissolved metals, and remain unfiltered for Total metals then acidified				
TM34	Turbidity by 2100P Turbidity Meter. complies with EPA 180.1 1993	PM0	No preparation is required.				
TM37	Modified methods - TSS: USEPA 160.2 (1983), EN872:2005 and APHA SMEWW 2540D:1999 22nd Edition; VSS: USEPA 1684 (Jan 2001), USEPA 160.4 (1971) and SMEWW 2540E:1999 22nd Edition. Gravimetric determination of Total Suspended Solids (TSS) and Volatile Suspended Solids (VSS). Sample is filtered through a 1.5um pore size glass fibre filter and the resulting residue is dried and weighed at 105°C for TSS and 550°C for VSS	PM0	No preparation is required.	Yes			
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993) – All anions comparable to BS ISO 15923-1: 2013l	PM0	No preparation is required.	Yes			
TM58	APHA SMEWW 5210B:1999 22nd Edition. Comparible with ISO 5815:1989. Measurement of Biochemical Oxygen Demand. When cBOD (Carbonaceous BOD) is requested a nitrification inhibitor is added which prevents the oxidation of reduced forms of nitrogen, such as am	PM0	No preparation is required.	Yes			
TM73	Modified US EPA methods 150.1 (1982) and 9045D Rev. 4 - 2004) and BS1377-3:1990. Determination of pH by Metrohm automated probe analyser.	PM0	No preparation is required.	Yes			
TM75	Modified US EPA method 310.1 (1978). Determination of Alkalinity by Metrohm automated titration analyser.	PM0	No preparation is required.	Yes			
TM76	Modified US EPA method 120.1 (1982). Determination of Specific Conductance by Metrohm automated probe analyser.	PM0	No preparation is required.	Yes			

APPENDIX 9.3
PAST FLOOD EVENT LOCAL AREA SUMMARY REPORT

VOLUME III
APPENDICES TO ENVIRONMENTAL IMPACT ASSESSMENT REPORT

RFI Response July 2025

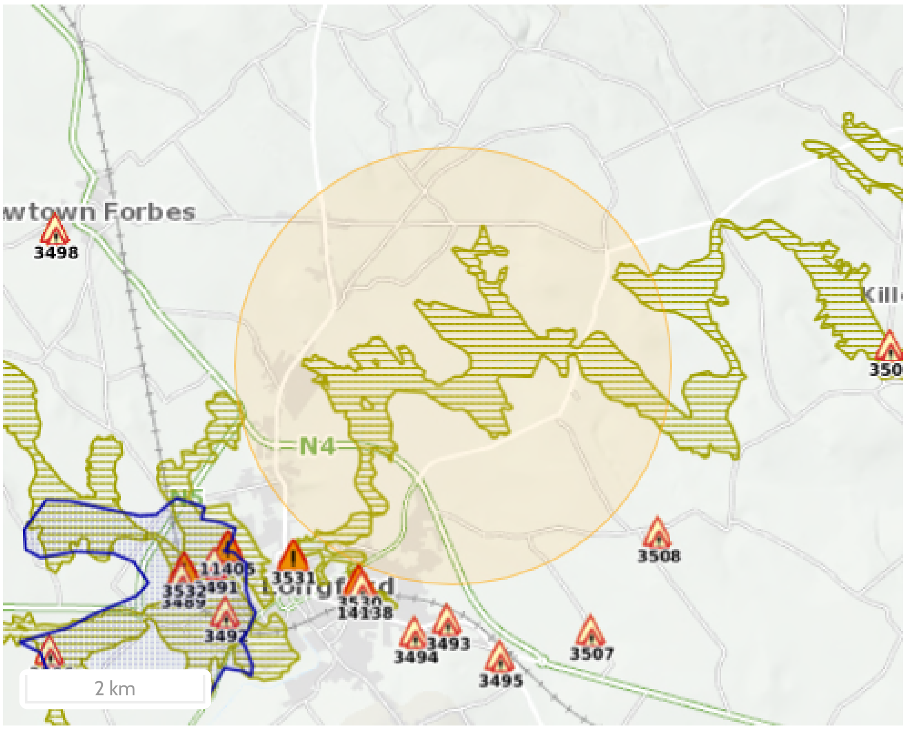
Past Flood Event Local Area Summary Report

OPW Oifig na nOibreacha Poiblí Office of Public Works

Report Produced: **19/9/2024 9:26**

This Past Flood Event Summary Report summarises all past flood events within 2.5 kilometres of the map centre.

This report has been downloaded from www.floodinfo.ie (the "**Website**"). The users should take account of the restrictions and limitations relating to the content and use of the Website that are explained in the Terms and Conditions. It is a condition of use of the Website that you agree to be bound by the disclaimer and other terms and conditions set out on the Website and to the privacy policy on the Website.



Map Legend

- Single Flood Event
- Recurring Flood Event
- Past Flood Event Extents
- Drainage Districts Benefited Lands*
- Land Commission Benefited Lands*
- Arterial Drainage Schemes Benefited Lands*

* Important: These maps do not indicate flood hazard or flood extent. Their purpose and scope is explained on Floodinfo.ie

0 Results

Name (Flood_ID)	Start Date	Event Location

APPENDIX 10.1

BIODIVERSITY ENHANCEMENT MANAGEMENT PLAN

VOLUME III

APPENDICES TO ENVIRONMENTAL IMPACT ASSESSMENT REPORT

RFI Response July 2025

ENVIRONMENTAL CONSULTANTS

BIODIVERSITY ENHANCEMENT MANAGEMENT PLAN

Cloonanny Windfarm Development

Cloonanny, Co. Longford

September 2024

Document Details

Client:	Natural forces
Project Title:	Longford Windfarm
Project Code:	15-NF-2023
Document Title:	Longford Windfarm Bat Survey
Prepared By:	Ian Douglas and Ita Sherlock

Rev	Status	Date
01	Draft 1	02/08/2024
02	Final	15/09/2024

Table of Contents

1 Introduction

This Biodiversity Management and Enhancement Plan (BMEP) has been prepared to support the Environmental Impact Assessment Report (EIAR) for the Proposed Development in Co. Longford.

The plan has been prepared as part of the Proposed Development to enhance the ecological condition of habitats within the site boundary, which will, in turn, support a range of flora and fauna.

The footprint of the Proposed Development has been designed to avoid the most sensitive habitats within the Application Site, particularly watercourses, areas of high-quality wet grassland and hedgerows. The vast majority of the turbine hardstands, access routes, and associated infrastructure are located on existing roadways and improved grassland.

Figure A1: Figures for habitat areas permanently or temporarily lost as part of this development

Habitat types	Temporary Works Area	Permanent Works Areas	Total M^2 Lost
GA1 - Improved agricultural grassland	7353.3	2672.0	10025.3
GS4 - Wet grassland	6279.4	3239.0	9518.4
GS4/GA1 - Wet grassland/Improved agricultural grassland	3314.7	2612.0	5926.7
FW4 - Drain	248.1	39.0	287.1
WS1 - Scrub	80.3	99.0	179.3

GS2 - Grassy verges		39.0	39.0
Total Figures (M^2)	**20160.5**	**9300.0**	**29460.5**

By area, the largest habitat type lost, as a result of the Proposed Development, is improved agricultural grassland, which is approximately 1Ha. This is a habitat type of low local ecological significance. These grasslands have been subject to improvement in drainage and reseeding and are typically subject to intensive fertilisation. Of the areas of improved grassland, 73% are within temporary works areas, while 27% will be permanently converted into hard-standing grounds. Wet grassland and improved /wet grassland comprise the second largest habitat type impacted, accounting for 1.5Ha. This habitat is classified as high local ecological significance (CIEMM, 2016). 75% of wet grassland and improved /wet grassland will be permanently converted into hardstanding areas. While 27% will be available to return to wet grassland post works. Wet grasslands of varying degrees of naturalness are found within the Proposed Development area. Many of the fields of this habitat have been extensively drained, fertilised and reseeded but are still subject to occasional flooding. Thus, maintaining their semi-natural characteristics.

To allow access to the site, some hedgerow and treeline removal will be required. The total length of the hedgerow, which will be removed, is approximately 1,393m. Approximately 82%, or 1141m, are within temporary works areas and available for restoration and enhancement. Meanwhile, 17%, or 251m, will be permanently lost. A qualitative assessment of hedgerow habitat quality was carried out. This was based on the diversity of species, cultural significance (whether it is a townland boundary hedgerow) and management, and it was broadly based on the hedgerow appraisal system (Foulkes et al., 2012). The result of this hedgerow assessment can be seen in Appendix 1.

Figure 2: Hedgerow Quality Assessment Scoring methodology and figures.

Hedgerow Quality Assessment	Description	Meters of hedgerow for removal
Good Quality	Dense, continuous, species-rich, over 2m high and 2m wide.	254
Moderate Quality	Top heavy, mostly continuous, moderate species richness, mainly composed of 1 or 2 species, 2m high or 2m wide but not both.	124
Poor Quality	Low, box cut, discontinuous, low diversity or no opportunities for fruiting or flowering due to over-management.	1015

Other minor habitat types removed and lost as a result of the Proposed Development include grassy verges ($39m^2$) and drain habitat ($268m^2$). Both habitats are considered of low local ecological significance. Where grassy verge habitats are found at the base of hedgerows, they will be reinstated as part of the restoration of those hedgerows. A figure showing the location and the quality of the of the hedgerows due for removal is shown in f

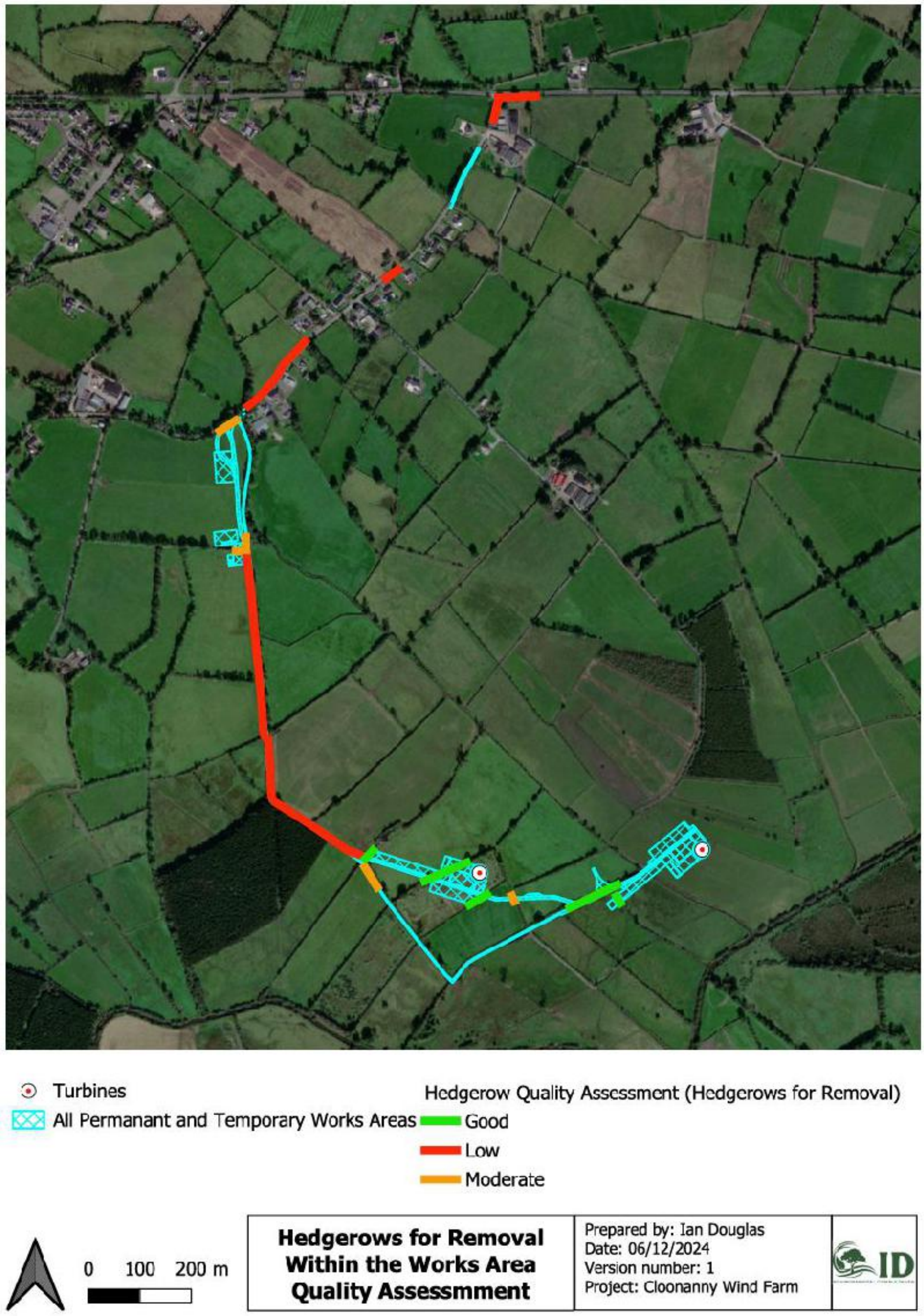


Figure 1: Hedgerows due for removal; Hedgerow Quality Map

1.1 Statement of Authority

This survey was completed by Ian Douglas (MSc, BSc, H Cert. Ag) of ID Environmental Consultants. Ian is an ecologist and environmental consultant with over ten years of experience in appropriate assessment, ecological impact assessment, habitat assessment, soil science, GIS mapping, and regenerative agriculture. Ian has worked on projects including large road developments, power infrastructure projects, planning applications, planning and designing nature trails, constructing wetland creation, and on farm habitat development. Ian previously worked in Ecology and Agriculture in England and Australia before taking a position with Flynn, Furney Environmental Consultants in 2018. With whom he retains a position as Associate Director. Ian formed ID Environmental Consultants in 2022.

2 Habitat Restoration and Enhancement Measures

2.1 Habitats – Grasslands

All areas of improved grassland within the temporary works area will be returned to improved grassland after the completion of the works to restore them for agricultural use and will, as such, remain of low ecological value. Approximately 1Ha of wet grassland is available for restoration and enhancement post works. The majority of this area is to the south of the Proposed Development near the Camlin River. The key to maintaining the functionality of wet grassland is to ensure that the proposed works do not impact the hydrological regimes of the site. Flooding from the direction of the Camlin will persist during this development's operational phase. Given the abundance of semi-natural wet grassland surrounding the site, which provides a subtle seed bank, natural regeneration of this area of grassland will be allowed to occur.

2.2 Habitats – Hedgerows

Works will lead to the temporary and permanent removal of hedgerow habitat to facilitate widening the access road for large machinery. The following plan is proposed for restoring and replacing hedgerows and treeline habitats in temporary works areas:

- Where banks that contain hedgerow habitat are removed, they should be replaced again with bank features such as banks and drains. Given their variability in light, aspect, and slope, these provide a larger range of habitat niches than a hedgerow planted on flat ground.
- 'All Ireland Pollinator Plan: Pollinator-friendly Hedgerow Establishment' should be used to establish species and as a general guide to choosing appropriate species.
- Hedgerows should be primarily planted with the following species, all of which should be sourced from native stock: hawthorn, blackthorn, holly, hazel, wild cherry, guelder rose, spindle, dog rose, elder and field maple. In addition to occasional large trees, including oak and, in wetter areas, alder and willow.
- New roadside verges created as part of the hedgerow reestablishment will be seeded with seed collected from the quality hedgerow and grassland habitat surrounding the site to ensure local provenance. Other areas will be allowed to regenerate naturally.

2.3 Pollinator Habitat Creation and Management

The Proposed Development has been designed to avoid areas of suitable marsh fritillary habitat within the Proposed Development site and broader area. The Proposed Development overlaps with areas containing devils-bit scabious; however, 3 years of surveys within this area found no evidence of marsh fritillary. The following pollinator-friendly measures will be undertaken along the route of the Proposed Development corridor to provide and enhance regions of suitable pollinator-foraging habitat within the Proposed Development site. Temporary areas created around the turbine bases will be allowed to regenerate naturally. The only exception will be planting of devils-bit scabious. Seed collection of devils-bit scabious will occur from the Molina meadow area found near the Proposed Development. Seeds will be collected late in September by a suitably qualified ecologist. Seed collection will only occur after it has been determined that no marsh fritillary webs are present within the chosen donor site. Where calcareous mixed gravels are used for hard stand creation, these will be left to regenerate naturally, as such material will facilitate the establishment of calcareous plant species. Establishing such vegetation will benefit pollinator species generally and provide a food source for adult marsh fritillary. Birds-foot trefoil naturally colonises this substrate and is a key food plant for other species, including the common blue and dingy skipper. In addition to planting devils-bit scabious, this may lead to the development of a suitable marsh fritillary breeding habitat.

2.4 Molinia Meadow Management

An area of quality Molinia meadow habitat covering approximately 2Ha is found near the Proposed Development site. Currently, the landowner manages this site through extensive horse grazing. This management strategy, while not intentionally for ecological reasons, is largely beneficial to the maintenance of this habitat and the maintenance of the large marsh fritillary population it supports. Two other small fields are found adjacent to this meadow, which do not conform to Molinia meadow. They may, under suitable management conditions, support marsh fritillary as either adults or during their larval stages. Currently, poaching is a pressure for the maintenance of these secondary fields. The following measures should be implemented to protect the quality of Molinia meadows and enhance the other fields for marsh fritillary:

- To reduce poaching during winter, a hard stand should be created at the field entrance leading down through the first two fields. This will give a dry place for horses to stand and be fed hay and will reduce compaction and poaching within the adjacent fields.
- A gate should be installed at the final field entrance to allow for more controlled grazing of the Molinia meadow.
- Devils bit scabious seed should be collected from the Molinia meadow and sown with the other two fields to enlarge the available habitat area of marsh fritillary.

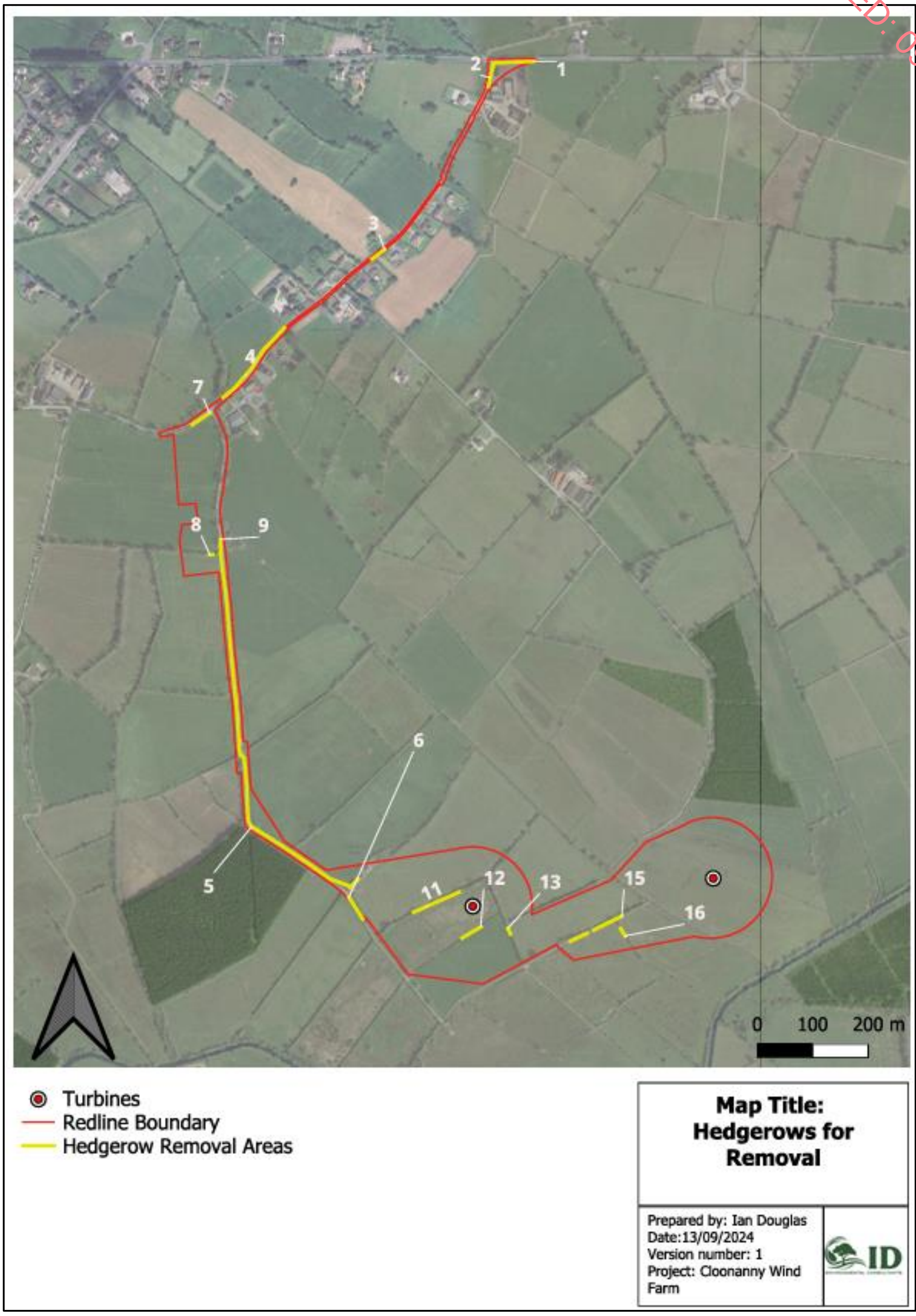
3 Monitoring of Enhancement Plan

To confirm that habitat enhancement has been successful, all areas of restoration will be monitored post-enhancement. Monitoring results will be reported by a suitably experienced ecologist (person with relevant academic qualifications) and within an Annual Environmental Report for the first 5 years post-construction and every 5 years thereafter for the operational life of the Proposed Development, with any criteria failures identified, and adaptive mitigation actions implemented if required. Prior to the commencement of all habitat enhancement measures described in this Plan, permanent vegetation monitoring plots will be established within the management areas. The monitoring plot locations will be selected using stratified random sampling. Monitoring plots will be surveyed and classified using the relevé method, with 2m x 2m plot sizes. As part of the monitoring plan, all species records for the site will be shared with the National Biodiversity Data Centre (NBDC).

4 Conclusion

As described in this report and in Biodiversity of the EIAR, the majority of the Proposed Development is located within improved grassland and wet grassland habitats. The overall area of habitats which will be permanently lost as a result of this development is negligible. Other areas within temporary works sections or those improved for access will be subject to the enhancements outlined in this plan. The success of these measures will be evaluated through a detailed monitoring and reporting programme, as described in section 3.

Appendix A1: Hedgerow Removal Maps and Figures



1
2
3
4
5
6
7
8
9
11
12
13
15
16
0
100
200 m
Turbines
Redline Boundary
Hedgerow Removal Areas
Map Title:
Hedgerows for Removal
Prepared by: Ian Douglas
Date:13/09/2024
Version number: 1
Project: Cloonanny Wind Farm

Hedgerow removal figures and areas

Name	Townland B	Sp Diversity	Quality	Management	Length (M)
1	No	Low	Low	Box Cut	73
2	No	Low	Low	Box Cut	40
3	No	Low	Low	Box Cut	28
4	No	Low	Low	Box Cut	168
5	No	Low	Low	Box Cut	706
6	No	Moderate	Moderate	Overgrown	46
7	No	Moderate	Moderate	Overgrown	37
8	Yes	Moderate	Moderate	Overgrown	5
9	No	Moderate	Moderate	Overgrown	25
10	No	High	Good	Overgrown	21
11	No	High	Good	Overgrown	90
12	No	High	Good	Box Cut	39
13	No	Low	Moderate	Box Cut	11
14	No	Moderate	Good	Overgrown	33
15	No	Moderate	Good	Overgrown	56
16	No	Moderate	Good	Overgrown	15

APPENDIX 10.2

BAT REPORT AND BMMP

VOLUME III

APPENDICES TO ENVIRONMENTAL IMPACT ASSESSMENT REPORT

RFI Response July 2025

20241010/540/D

Bat Survey Report and BMMP for Cloonanny Windfarm

For: Natural Forces

March 2024

Ecological Assessment | Ecological Clerk of Works | Bat Surveys | Badger Surveys
Biodiversity Checklists | Ornithological Assessment | Preliminary Ecological Appraisal

Blackstaff Ecology

Document history

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Checked	Cormac Loughran	14/03/2024
Approved	Cormac Loughran	14/03/2024

Client Details		
Contact	Jonathan Coffey	
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Contents

Executive Summary

This is a brief summary of survey results. For full details please read the report in its entirety.

- The development seeks to install a new windfarm consisting of two turbines. The turbines will be located in neighbouring agricultural fields. Surrounding habitat contains field hedgerows, Camlin River and pockets of woodland.

- The development originally sought to install five turbines therefore the 2023 pre-construction static detector survey collected bat activity data at five locations around the site. The two revised turbine locations present a rotor swept area outside the recording range of deployed detectors: however, a significant quantity of data has been collected for the immediate surrounding landscape and results will be used to inform mitigation. As such, the data collected is considered sufficient to allow assessment for any potential impacts this development could have upon local bat populations.

- The static detector survey recorded significant levels of bat activity (a BAI of >5) at each of the five deployment locations. The species assemblage present on site is varied (seven species) and includes those species which are considered most at risk from turbine associated mortality. This data indicates the proposed turbines could present a risk to foraging / commuting bats: <u>mitigation is required</u>. Furthermore, temporary and permanent loss of potential foraging and commuting habitat i.e. field hedgerows will occur in order to facilitate the site infrastructure: compensation is recommended.

- **A Bat Monitoring and Mitigation Plan (BMMP)** is recommended – the BMMP is appended to this report in Appendix 4. With this mitigation, any potential impacts upon the local bat population will be reduced significantly.

Introduction

1. Blackstaff Ecology Ltd. was commissioned by Natural Forces to assess bat activity at a proposed windfarm (to consist of 5 turbines) situated north-east of Longford town. Bat surveys were required to collect a robust dataset on the level and distribution of bat activity at the site; a suite of bat surveys were undertaken in 2023. This data will allow assessment of the development's potential impacts on the local bat population.

2. Proposed turbine locations are (ITM):

   T1 – E615036 N777906
   T2 – E615470 N777952

3. Turbine specifications are proposed to be a hub height of 112m, rotor diameter of 175m and turbine tip heights of 200m.

4. The turbine locations are within neighbouring agricultural fields. Several patches of woodland are present in the surrounding landscape. The river Camlin runs along the south of the site. It is anticipated that approximately 1,393m of hedgerow will be removed. Approximately 1,1052m is available and recommended for reinstation in the original location following construction. The remaining ~341m is recommended for reinstation in alternative locations to help direct bats farther from the rotor swept areas without compromising connectivity across the. An additional 500m of new planting is recommended to occur – see the appended BMMP for further detail on hedgerow compensation.

5. The development's risk level to bats was determined based upon Table 10.1 (Chapter 10) of the Bat Conservation Trust (BCT)'s 2012 Good Practice Guidelines (Hundt, 2012). The project was initially identified as <u>Moderate risk</u> to the local bat population. This assessment was based on the foraging and commuting habitat within a 100m plus rotor radius of the initial proposed turbine locations i.e. Camlin River proximate to the south, a mosaic of field hedgerows and patches of woodland in the surrounding landscape.

6. In accordance with SNH (2021) guidance static detector monitoring occurred for each of the initial proposed turbine locations across spring, summer and autumn with each season receiving ten consecutive nights of monitoring during the deployment period. This equates to thirty nights of static monitoring for five locations across the site. At the time of survey each proposed turbine location was either directly proximate to or within a 30m buffer zone of nearby habitat features: therefore a paired static survey was not conducted because static detectors were placed at the habitat feature and data collected applicable to both the habitat feature and proposed turbine location.

7. The development has since reduced the number of proposed turbines from five to two. Updated turbine locations here (T1, T2) present a rotor swept area outside the recording range of the five deployed static detectors. Five static detectors have recorded a significant amount of bat data in the immediate and wider surrounding landscape: a robust dataset has nonetheless been accumulated which should allow adequate assessment of any potential the project may hold to impact upon on the local bat population.

Statement of Authority

8. The static detector survey was co-ordinated by Philip Leathem and collected data subsequently analysed and manually verified with use of Kaleidoscope Pro by Philip. Results were then interpreted in this report

by Catriona Porter MSc, reviewed and approved by Cormac Loughran CEnv MCIEEM MSc.

9. Catriona has an MSc in Animal Behaviour and Welfare (Distinction) from Queen's University, Belfast. She has several years of experience within the nature conservation sector through extensive volunteering including organisations such as UK Overseas Territories Conservation Forum, Ulster Wildlife and the RSPB. Catriona has over 3 yrs of experience within the ecological consultancy sector, beginning in April 2021 with Allen & Mellon Environmental. She has been involved in projects in the north and south of Ireland and has gained varied experience in survey techniques and the associated ecological reports. Catriona has conducted approximately thirty-five emergence/re-entry bat surveys, twenty bat roost potential assessments on buildings and trees, two Ecological Clerk of Works (ECoW) supervised demolitions and over one hundred bat carcass searches for single wind turbines. She is a Qualifying CIEEM member.

10. Cormac is a Chartered Environmentalist (CEnv), and a full member of the Chartered Institute of Ecology and Environmental Management (MCIEEM). He holds an MSc (Distinction) in Environmental Management from the University of Ulster, and has extensive experience in bat surveys; having undertaken and coordinated full bat surveys and associated impact assessments for numerous major infrastructure developments, and small-scale projects. Cormac has also previously held a Natural England Disturbance Licence (20121610) for Bats (all species, (all counties of England)). He has attended numerous courses and conferences, specifically relating to bats, for the purposes of CPD (Continuing Professional Development). These have included the Natural England approved 'Bat Licence Training Course' run by Wildwood Ecology (Cardiff). Cormac has also attended the BCT (Bat Conservation Trust) approved course 'Bats and Trees', and has attended three BCI (Bat Conservation Ireland) biannual conferences (2010 Kilkenny, 2012 Sligo & Cork 2014). He also attended the Nathusius' Pipistrelle Workshop in Enniskillen (2009).

11. Philip has worked as an Environmental Technician with Blackstaff Ecology Ltd for over six years. In this role he is responsible (among other things) for the upkeep and deployment of a suite of 30 static detectors (used on a wide variety of sites in any given year). To date he has deployed and gathered data on over 20 windfarms as well as 200 individual turbine installations. In addition, he has completed 5 years of carcass searches at two major windfarms. He is also currently working towards a degree in Environmental Science.

Legislation

12. There are eleven recorded bat species in Ireland and nine are considered resident. All bat species found in Ireland are listed under Annex IV of the EC Habitats Directive which requires protection for bats and their habitats. The lesser horseshoe bat *Rhinolophus hipposideros* is further listed under Annex II of the Directive, requiring designation of conservation areas for this species. Irish bat species are also protected by national legislation (Wildlife Acts 1976 – 2012).

13. Bats are protected across Europe by the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention 1982). Migrant bat species are further protected across all European boundaries by the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention 1979, enacted 1983). There is therefore an obligation to protect the habitat of bats, including links to important feeding areas.

14. In relation to the above legislation, it is an offence if:

- *They are deliberately captured, injured or killed*
- *These animals are disturbed in such a way as to significantly affect their ability to survive, breed, or rear / nurture their young, or in a way that affects the local distribution or abundance of that species*
- *A breeding site or resting place of these species is damaged or destroyed, even if this is unintentional and / or when the animal is not present*
- *Access to a structure or place used by these species for protection or shelter is intentionally or recklessly obstructed*
- *This legislation applies to all life stages of these species*

15. The protected species legislation applies independently of planning permission, so licences are likely to be necessary for operations that affect bats but do not require planning permission. A grant of planning permission does not constitute a licence or permit to disturb bats or interfere with their breeding or resting places. The destruction, alteration or evacuation of a roost site must be carries out under licence obtained from the National Parks and Wildlife Service (NWPS) – however, NWPS advise that if the proposed activity can be timed, organised and carried out so as to avoid committing offences then a licence may not be required.

Bats & Wind Turbines

16. There is evidence from the USA and mainland Europe to suggest that single wind turbines can impact upon bats as dead bats have been found beneath some turbines. Such deaths may have been caused by direct collision with the turbine blades or by damage to the bat's lungs as they pass close to the rotating turbine blades.

17. Such damage is called 'pulmonary barotrauma' and is thought to occur as bats fly into areas of low air pressure, which are created as the turbine blades are rotating; the resulting sudden change in air pressure is thought to cause the bat's lungs to expand at a rate which causes soft tissues within the lungs to rupture.

18. A European Union Advisory Committee called EUROBATs (which was initiated in 1994 and is concerned with the conservation of European bat populations) has produced guidance on how any potential impacts of wind turbines on bats can be assessed.

19. The guidance, 'EUROBATS Publication Series No. 3: Guidelines for consideration of bats in windfarm projects (Rodrigues *et al.* 2008)' identifies a need to conduct pre-construction bat activity surveys as well as assessing any habitat feature(s) which may be used by bats within the local landscape. Such a survey should particularly aim to identify situations which would pose a high level of risk to bats e.g. active bat roost, commuting corridor or foraging habitat in close proximity to a proposed turbine location.

20. Various bat species are at varying degrees of risk from wind turbines as each species has a different flight style, foraging method and echolocation call. Using these parameters, it has been determined that <u>four Irish bat species - common, soprano and Nathusius' pipistrelles, and Leisler's bat</u> - are at a high level of risk from turbines with the latter two species also having a high population vulnerability. The remaining Irish bat species (*Myotis* spp., long-eared bats and horseshoe bats) were regarded as being at a low level of risk collision with turbines, and having low population vulnerability. The SNH 2021 guidelines summarise the risk of impact and factors involved, shown in Table 1.

Table 1: Factors that influence risk of turbine impact in Irish bats[1]

	Risk of turbine impact	
Factor	**Low Risk**	**High Risk**
Habitat preference	Bats preferring cluttered habitat	Bats preferring to use open habitat
Echolocation characteristics	Short range High frequency Low intensity Detection distance ~15m	Long range Low frequency High intensity Detection distance ~80m (except *Pipistrellus* spp.)
Wing shape	Low wing loading Low aspect ratio Broadest wings	High wing loading High aspect ratio Narrow wings
Flight speed	Slow	Fast
Flight behaviour and use of landscape	Manoeuvre well Will travel in cluttered habitat Keeps close to vegetation Gaps may be avoided	Less able to manoeuvre May avoid cluttered habitat Can get away from unsuitable habitat quickly Commute across open landscape
Hunting techniques	Hunt close to vegetation Exploit richer food sources in cluttered habitat Gleaners	Less able to exploit insect abundance in cluttered habitat Aerial hawker Feed in open
Migration	Local or regional movements	Long-range migrant in some parts of range
Conclusion	*Myotis* spp. Long eared bats Horseshoe bats	Common pipistrelle Soprano pipistrelle Leisler's bat Nathusius' pipistrelle

Bat Call Analysis

21. Kaleidoscope Pro was used to undertake analysis of data collected during automated passive monitoring, although noise files were also manually checked using AnalookW in order to double check the bat classifiers were accurate. Bat activity was measured using the number of files containing a bat call or bat call sequence irrespective of length, for a complete night of recording. This method of passive monitoring enables determination of species composition, temporal activity patterns (between different times of year and different times of night) at a fixed location.

22. All detectors used during surveys are broadband detectors however, the frequencies of ultrasonic calls (from the static detectors) were divided by a factor of 8 and the data produced were then viewed as ZC (zero-crossed) files.

23. All the various software programmes used represent the recorded calls as sonograms (graphs of call frequency along the Y axis against time (duration) of the call along the X axis). All sonograms were then analysed to determine bat species. Echolocation calls are reliably distinguishable from other sounds (e.g.

[1] Information taken from Appendix 3 - Scottish Natural Heritage. (2021). Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation.

wind, mechanical sounds, birds or insects), but the ability to distinguish species of bats varies with taxon, location, type of equipment & quality of recording, and can be difficult. Some bats are relatively easy to speciate from viewing sonograms and very little additional analysis of the sonograms may be required. Some species, such as those within the genus Myotis, can be extremely difficult, if not impossible to separate into species.

24. Bat echolocation calls consist of repetitive patterns commonly referred to as pulses or calls. Here, a singularly produced sound is defined as a pulse and the consecutive repetition (sequence) of pulses is defined as a call. Calls which were difficult to identify from viewing the sonogram alone were analysed in more detail by determining the mathematical parameters of the pulses that could be defined. Any noise distorting the clear definition of a pulse was excluded from analysis. The mathematical parameters measured included:

- Time between each pulse known as Inter Pulse Interval (IPI);
- Duration of call (Dur);
- Maximum frequency of call (Fmax);
- Minimum frequency of call (Fmin); and,
- Peak frequency of the call (Fpeak).

25. There are inherent limitations when surveying bats using ultrasonic detectors. Ultrasound, unlike audible sound, is attenuated rapidly in air. Many echolocation calls are in the 40KHz to 60KHz region, where air attenuation is over 1dB per metre. Sound absorption increases exponentially with frequency and a bat echolocating at 30kHz is unlikely to have a range exceeding 30m, with the range decreasing to 10m at 100KHz. Some bats call louder than others, notably Leisler's bat, which calls at the lowest frequency of any Irish at <25KHz where excess attenuation is around 0.5 dB per metre. It is frequently audible at around 80m (Altringham, 2003).

26. In practice this means that bat detectors do not detect most bats calling from 30kHZ and upwards at distances over 30m[2]. Some species, such as brown long-eared bat, make very directional and quiet calls and can only easily be detected when the detector is facing the source of call (i.e. the bat) and at close range.

27. Therefore, there may be some bias in the recording of bat species, caused by variations in the detectability of different species.

28. Data from automated/static systems is limited because there is no observational context. Fifty bat passes could represent one bat passing 50 times (i.e. while foraging along a riparian corridor) or 50 bats each passing once (i.e. when commuting between a roost and a favoured foraging location. Reality is likely to be somewhere between these two extremes.

29. Therefore, the ability to estimate abundance of bats by carrying out detector surveys is limited as it requires differentiation between multiple passes of a single bat and multiple bats making single passes, and is not usually possible through echolocation monitoring. However, the results can be used to indicate relative activity of bats in different habitats based on number of bat passes over time.

30. There are also some limitations on identification of some bats to species level, particularly those of the genera Myotis. This is due to similarities in calls of the different species and they can be difficult to identify to species level in cases where the bat pass was; brief, distant, faint or if the bat was not seen. Due to the similarities in call parameters, species of the genera Myotis can often not be identified to species level

[2] John D. Altrincham (2003) British Bats

using analysis of recorded bat calls.

31. Static recording was undertaken for spring, summer and autumn 2023 and covered all initial five proposed turbine locations. The turbine numbers have since been reduced to two, and exact positions revised slightly. The data collected provides good insight into bat activity levels in the landscape surrounding the two turbine locations and is considered suitable for an impact assessment in relation to the proposed development.

Survey Constraints

32. Horse and cattle presence caused some minor influence to the static detector survey: for the initial spring deployment two static detector locations (S1, S5) could not be safely accessed by Blackstaff Ecology therefore equipment was secured to the pre-installed wooden posts at these locations by the relevant land owner under direction of Philip Leathem. As such, deployment photographs were not obtained for these two locations in spring. Static detectors here functioned without fault and deployment by a third party is not considered to influence obtained data – deployment photographs for other periods may be used to provide visual context of these spring deployment locations. For the summer deployment period, horses were present at one location (S5) resulting in a minor change of static detector location: as the post could not be safely accessed, the detector was secured inside the field hedgerow itself as it could be safely accessed from the neighbouring field on the other side. Deploying the detector inside the hedgerow as opposed to the post directly adjacent to it is not anticipated to significantly impact survey results.

33. Proposed turbine locations have changed slightly following completion of the static detector survey: turbine numbers were reduced from five to two, and these two locations present rotor swept areas which are outside the 30m recording range of the static detectors. A significant quantity of data has been collected for the surrounding area due to five static detectors positioned across the wider site. The two turbine locations are surrounded by static detectors: T1 on three sides by S2 (NW), S3 (SE), S5 (SW) and T2 on two sides by S3 (SW) and S4 (NE). The bat data collected presented elevated levels of bat activity which is being used to inform mitigation: the survey findings are considered sufficient to enable a robust assessment of potential impacts upon local bat populations which may be caused by the development.

Methodology

34. Survey methodology was informed by the BCT's 2012 and 2023 Good Practice Guidelines, 2021 SNH guidance, NWPS 2022 guidance and BCI 2012 guidance.

35. Automated passive monitoring was undertaken between May – September 2023 for ten consecutive nights during spring, summer and autumn each. As aforementioned, the development initially intended to install five turbines therefore monitoring was undertaken for five total locations. The data from these detectors is considered relevant to the finalised turbine layout (two turbines) because it provides a significant amount of data concerning bat activity in the immediate surrounding landscape. This will be used to inform mitigation.

36. Anabat Chorus and Song Metre Mini detectors were used during each deployment period. Detectors were programmed to record 30 minutes prior to sunset until 30 minutes after sunrise, equating to one extra hour of monitoring per night. This results in ten extra hours of recording per location in each

deployment period.

37. Static detector deployment locations are (ITM):

S1 - E614477.44, N777949.58
S2 - E614860.13, N777963.13
S3 - E615233.70, N777800.85
S4 - E615579.50, N778003.85
S5 - E614855.63, N777698.04

38. The spring period is considered from mid-April – mid-June; summer from mid-June – mid-August; autumn from mid-August – mid-October.

39. These surveys have provided a significant volume of data on the site under investigation. The results of these surveys are considered sufficient for assessment of any potential impacts a lifetime extension could have on the local bat population.

Results

40. There was significant variation in night length throughout the survey period, so the number of bat passes recorded during different months of the year are not directly comparable. In order to standardise bat activity between survey periods, results are displayed as a 'Bat Activity Index' (BAI), which is the total number of bat passes divided by the number of hours per night (Hundt, 2012). This was calculated from 30 minutes prior to sunset until 30 minutes after sunrise, using publicly available data from www.timeanddate.com.

41. At present there is not a standard system in Ireland to categorise bat activity as low, moderate or high, because activity levels vary depending on the species involved and the location of the site. For the purposes of this report, we use a bespoke system to discuss and compare levels of bat activity as outlined in the table below. This approach uses standardised terms (e.g., occasional, frequent) to categorise bat activity indices within certain ranges; the average time interval between passes is also provided to give a more- intuitive interpretation of the terms. For the purposes of this assessment, we consider activity levels of occasional or higher (i.e., a BAI of >5) to be significant. This is similar to the threshold of 50 bat passes used in Mathews et al (2016) to define 'high bat activity', because 50 bat passes in a 10-hour night gives a BAI of 5.

42. It should be noted that activity levels should only be compared within a species and not between species, due to differences in the detection distances for each species and their flight characteristics. For example, if there are infrequent passes by brown long-eared bats (a species with short-range echolocation pulses) and occasional passes by Leisler's bats (which has longer-range echolocation pulses), it does not necessarily mean that Leisler's bats are more abundant than brown long-eared bats at that location.

Table 2 – Description of levels of bat activity (adopted from Matthews et al. 2016)

Description	Bat Activity Index	Interval between passes
Negligible	<1	>60 minutes
Low	1 – 5	12 – 60 minutes

Moderate	5 – 12	5 – 12 minutes
High	12 – 60	1 – 5 minutes
Near-constant	>60	<1 minute

43. Levels of bat activity recorded at the turbines varied from negligible – near constant. On occasion no bat passes were recorded. Elevated levels of bat activity were recorded for Leisler's bat, Common pipistrelle and Soprano pipistrelle: species considered most at-risk from turbine associated mortality. The following section is a summary of results per turbine, per season.

Spring

44. Bat activity reached and / or surpassed moderate levels at every location in this season. Four locations featured high levels of activity and one location reached near constant levels. Appendix 1 presents results broken down on a per night basis. Below is a summary of results per location in the spring monitoring period. Locations S2, S3, S4, S5 are most proximate to the proposed turbine locations.

<u>S1</u>
10 nights had high activity

<u>S2</u>
1 night had moderate activity
8 nights had high activity
1 night had near constant activity

<u>S3</u>
1 night had negligible activity
6 nights had moderate activity
3 nights had high activity

<u>S4</u>
3 nights had negligible activity
4 nights had low activity
3 nights had moderate activity

<u>S5</u>
3 nights had moderate activity
7 nights had high activity

Summer

45. Bat activity reached and / or surpassed moderate levels at every location in this season. Four locations featured high levels of activity and two locations reached near constant levels.

46. One night (07.08.23) at S3 had a BAI exactly on the threshold between moderate and high activity: under the precautionary principle this night has been categorised as high.

47. Appendix 1 presents results broken down on a per night basis. Below is a summary of results per location

in the summer monitoring period.

S1
1 night had low activity
1 night had moderate activity
7 nights had high activity
1 night had near constant activity

S2
1 night had negligible activity
3 nights had low activity
5 nights had moderate activity
1 night had high activity

S3
1 night had negligible activity
1 night had low activity
3 nights had moderate activity
4 nights had high activity
1 night had near constant activity

S4
3 nights had negligible activity
3 nights had low activity
4 nights had moderate activity

S5
1 night had negligible activity
3 nights had low activity
4 nights had moderate activity
2 nights had high activity

Autumn

48. Bat activity reached and / or surpassed moderate levels at four out of five locations in this season. Three locations featured high levels of activity. S4 did not surpass low levels of bat activity in this season.

49. Appendix 1 presents results broken down on a per night basis. Below is a summary of results per location in the autumn monitoring period.

S1
2 nights had negligible activity
3 nights had low activity
3 nights had moderate activity
2 nights had high activity

S2
1 night had negligible activity
2 nights had low activity
4 nights had moderate activity

3 nights had high activity

<u>S3</u>
2 nights had negligible activity
5 nights had low activity
3 nights had moderate activity

<u>S4</u>
5 nights had negligible activity
5 nights had low activity

<u>S5</u>
4 nights had negligible activity
2 nights had low activity
2 nights had moderate activity
2 nights had high activity

Discussion

Potential Impacts

Construction phase

50. To facilitate turbine installation vegetation clearance will take place. Approximately 1,393m of existing hedgerow will be removed.

51. The construction phase will therefore result in removal of potential foraging and commuting habitat for bats. Mitigation and / or compensation is required. <u>Further detail is provided in the appended BMMP.</u>

52. Any vegetation clearance should occur outside of the breeding bird season (March – August inclusive) unless a nest survey can first be completed by a suitably qualified ecologist. Further protected species surveys may be necessary before any alteration to hedgerows or scrub. Regarding bats any alteration to trees should only be done after a bat roost potential survey has been completed and roost absence confirmed.

Operation phase

53. Although bat fatalities have been reported from operational windfarms in North America and parts of Europe for decades, evidence from Britain and Ireland has emerged in later years. The publication in 2016 of a large-scale study by researchers at Exeter University (Mathews et al.), which was based on observations of bat activity and carcass searches at 46 operational wind farms throughout Britain (but excluding Ireland) provides useful data concerning bat fatalities and windfarms which may still be applicable to an Irish windfarm context.

54. Bat carcasses were found at two-thirds of these sites, of which 48% of fatalities were common pipistrelles, 40% were soprano pipistrelles and 10% were noctule bats (which are closely related to Leisler's bats, and in fact this species is commonly referred to as the lesser noctule across much of the rest of Europe).

55. The estimated casualty rates, which were corrected for predator removals and the efficiency of the

searchers, ranged from 0 - 5.25 bats per turbine per month, and from 0 - 77 bats per site per month, during the period of the study. As with previous studies on bats & windfarms, there was a relationship between weather conditions and recorded bat fatalities: most nights where casualties occurred (81.5%) had low mean wind speeds (less than or equal to 5m/s measured at the ground} and maximum night-time temperatures of >10ºC. It was also estimated that 95.3% of nights with mean wind speeds >5m/s would have no casualties.

56. The study revealed no clear relationship between recorded bat activity levels and the number of fatalities recorded at a site, as follows: "*Activity at the control locations (a proxy for pre-construction surveys) was not a useful predictor of the number of bat casualties, although it was a predictor of whether or not any casualties occurred (i.e., a binary yes/no categorisation*)".

57. The nights of highest pipistrelle activity were considered to have the highest likelihood of casualties, although bat fatalities were only recorded in one third of locations. In the Mathews et al. (2016) study, 'high activity' was defined as a night with more than 50 bat passes, which is similar to the BAI of 5 used in this assessment (i.e., 50 bat passes over a 10-hour night gives a BAI of 5).

58. Fatality research studies elsewhere in Europe have shown that, due to their different behaviour and flight style, bat species are affected differently by wind turbines (Rodrigues et al., 2008; Natural England, 2014). On this basis, the risk of impacts for this species are assessed below.

59. There were significant levels of bat activity (i.e., a BAI of >5) recorded at all turbines (1, 2, 3, 4, 5, 6, 7, 8, 9, 10 and 12), on 60 of the 308 survey nights (by individual species) with negligible or low activity on all other nights.

60. Therefore, all turbines may present a risk to foraging/commuting bats, particularly Pipistrelles and Leisler's bats. It is not possible to make a prediction about the number of bats that may be affected, but in a worst-case scenario it is possible that there could be a significant impact on local populations of this species.

Decommissioning phase

61. All decommissioning work will be carried out from access tracks and hardstanding areas to be constructed: decommissioning is therefore not anticipated to require significant additional vegetation clearance and is not anticipated to impact on feeding areas or commuting routes.

Mitigation

62. The bat species assemblage present on site is varied and includes species which are considered most at risk from turbine associated mortality. The results from the 2023 pre-construction survey have indicated significant levels of bat activity occur across the wider site including landscape surrounding the proposed two turbine locations. The only exception being S4 in autumn, where activity levels did not surpass low – however this recording location presented elevated levels in the other two monitoring seasons. S4 is proximate to T2, to the NE, outside the rotor swept area. These results suggest that the proposed windfarm could impact the local bat population and mitigation is considered necessary for this development.

63. <u>A Bat Monitoring and Mitigation Plan (BMMP) is recommended.</u> The information collected during this pre-construction survey should be used to inform the mitigation strategy presented in the BMMP. The

BMMP is recommended to include post-construction monitoring in the form of casualty search efforts combined with static detector monitoring, in addition to mitigation efforts in the form of precautionary curtailment and feathering. Mitigation or compensation for hedgerow removal is also required. Results from the ongoing monitoring should be presented annually and such results will be reviewed to determine whether the enacted mitigation is sufficiently negating potential impacts upon bats. The data collected will be used to inform any necessary changes to the BMMP for example expanding / enhancing mitigation efforts. The BMMP is recommended to occur for three years post-construction: at the end of year three, the dataset collected will be reviewed to determine whether monitoring should continue.

Conclusion

64. Static detector monitoring revealed a varied species assemblage across the site including presence of those species considered high risk from turbine associated mortality: bat activity surpassed non-significant levels at all five static detector locations including those most proximate to the two proposed turbine locations. Therefore under the precautionary principle a Bat Monitoring and Mitigation Plan (BMMP) is recommended to support the development. This BMMP will be informed by the bat survey data collected in 2023 presented in the above report. Details of the recommended monitoring and mitigation efforts as well as further detail on hedgerow loss are provided in Appendix 4.

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Figure 1 – Turbine Locations

Cloonanny Windfarm

FIGURE 1

Turbine Locations

KEY

Turbine

Rotor Swept Area

LAYOUT DWG

T-LAYOUT NO.

DRAWING NUMBER

Bat Survey Report

Figure 2 - Static Detector Locations

Cloonanny Windfarm

FIGURE 2

Static Detector Locations

KEY

- Turbine
- Rotor Swept Area
- Static Detector
- 30m Recording Buffer

LAYOUT DWG | T-LAYOUT NO.

DRAWING NUMBER

Bat Survey Report

Figure 3 – Bat Activity Levels Across the Windfarm

Cloonanny Windfarm

FIGURE 3

Bat Activity Levels Across the Windfarm

KEY

Near Constant BAI
High BAI
Moderate BAI
Low BAI
Negligible BAI
Detector Location

YOUT DWG | T-LAYOUT NO.

AWING NUMBER

Bat Survey Report

Appendix 1 – Static Detector Results Tables

The abbreviations for each species are as follows:

NYLE – *Nyctalus leisleri* (Leisler's bat)
PIPPIP – *Pipistrellus pipistrellus* (common pipistrelle)
PIPPYG – *Pipistrellus pygmaeus* (soprano pipistrelle)
PIPNAT – *Pipistrellus nathusii* (Nathusius' pipistrelle)
MYODAU - *Myotis daubentonii* (Daubenton's bat)
MYONAT - *Myotis nattereri* (Natterer's bat)
PLEAUR – *Plecotus auritus* (Brown long-eared)

Spring

S1

DATE	MYODAU	MYONAT	NYCLEI	PIPPIP	PIPPYG	PLEAUR	TOTALS	BAI
20230529	0	1	12	97	7	0	**117**	**14.18**
20230530	0	2	33	66	4	0	**105**	**12.73**
20230531	1	5	106	72	0	1	**185**	**22.42**
20230601	1	3	151	75	8	0	**238**	**28.85**
20230602	1	0	18	191	8	0	**218**	**26.42**
20230603	0	0	80	128	3	0	**211**	**25.58**
20230604	0	0	99	164	2	0	**265**	**32.12**
20230605	1	1	79	173	5	0	**259**	**31.39**
20230606	0	0	98	90	1	0	**189**	**22.91**
20230607	0	1	61	160	2	0	**224**	**27.15**
Species Total	**4**	**13**	**737**	**1216**	**40**	**1**	**2011**	
Passes per hour	**0.05**	**0.16**	**8.93**	**14.74**	**0.48**	**0.01**	**24.38**	

S2

DATE	MYODAU	MYONAT	NYCLEI	PIPNAT	PIPPIP	PIPPYG	PLEAUR	TOTALS	BAI
20230523	2	0	49	0	344	15	1	**411**	**48.35**
20230524	0	0	80	0	282	27	4	**393**	**46.24**
20230525	1	2	91	0	148	13	5	**260**	**30.59**
20230526	0	0	67	0	73	4	1	**145**	**17.06**
20230527	0	0	111	3	364	48	0	**526**	**61.88**
20230528	0	0	57	0	37	2	0	**96**	**11.29**
20230529	1	0	44	0	70	13	0	**128**	**15.06**
20230530	0	0	73	0	35	8	0	**116**	**13.65**
20230531	0	0	79	0	48	8	0	**135**	**15.88**
20230601	0	0	67	1	48	6	2	**124**	**14.59**
Species Total	**4**	**2**	**718**	**4**	**1449**	**144**	**13**	**2334**	
Passes per hour	**0.05**	**0.02**	**8.45**	**0.05**	**17.05**	**1.69**	**0.15**	**27.46**	

S3

DATE	MYODAU	MYONAT	NYCLEI	PIPNAT	PIPPIP	PIPPYG	PLEAUR	TOTALS	BAI
20230523	10	0	20	1	78	4	2	**115**	**13.53**
20230524	9	0	24	3	47	17	0	**100**	**11.76**
20230525	7	1	33	3	50	10	1	**105**	**12.35**
20230526	3	0	24	2	54	16	0	**99**	**11.65**
20230527	2	1	45	2	260	23	0	**333**	**39.18**
20230528	6	0	20	0	25	3	1	**55**	**6.47**
20230529	3	0	15	2	56	18	2	**96**	**11.29**
20230530	3	3	19	1	18	15	2	**61**	**7.18**
20230531	0	1	10	1	34	17	0	**63**	**7.41**
20230601	0	0	0	0	0	0	0	**0**	**0.00**
Species Total	**43**	**6**	**210**	**15**	**622**	**123**	**8**	**1027**	
Passes per hour	**0.51**	**0.07**	**2.47**	**0.18**	**7.32**	**1.45**	**0.09**	**12.08**	

S4

DATE	MYODAU	MYONAT	NYCLEI	PIPPIP	PIPPYG	PLEAUR	TOTALS	BAI
20230523	1	0	2	37	3	0	**43**	**5.06**
20230524	0	0	5	30	9	0	**44**	**5.18**
20230525	1	0	5	22	3	1	**32**	**3.76**
20230526	0	1	2	8	5	0	**16**	**1.88**
20230527	0	0	5	47	9	0	**61**	**7.18**
20230528	1	0	1	4	1	0	**7**	**0.82**
20230529	0	0	3	2	3	0	**8**	**0.94**
20230530	0	0	1	4	3	0	**8**	**0.94**
20230531	0	0	12	4	3	1	**20**	**2.35**
20230601	0	0	9	15	4	0	**28**	**3.29**
Species Total	**3**	**1**	**45**	**173**	**43**	**2**	**267**	
Passes per hour	**0.04**	**0.01**	**0.53**	**2.04**	**0.51**	**0.02**	**3.14**	

S5

DATE	MYODAU	MYONAT	NYCLEI	PIPPIP	PIPPYG	PLEAUR	TOTALS	BAI
20230529	1	2	24	62	34	0	**123**	**14.91**
20230530	0	1	19	42	3	2	**67**	**8.12**
20230531	1	0	19	36	20	0	**76**	**9.21**
20230601	4	0	69	110	38	0	**221**	**26.79**
20230602	1	1	27	53	6	0	**88**	**10.67**
20230603	0	0	37	74	4	0	**115**	**13.94**
20230604	0	0	24	92	9	0	**125**	**15.15**
20230605	0	0	23	88	6	0	**117**	**14.18**
20230606	1	0	44	66	7	0	**118**	**14.30**
20230607	0	0	21	105	5	0	**131**	**15.88**
Species Total	**8**	**4**	**307**	**728**	**132**	**2**	**1181**	
Passes per hour	**0.10**	**0.05**	**3.72**	**8.82**	**1.60**	**0.02**	**14.32**	

Summer

S1

DATE	MYODAU	MYONAT	NYCLEI	PIPNAT	PIPPIP	PIPPYG	PLEAUR	TOTALS	BAI
20230803	0	1	14	0	252	44	3	**314**	**32.21**
20230804	1	0	58	0	2	0	0	**61**	**6.26**
20230805	4	0	31	1	256	24	0	**316**	**32.41**
20230806	3	1	36	2	668	134	2	**846**	**86.77**
20230807	2	2	85	3	237	72	6	**407**	**41.74**
20230808	2	2	55	2	219	162	16	**458**	**46.97**
20230809	0	3	50	0	221	150	8	**432**	**44.31**
20230810	0	0	16	0	1	2	0	**19**	**1.95**
20230811	0	1	13	0	188	46	5	**253**	**25.95**
20230812	1	0	21	0	53	97	16	**188**	**19.28**
Species Total	**13**	**10**	**379**	**8**	**2097**	**731**	**56**	**3294**	
Passes per hour	**0.13**	**0.10**	**3.89**	**0.08**	**21.51**	**7.50**	**0.57**	**33.78**	

S2

DATE	MYODAU	MYONAT	NYCLEI	PIPNAT	PIPPIP	PIPPYG	TOTALS	BAI
20230803	0	1	20	0	19	11	**51**	**5.23**
20230804	0	1	21	0	1	0	**23**	**2.36**
20230805	1	0	16	0	31	9	**57**	**5.85**
20230806	0	1	27	0	28	11	**67**	**6.87**
20230807	1	0	42	3	68	24	**138**	**14.15**
20230808	2	1	40	1	41	23	**108**	**11.08**
20230809	0	0	50	0	22	26	**98**	**10.05**
20230810	0	0	11	0	1	0	**12**	**1.23**
20230811	0	0	6	0	8	2	**16**	**1.64**
20230812	0	0	3	0	1	0	**4**	**0.41**
Species Total	**4**	**4**	**236**	**4**	**220**	**106**	**574**	
Passes per hour	**0.04**	**0.04**	**2.42**	**0.04**	**2.26**	**1.09**	**5.89**	

S3

DATE	MYODAU	MYONAT	NYCLEI	PIPNAT	PIPPIP	PIPPYG	PLEAUR	TOTALS	BAI
20230803	0	1	2	0	21	6	0	**30**	**3.08**
20230804	0	0	6	0	1	0	0	**7**	**0.72**
20230805	0	0	10	0	33	9	0	**52**	**5.33**
20230806	2	4	9	0	43	23	0	**81**	**8.31**
20230807	1	1	11	3	54	47	0	**117**	**12.00**
20230808	0	2	19	0	62	60	0	**143**	**14.67**
20230809	0	1	19	2	32	43	2	**99**	**10.15**
20230810	0	2	14	0	254	110	0	**380**	**38.97**
20230811	1	3	19	0	23	99	1	**146**	**14.97**
20230812	2	1	25	1	812	50	0	**891**	**91.38**
Species Total	**6**	**15**	**134**	**6**	**1335**	**447**	**3**	**1946**	
Passes per hour	**0.06**	**0.15**	**1.37**	**0.06**	**13.69**	**4.58**	**0.03**	**19.96**	

S4

DATE	MYODAU	MYONAT	NYCLEI	PIPNAT	PIPPIP	PIPPYG	PLEAUR	TOTALS	BAI
20230803	0	0	11	0	9	3	0	**23**	**2.36**
20230804	0	0	4	0	0	0	0	**4**	**0.41**
20230805	1	2	9	1	9	10	2	**34**	**3.49**
20230806	4	2	21	1	8	17	0	**53**	**5.44**
20230807	3	4	25	0	14	39	1	**86**	**8.82**
20230808	1	1	18	2	27	43	2	**94**	**9.64**
20230809	0	0	20	1	36	51	0	**108**	**11.08**
20230810	0	0	1	0	0	0	0	**1**	**0.10**
20230811	0	0	15	0	4	11	0	**30**	**3.08**
20230812	0	0	4	0	1	4	0	**9**	**0.92**
Species Total	**9**	**9**	**128**	**5**	**108**	**178**	**5**	**442**	
Passes per hour	**0.09**	**0.09**	**1.31**	**0.05**	**1.11**	**1.83**	**0.05**	**4.53**	

S5

DATE	MYONAT	NYCLEI	PIPPIP	PIPPYG	TOTALS	BAI
20230803	0	6	36	1	**43**	**4.41**
20230804	0	1	0	0	**1**	**0.10**
20230805	0	0	66	0	**66**	**6.77**
20230806	0	0	13	0	**13**	**1.33**
20230807	0	65	414	9	**488**	**50.05**
20230808	1	57	45	8	**111**	**11.38**
20230809	2	78	63	15	**158**	**16.21**
20230810	0	21	44	10	**75**	**7.69**
20230811	0	12	25	4	**41**	**4.21**
20230812	0	27	30	6	**63**	**6.46**
Species Total	**3**	**267**	**736**	**53**	**1059**	
Passes per hour	**0.03**	**2.74**	**7.55**	**0.54**	**10.86**	

Autumn

S1

DATE	MYODAU	MYONAT	NYCLEI	PIPNAT	PIPPIP	PIPPYG	PLEAUR	TOTALS	BAI
20230916	1	2	4	0	38	54	1	**100**	**8.00**
20230917	0	1	3	0	168	61	0	**233**	**18.64**
20230918	1	0	5	0	11	15	1	**33**	**2.64**
20230919	0	0	0	0	0	0	0	**0**	**0.00**
20230920	0	0	0	0	97	47	0	**144**	**11.52**
20230921	0	1	1	0	33	31	0	**66**	**5.28**
20230922	0	2	0	0	11	37	1	**51**	**4.08**
20230923	0	0	0	0	0	24	0	**24**	**1.92**
20230924	0	0	1	0	1	0	0	**2**	**0.16**
20230925	2	1	8	2	102	82	1	**198**	**15.84**
Species Total	**4**	**7**	**22**	**2**	**461**	**351**	**4**	**851**	
Passes per hour	**0.03**	**0.06**	**0.18**	**0.02**	**3.69**	**2.81**	**0.03**	**6.81**	

S2

DATE	MYODAU	MYONAT	NYCLEI	PIPNAT	PIPPIP	PIPPYG	PLEAUR	TOTALS	BAI
20230914	3	0	62	0	108	73	0	**246**	**19.68**
20230915	2	1	31	2	14	18	1	**69**	**5.52**
20230916	1	0	86	1	49	29	0	**166**	**13.28**
20230917	2	0	141	0	105	63	1	**312**	**24.96**
20230918	3	0	82	0	5	7	2	**99**	**7.92**
20230919	0	0	0	0	0	0	0	**0**	**0.00**
20230920	1	0	63	0	10	4	0	**78**	**6.24**
20230921	3	1	16	0	21	23	0	**64**	**5.12**
20230922	2	0	10	0	20	13	0	**45**	**3.60**
20230923	0	1	17	0	3	3	0	**24**	**1.92**
Species Total	**17**	**3**	**508**	**3**	**335**	**233**	**4**	**1103**	
Passes per hour	**0.14**	**0.02**	**4.06**	**0.02**	**2.68**	**1.86**	**0.03**	**8.82**	

S3

DATE	MYODAU	MYONAT	NYCLEI	PIPNAT	PIPPIP	PIPPYG	PLEAUR	TOTALS	BAI
20230914	3	0	2	1	26	20	0	**52**	**4.16**
20230915	2	1	1	0	3	2	3	**12**	**0.96**
20230916	1	1	3	0	71	10	0	**86**	**6.88**
20230917	1	0	11	0	54	28	1	**95**	**7.60**
20230918	0	2	1	0	8	5	0	**16**	**1.28**
20230919	0	0	0	0	0	0	0	**0**	**0.00**
20230920	0	2	0	1	7	11	0	**21**	**1.68**
20230921	2	3	3	0	114	11	0	**133**	**10.64**
20230922	4	2	0	0	4	8	0	**18**	**1.44**
20230923	0	0	1	0	56	1	0	**58**	**4.64**
Species Total	**13**	**11**	**22**	**2**	**343**	**96**	**4**	**491**	
Passes per hour	**0.10**	**0.09**	**0.18**	**0.02**	**2.74**	**0.77**	**0.03**	**3.93**	

S4

DATE	MYODAU	MYONAT	NYCLEI	PIPNAT	PIPPIP	PIPPYG	PLEAUR	TOTALS	BAI
20230914	0	0	4	1	16	17	0	**38**	**3.04**
20230915	0	0	0	0	0	0	0	**0**	**0.00**
20230916	0	0	8	0	7	6	1	**22**	**1.76**
20230917	0	0	12	0	7	23	1	**43**	**3.44**
20230918	1	1	5	0	1	4	0	**12**	**0.96**
20230919	0	0	6	0	0	0	0	**6**	**0.48**
20230920	0	0	0	0	0	0	0	**0**	**0.00**
20230921	5	1	14	1	6	5	0	**32**	**2.56**
20230922	1	2	0	0	0	3	0	**6**	**0.48**
20230923	1	0	6	1	14	6	0	**28**	**2.24**
Species Total	**8**	**4**	**55**	**3**	**51**	**64**	**2**	**187**	
Passes per hour	**0.06**	**0.03**	**0.44**	**0.02**	**0.41**	**0.51**	**0.02**	**1.50**	

S5

DATE	MYODAU	MYONAT	NYCLEI	PIPNAT	PIPPIP	PIPPYG	TOTALS	BAI
20230914	1	2	4	1	144	39	**191**	**15.28**
20230915	0	0	0	0	0	0	**0**	**0.00**
20230916	0	2	3	1	73	23	**102**	**8.16**
20230917	0	0	3	0	107	28	**138**	**11.04**
20230918	0	0	1	0	7	3	**11**	**0.88**
20230919	0	0	0	0	0	0	**0**	**0.00**
20230920	0	1	2	1	5	1	**10**	**0.80**
20230921	1	0	4	1	45	3	**54**	**4.32**
20230922	1	3	2	0	2	7	**15**	**1.20**
20230923	4	2	3	0	138	25	**172**	**13.76**
Species Total	**7**	**10**	**22**	**4**	**521**	**129**	**693**	
Passes per hour	**0.06**	**0.08**	**0.18**	**0.03**	**4.17**	**1.03**	**5.54**	

Appendix 2 – Photographs

Spring

S1
Detector deployed by land owner due to health and safety concerns (see Survey Constraints section): photograph not taken of deployment.

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S2
Detector attached to wooden post.

S3
Detector attached to wooden post.

S4
Detector attached to wooden post.

S5
Detector deployed by land owner due to health and safety concerns (see Survey Constraints section): photograph not taken of deployment.

-

Summer

S1
Detector attached to wooden post.

S2
Detector attached to wooden post.

S3
Detector attached to wooden post.

S4
Detector attached to wooden post.

S5
Detector deployed within hedgerow (see Survey Constraints section).

Autumn

S1
Detector attached to wooden post.

S2
Detector attached to wooden post.

S3
Detector attached to wooden post.

S4
Detector attached to wooden post.

S5
Detector attached to wooden post.

Appendix 3 – Weather Data

	Date	Weather Conditions (@21:00pm)			
		Temperature (°C)	Wind Speed (m/s)	Wind Direction	Rainfall (mm)
Spring	5/23/2023	12	2	NE	0
	5/24/2023	12	3	NE	0
	5/25/2023	13	2	E	0
	5/26/2023	15	1	SSW	0
	5/27/2023	13	3	NE	0
	5/28/2023	11	3	SE	0
	5/29/2023	13	3	S	0
	5/30/2023	16	2	SSW	0
	5/31/2023	14	2	SSE	0
	6/1/2023	16	2	SSE	0
Summer	8/3/2023	13	5	NE	0
	8/4/2023	12	4	SW	19.9
	8/5/2023	12	2	NE	0
	8/6/2023	13	2	NNE	0
	8/7/2023	14	0	NE	0
	8/8/2023	16	1	W	0
	8/9/2023	19	3	WSW	0
	8/10/2023	18	6	W	0.6
	8/11/2023	16	6	W	2.2
	8/12/2023	14	5	NW	0.2
Autumn	9/16/2023	12	3	SE	5.1
	9/17/2023	14	3	NNE	0.4
	9/18/2023	11	6	NNW	5.2
	9/19/2023	16	8	WNW	3.4
	9/20/2023	8	5	WNW	0
	9/21/2023	9	5	N	0.3
	9/22/2023	6	3	NNE	0
	9/23/2023	14	7	W	0.1
	9/24/2023	12	6	WNW	0.1
	9/25/2023	13	8	WSW	0

Appendix 4 – Bat Monitoring and Mitigation Plan (BMMP)

Mitigation for bats

1. The 2023 static detector monitoring recorded a varied species assemblage across the proposed windfarm site including those species considered high risk of turbine associated mortality. This survey revealed bat activity surpassing non-significant levels in all parts of the site: reaching moderate, high and / or near constant. A Bat Monitoring and Mitigation Plan (BMMP) is considered necessary to support the new windfarm.

2. The BMMP is recommended to operate for three years post-construction. In the third year the dataset collected will be reviewed and a decision made whether continued monitoring is necessary. The BMMP will consist jointly of post-construction monitoring and mitigation measures. Post-construction monitoring will be bat casualty searches in conjunction with static detector recording. Mitigation measures will be feathering and curtailment. The monitoring undertaken as part of the BMMP will give an opportunity to adjust these mitigation measures should any concerns arise – for example, if at any point a bat carcass is found, curtailment parameters could be expanded, survey effort enhanced e.g. through use of search dogs utilised for carcass searches.

Feathering

3. Feathering has been shown to significantly reduce bat fatalities (by up to 50%) in some studies and will reduce the spatial extent of low-pressure vortices in the wake of the blades (i.e. will substantially reduce the potential for barotrauma to occur). It can be applied to all turbines without reducing their economic output, as electricity is not generated below the cut-in speed of wind turbines. In practice this means that when wind speeds are below the cut-in speed of the proposed turbine the blades are pitched at 90 degrees or parallel to the wind to reduce their rotation speed while idling to below two revolutions per minute. Feathering will occur for both turbines at Cloonanny Windfarm.

Casualty Searches

4. This BMMP will also consist of bat casualty searches. SNH note that vulnerability to collision is likely to depend on the location of turbines in relation to bat activity. Bat activity hence risk levels are rarely uniform across a site, but good coverage of static detector recording spread across a site will help assess which turbine locations present greater risk. Initially these searches are therefore only considered necessary for those turbines which recorded elevated levels of bat activity (moderate or higher). Bat casualty searches would not be considered necessary for turbines which recorded only negligible or low levels of activity. The 2023 bat surveys recorded elevated bat activity levels at all five recording locations: casualty searches will therefore occur for both turbines. Such monitoring is recommended to occur for a period of three years post-construction, with provisions for amending and / or extending the monitoring depending on survey results. The search schedule should cover spring, summer and autumn. Searches should ideally begin no later than 1 hour post sunrise to minimise the potential for carcass removal by predators. If any bat carcasses are found they should be collected (if necessary) to enable accurate species identification, DNA analysis undertaken where necessary.

5. Currently there is no standardised methodology for monitoring wind farm collisions in Ireland: the casualty search schedule must be agreed with the planning authority. The schedule must have a sufficient break between seasons (adjusted accordingly depending on weather conditions). It is recommended that five searches occur for each turbine in spring, ten searches in summer, and five searches in autumn. Summer is typically considered a higher risk period for turbine associated bat mortality, therefore often receives greater survey effort.

6. The monitoring for carcasses will entail the systematic search for bat casualties within a 50m x 50m grid centred on the turbine. Searches will consist of an initial 'sweep' then alternate survey days adjusted accordingly depending on weather conditions. Ideally searches will begin no later than 1-hour post-sunrise to minimise the potential for carcass removal by predators. The searches will be conducted by a specialist ecologist and the exact search schedule may be adjusted at the discretion of said appointed ecologist, for example to account for weather changes, access constraints caused by livestock presence, et cetera.

7. In usual circumstances searches will only take place the morning after optimal conditions for bats have occurred. These are defined as:

    a. <5m/s ground wind speed,
    b. >10oC of temperature (1 hour after dusk),
    c. no rain, and
    d. after a warm day of similar settled conditions

8. However, as curtailment is recommended, the turbine should not be fully operational during optimal conditions for bats – initially this curtailment will be focused on wind speed. Therefore the bat carcass searches should occur after nights where the turbine has been operating, and should factor in other weather conditions such as temperature and rainfall to ascertain the nights in which bats are more likely to have been active. The development may choose to incorporate a more specialised method of curtailment, i.e. a bat detection system incorporated into the turbine operating system, which enables automatic shut-down and re-start functions when bat activity is detected. In this instance, the turbine may still be operational during suitable weather conditions for bats if no bat activity has been detected. In this circumstance, the casualty searches should occur the morning after turbine operation in suitable conditions for bats as defined in paragraph 7 above. Bat casualty searches should not take place after nights of unsuitable conditions for bat activity because they will yield false negative results. Optimal, suitable, sub-optimal and unsuitable environmental conditions for bat activity will be decided by the appointed ecologist responsible for orchestrating the bat casualty survey each year. The appointed ecologist must include details of any such searches including reasons behind searches completed after sub-optimal or unsuitable conditions for bats in the subsequent reports. A report detailing post-construction survey effort and findings must be submitted at the end of each year, and allow for sufficient time to adjust the BMMP accordingly before the next survey period.

9. This approach has been selected to maximise the likelihood of finding bat carcasses, which is essential in enabling predicted bat mortality to be accurately estimated.

10. Simultaneous daily collection of meteorological data including wind speed, temperature, and precipitation will be undertaken at windfarm site alongside the bat carcass searches to better understand the effect on levels of bat activity at the turbine.

11. In the event that a bat carcass is found during these searches, NWPS will be informed and the BMMP will be adjusted accordingly. These adjustments may include switching from using human surveyors to using dog search teams (as this has been shown to improve search efficiency).

Automated Acoustic Monitoring

12. This BMMP will also include further automated acoustic monitoring undertaken concurrently (with the casualty searches above). Static recording is recommended to occur during spring, summer and autumn.

13. The automated monitoring will follow the methodology described in the bat survey report submitted by Blackstaff Ecology, repeating 10 consecutive days of monitoring over each monitoring season. This acoustic monitoring could also be supplemented with thermal imaging cameras to provide more detailed information on bat activity in the vicinity of each turbine.

Curtailment

14. The 2023 pre-construction bat survey indicates that installation of two turbines could cause bat fatalities. It is therefore initially considered necessary to employ curtailment as mitigation.

15. Curtailment involves raising the cut-in speed with associated loss of power generation in combination with reducing the blade rotation below the cut-in speed. This is considered where feathering below normal cut-in speed will not provide sufficient reduction in risk to bats. This curtailment is achieved by feathering (not the actual braking of the turbine) so that the blades continue to rotate slowly (at ~2 rpm or less).

16. The most basic and least sophisticated form of curtailment is blanket curtailment – this involves feathering the blades between dusk and dawn over the entire bat active season (generally accepted to be 15 April - 15 October). This is achieved on some turbines by setting the operating mode to "pause" for these specified periods. This form of curtailment is rarely employed due to the substantial impact on economic output and presence of alternative curtailment options. Blanket curtailment is not initially recommended to occur for this windfarm.

17. Alternatively, to avoid blanket curtailment, the turbine can be programmed to feather the blades in response to real time data via the manufacturer's bat protection programme (Enercon SCADA Bat Protection – the full technical description is provided in Appendix 2). This programme allows configuration based upon data including time (e.g. sunset to sunrise), date (e.g. only during the bat active season) and different environmental variables (e.g. wind, temperature). Preconditions of this bat protection programme require that sensors or data are present. The provided data is converted by the Enercon SCADA server and Edge Server into 10 minute mean values, which are used to inform the bat protection programme. Parameters are recommended to focus on SNH 2021 curtailment strategy findings i.e. windspeed below 5m/s, temperature exceeding 11.5°C, 30minutes after sunset and 40minutes before sunrise, 15 April – 15 October. These curtailment parameters will be reviewed annually with use of carcass searches: if at any point a bat carcass is found, these parameters will be expanded. The curtailment regime can also be adapted using the acoustic and meteorological data to ensure it is only employed when necessary: e.g. if the acoustic data indicates that bat activity is low during certain periods then curtailment does not need to be implemented during such times.

18. The Enercon SCADA Bat Protection programme writes control actions on a monthly basis to a file which can be downloaded using Enercon SCADA Remote 3. Therefore, details of when turbines have been fully operational versus curtailed are accessible and can be included in the subsequent annual BMMP reports. Only Enercon staff are able to edit the configuration settings of the Bat Protection programme.

19. The development may alternatively choose to employ a more specialised form of curtailment via an integrated automated bat detection programme. Such programmes have gained traction in the past decade and are useful tools for reducing turbine associated mortality by triggering turbine shut-down (and re-start) in real time in response to bat presence. With such a bat detection programme the turbine would automatically shut down only when bats are detected. If conditions fall outside environmental parameters considered suitable for bat activity but bats are detected, the programme will trigger shut down - if conditions are within these environmental parameters but bats are not detected, the turbine will remain operational. There are various programmes offering automatic stop and re-start triggers linked to bat activity and / or environmental parameters. The applicant is advised to discuss with their chosen turbine operator to choose an appropriate programme.

20. Bat deterrents have been considered as a potential form of mitigation, particularly should a carcass be found post-construction, however latest guidance (e.g. CIEEM 2023) stipulates that whilst sonic bat deterrents modify bat behaviour and have been trialled for use in a range of situations, the results indicate species- and location-specific responses, meaning as yet such <u>deterrents must not be employed.</u>

Searcher Efficiency / Scavenger Removal Trials

21. SNH state that evidence from the National Bats and Wind Turbines study and European studies indicate approximately one third of bat carcasses are removed (by invertebrates, mammals or birds) in the first few days, one third remain for more than a month, and the remaining third take variable periods to disappear: bat carcasses are scavenged not only by vertebrate predators but also by insects and burying beetles. The latter are able to remove carcasses completely over the course of one or two days. At many sites, almost all casualties are removed within a few days of collision. To some extent, this error can be compensated for if the carcass removal rate is known. SNH therefore recommend that it is essential the carcass removal rate by predators be quantified. This 2021 guidance also underlines that in almost all circumstances, the number of bats to be detected at an individual turbine will be low (fewer than 3 per month). If the observer efficiency is low, then it is unlikely that any casualties will be detected therefore giving a false conclusion regarding the true number of bat fatalities on a site: it is essential that casualty searches use a method with high observer efficiency. To provide appropriate correction factors, searcher efficiency trials should be conducted.

22. The BMMP will therefore incorporate searcher efficiency and predation trials as part of the casualty searches. Carcasses of similar size and colour to a bat e.g. laboratory mice will be deposited each search season. Different locations will be selected for the carcasses during each visit so that scavengers do not become familiar with feeding locations. Care should be taken to avoid creating a super-abundance of prey, i.e. deploying too many carcasses in one search plot. The carcasses will be dropped from waist-height and transference of human smell avoided. At least one hour will pass between depositing the carcasses and beginning the searcher efficiency trial. The person deploying the carcasses (Tester) will not be involved in the search and will not reveal to the Seeker the exact number or location of carcasses deployed. In order to determine the rate at which carcasses are removed, the carcasses will be monitored via use of a motion-activated remotely operated camera for up to 10 days (battery life is affected by weather and the number of times the camera is triggered and is not entirely predictable). A second visit will be made to the site to check the cameras and change the batteries to ensure the scavenging rates can be assessed over a three-week period. Assessing rates over a shorter timeframe would not enable a true test of scavenging removal rates to be made (Mathews et al., 2016). Different habitat types will be selected for the trials to ensure a robust evaluation of scavenging rates can be made. The methods used in the Matthews *et al.* (2016) study involved daily visits, rather than camera traps, to check corpses for the first seven days - but the use of camera traps will be more resource efficient and should also indicate the time at which the corpse was taken as well as the species of scavenger in most cases.

Estimating actual mortality rates

23. The numbers of observed bat carcasses recorded during the study (if any) will be corrected taking into account the area searched, scavenger rates and searcher efficiency results. Various researchers have proposed different approaches to data correction including Korner-Nievergelt et al. (2011), Korner-Nievergelt et al. (2013), Bispo et al. (2012), and Lintott et al. (2016). The most up to date formula for estimating the total number of carcasses present per turbine per season will be applied to the data collected at the end of the survey season.

Remedial Measures

24. The requirement for and design of additional remedial measures will depend upon the findings and conclusions of monitoring and specific measures will be developed as appropriate to mitigate and significant impact predicted (those considered significant to bat populations at the local scale or above). Where significant impacts are predicted, potential remedial options may include, but are not limited to, expansion of curtailment parameters. The remedial measures will include a monitoring provision as part of the curtailment strategy for increasing the cut-in speed incrementally (i.e. by continuing to measure wind speed and bat fatalities) until bat fatalities are below an acceptable level.

Reporting

25. A report detailing the results of the monitoring will be issued to Council/NWPS within 3 months of the end of the monitoring period, prior to the next season of monitoring so that any changes to the plan can be agreed in advance.

Hedgerow Compensation

26. A significant amount of hedgerow removal will occur. Approximately 16 existing individual hedgerow sections totalling 1,393m is anticipated to be removed in order to facilitate the development.

27. Approximately 1,052m of removed hedgerow is available for and recommended to be reinstated in the original location following construction. The remaining ~341m is recommended to be reinstated elsewhere on site. Existing hedgerow sections available for reinstation in the original location following construction and which are proximate to either turbine location are not recommended to be installed in their original locations. New hedgerow locations will help redirect bats away from rotor swept areas without compromising site connectivity.

28. Individual sections of hedgerow to be removed vary greatly in length, ranging between ~5m and ~706m. The overall quality of each hedgerow section intended for removal is detailed below in Table 1. A hedgerow was determined to be of Good quality if it was dense, intact, species-rich, greater than 2m in height and width with high foraging potential. Moderate quality was assigned should a hedgerow be mostly intact, top-heavy, dominated by 1 – 2 species, of 2m width or height but not both and with moderate foraging potential. A hedgerow was assigned Poor quality should it be subject to a low box cut management style, yield low species diversity significance and / or no opportunities for fruiting / flowering due to over-management, with low – negligible foraging potential. Significance of species diversity was determined based upon composite scores for trees, shrubs, climbers and ground flora in respective hedgerows. Collins (2023) was utilised to determine the value of each hedgerow with respect to bat foraging potential.

29. Approximately 1,015m of the 1,393m existing hedgerow to be removed is of Low quality. Approximately 124m is Moderate quality and approximately 254m is Good quality.

Table 1 – Details of existing hedgerows which will be removed to facilitate development

Number	Townland	Species Diversity	Quality	Management	Length	Reinstation Location
1	No	Low	Low	Box Cut	73	Original Location
2	No	Low	Low	Box Cut	40	Original Location
3	No	Low	Low	Box Cut	28	Original Location
4	No	Low	Low	Box Cut	168	Original Location
5	No	Low	Low	Box Cut	706	Original Location
6	No	Moderate	Moderate	Overgrown	46	New Location
7	No	Moderate	Moderate	Moderate	37	Original Location
8	Yes	Moderate	Moderate	Overgrown	5	New Location
9	No	Moderate	Moderate	Overgrown	25	New Location
10	No	High	Good	Overgrown	21	New Location
11	No	High	Good	Overgrown	90	New Location
12	No	High	Good	Box Cut	39	New Location
13	No	Low	Moderate	Box Cut	11	New Location
14	No	Moderate	Good	Overgrown	33	New Location

15	No	Moderate	Good	Overgrown	56	New Location
16	No	Moderate	Good	Overgrown	15	New Location

30. Following removal of existing hedgerows a mosaic of alternative existing field hedgerows will continue to exist across the wider site, providing multiple alternative flightlines enabling bats to move through the landscape. Due to the abundance of alternative hedgerows, smaller sections of this hedgerow removal are not anticipated to significantly disrupt the ability of bats to traverse the site, nor significantly reduce potential foraging habitat. Removal of larger, uninterrupted sections could however remove potential key flightlines, significantly reduce connectivity through the landscape and also remove larger stretches of potential foraging habitat – namely Hedgerow 5 located along the site track. The cumulative impact of removing numerous shorter stretches of hedgerow thus reducing the total hedgerow present on site must also be considered. Hedgerows also provide important habitat for various breeding bird species: hedgerow removal could result in biodiversity loss on site. Mature trees could also be present which may hold bat roosting potential: should any such trees be present within hedgerows that require alteration or removal, an initial daytime GLTA (ground level tree assessment) should first be conducted to the methodology proposed by the latest available guidance.

31. The total ~1,393m of existing hedgerow to be removed will be reinstated following construction. It has not been specified what sections will be resinstated via translocation or new planting; both options are discussed below. In addition to recreating the total length of hedgerow removed, the development is recommended to provide ~500m of new hedgerow planting.

32. The desirable option in scenarios of hedgerow removal is retention via aversion. Where aversion is not possible, suitable compensation will be required. Several options are presented below.

New Hedgerow Planting and / or Hedgerow Translocation

33. Compensating for loss of hedgerow may occur via new hedgerow planting elsewhere on site. This could provide an opportunity to create more valuable hedgerow habitat elsewhere in the surrounding landscape via a mixture of native species, double layered structure et cetera. In such a scenario new planting whilst resulting in a temporary loss of biodiversity would result in a clear net gain in several years. At a minimum, the total amount of hedgerow lost to facilitate development should be reinstated on site. It must be noted that new planting could take decades to achieve the same value, resulting in a long-term loss of biodiversity value on site whilst the compensatory planting establishes. Over 1km of hedgerow will be removed to facilitate this development: therefore an additional 500m of planting is recommended should this compensation option be engaged.

34. Species planted should be native and ideally of local provenance. Examples include but are not limited to: Hawthorn, Blackthorn, Alder, Goat Willow, Holly, Wych Elm, Wild Cherry. New planting would be a more desirable option than translocation particularly in instances where existing hedgerow is gappy and species-poor, feature predominantly non-native species, sterile cultivars et cetera. New planting is therefore particularly recommended to compensate for Poor quality hedgerow sections intended for removal.

35. Alternatively, key sections of hedgerow to be removed could be translocated to alternative locations in the surrounding landscape. This may be a desirable option for particularly valuable sections of mature hedgerow, as new planting could take decades to achieve the same level of maturity, structure and ecological function. In this instance planting new whips would result in a net loss of biodiversity and translocation would be considered a more suitable form of compensation. Hedgerow translocation can fail and it is difficult to successfully translocate mature trees. Satellite imagery indicates presence of some mature trees within the hedgerows. If translocation is engaged as an option a suitably qualified ecologist should assess the hedgerow sections for removal to determine which area is best suited for translocation. Data collected should include the species present, dimensions, shape and integrity i.e.

gaps / structure and management, estimate of maturity, presence of any mature trees, associated features, ground flora, overall health, general notes and photographs. A translocation method statement should be compiled and adhered to. Where possible, new planting should occur as compensation for existing Low Quality hedgerow and should aim to provide a better quality hedgerow. Translocation is not recommended for existing Low Quality hedgerow sections. Translocation may be suitable for existing Moderate or Good Quality hedgerow sections. If translocation is engaged as a mode of compensation and translocation fails, new planting must occur. Likewise if sections of new planting are unsuccessfully established, BMMP hedgerow compensation recommendations must be updated by a suitably qualified ecologist and alternative compensation created where necessary. Hedgerow compensation areas should receive follow-up survey effort to determine translocation / planting success and results presenting alongside post-construction monitoring efforts pertaining to bats.

36. Potential receptor locations for sections of translocated hedgerow or new hedgerow planting should aim to enhance the site for example through supplementing other areas of the site with poor connectivity, whilst directing bats further from the rotor swept areas and thus potentially further reducing turbine associated fatalities.

Woodland Planting

37. A further alternative to new compensatory hedgerow planting or existing hedgerow translocation is creation of a new area of priority habitat. New tree planting could create one or several blocks of woodland. For example, two 0.5ha blocks of Sessile Oak woodland. This could occur in any feasible area elsewhere on site (or in the wider landscape, on land also under the applicant's control) which is outside a 200m plus rotor radius buffer from the turbine. This is desirable compensation: approximately 900m to the south-east lays a proposed natural heritage area (001822 Carrickglass Demesne pNHA). This area is of interest due to the mixed woodland present. Oak is present and some trees have been recorded to reach heights of 30.5m. There are few other mature predominantly broadleaved woodlands in the area; compensatory planting in the form of one or more woodland blocks would here create an additional stepping stone enabling wildlife to move between the site and Carrickglass Demesne.

Figure 1 – Hedgerow Removal Areas (North)

Natural Forces

Cloonanny Windfarm

FIGURE 1

Hedgerow Removal Areas (North)

KEY

Removed hedgerow available for same location reinstation

Removed hedgerow unavailable for same location reinstation

OUT DWG

T-LAYOUT NO.

WING NUMBER

BMMP

Blackstaff Ecology

Figure 2 – Hedgerow Removal Areas (South)

Cloonanny Windfarm

FIGURE 2

Hedgerow Removal Areas (South)

KEY

- Removed hedgerow available for same location reinstation
- Removed hedgerow unavailable for same location reinstation

UT DWG | T-LAYOUT NO.

ING NUMBER

BMMP

Figure 3 – Hedgerow Compensation (North)

Natural Forces

Cloonanny Windfarm

FIGURE 3

Hedgerow Compensation (North)

KEY

Removed hedgerow recommended for same location reinstation

UT DWG | T-LAYOUT NO.

VING NUMBER

Anticipated Hedgerow Impact Areas

Blackstaff Ecology

Figure 4 – Hedgerow Compensation (South)

Natural Forces

Cloonanny Windfarm

FIGURE 4

Hedgerow Compensation (South)

KEY

- Removed hedgerow recommended for same location reinstation
- Permanently removed hedgerow
- Suggested new hedgerow areas

BMMP

Blackstaff Ecology

Appendix 1 – Curtailment Case-study (SNH 2021)

Please note: Page numbers of Appendix are not consistent with above report.

Appendix 5: Case study of operational curtailment implementation

Introduction

Curtailment mitigation has been implemented at a large (>100MW) windfarm in response to new evidence on the frequency of bat fatalities which emerged during site operation. The site occupies the upland zone above 200m altitude and comprises a mixture of forestry plantation, felled plantation and existing moorland habitats.

Methodology

In order to determine whether curtailment would be effective at reducing bat fatalities, and if so what parameters should be used, a study was designed to investigate the pattern of bat activity at the site temporally, spatially and in response to weather conditions. Bat activity was measured at n=18 turbines continuously between July and September in Year 1 in combination with carcass surveys. In addition, wind speed and temperature data were continuously recorded at nacelle height.

In Year 2, curtailment was activated at the site using parameters determined from Year 1 data, with bat activity data collected from n=12 locations continuously between April and mid-October in combination at carcass surveys at n=24 locations.

Results

Over 95% of recorded passes on the site comprised 3 species: soprano pipistrelle (56.6%); common pipistrelle (35.5%); and noctule (3.8%).

There was a strong pattern of seasonal temporal variability in bat passes, with most activity occurring between the mid-August to mid-September period (Figure 1).

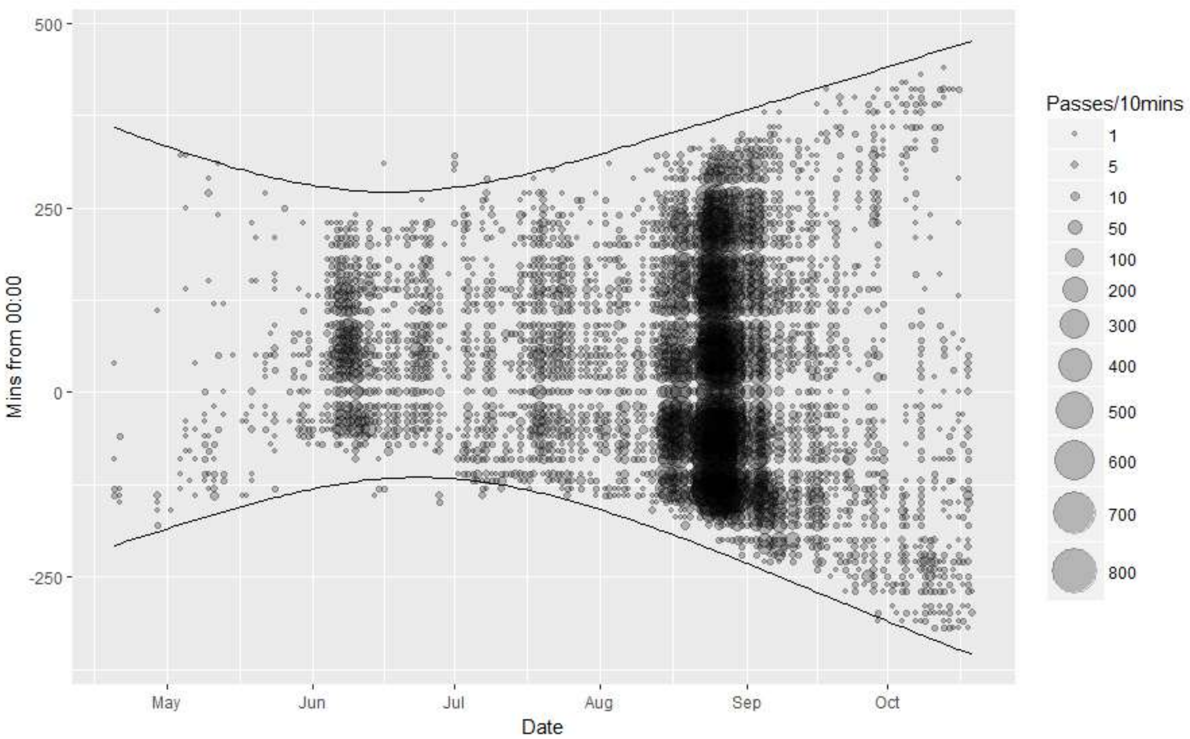

Figure 1: Total number of all bat passes recorded in Year 2 in each 10 minute period at n=12 locations. The upper and lower solid lines represent sunrise and sunset respectively. A similar pattern was recorded in Year 1.

There were no discernible spatial patterns in recorded bat activity or fatalities within the site. Temperature and wind speed were significant factors (both $p<0.001$) associated with recorded bat passes (adjusted R-squared 0.5). A plot of the raw activity data with corresponding nightly temperature and wind speeds is shown in Figure 2.

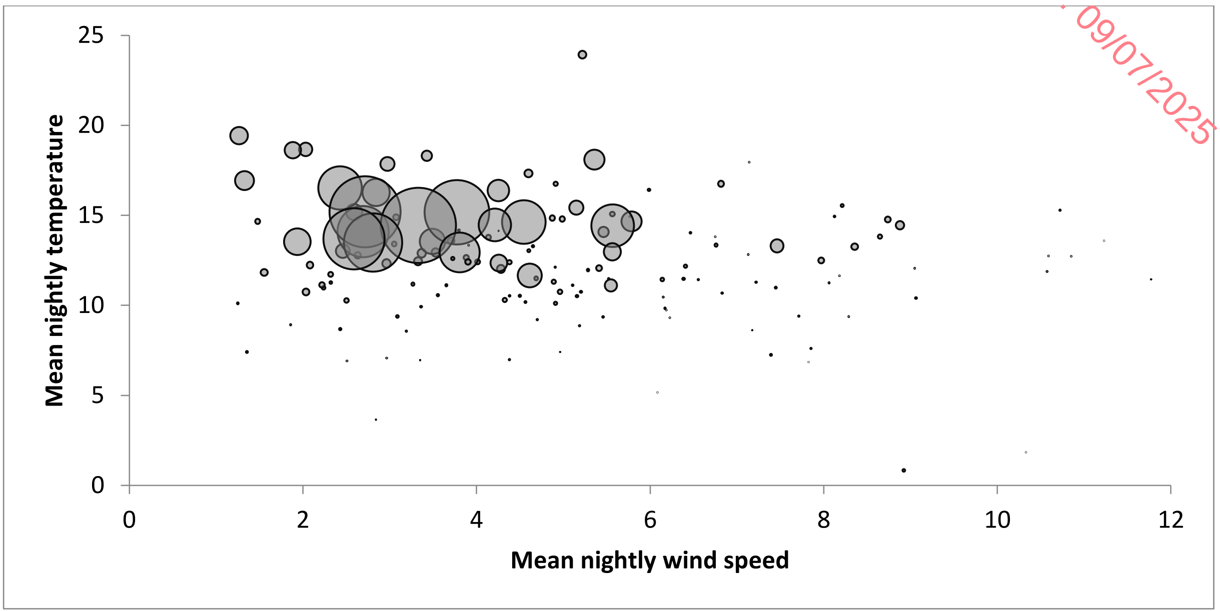

Figure 2: Relative abundance of recorded bat passes plotted against corresponding mean nightly wind speed and temperature.

Curtailment strategy

After Year 1 it was calculated that 90% of all bat activity occurred on the site when temperature exceeded 11.5°C and windspeed was below 5m/s. In addition, the first bat passes were recorded 30min after sunset and the last bat passes were recorded 40min prior to sunrise. As such a software module was programmed into the SCADA system controlling the turbines to curtail turbines when all of these criteria were met. Curtailment is achieved by opening the blade pitch into the fully-feathered position, which reduces blade rotation speed to <1rpm.

Following activation of this system, no bat carcasses were detected at any of the curtailed turbines during Year 2. Given the high probability of carcass detection using trained dog teams it can be concluded with high confidence that the total number of bat fatalities is either zero or so close to zero to be undetectable.

The performance of the system in terms of its ability to respond to the changes in bat abundance based on temperature and wind speed was analysed to confirm it was neither significantly over- nor under- curtailing during different periods of bat activity. Since individual turbines are subject to variation in ambient temperature and wind speed at any given time the whole site will be curtailed for a variable percentage of the available operational time during the night depending on the weather. The percentage of the available operating time within a night the site was curtailed and the corresponding level of bat activity in is shown below in Figure 3. The linear regression has an R-squared value of 0.57, which suggests the curtailment parameters are a good predictor of bat activity, with no points in the extreme bottom-right or top-left areas which would give concern as they would represent significant over- or under- curtailment respectively.

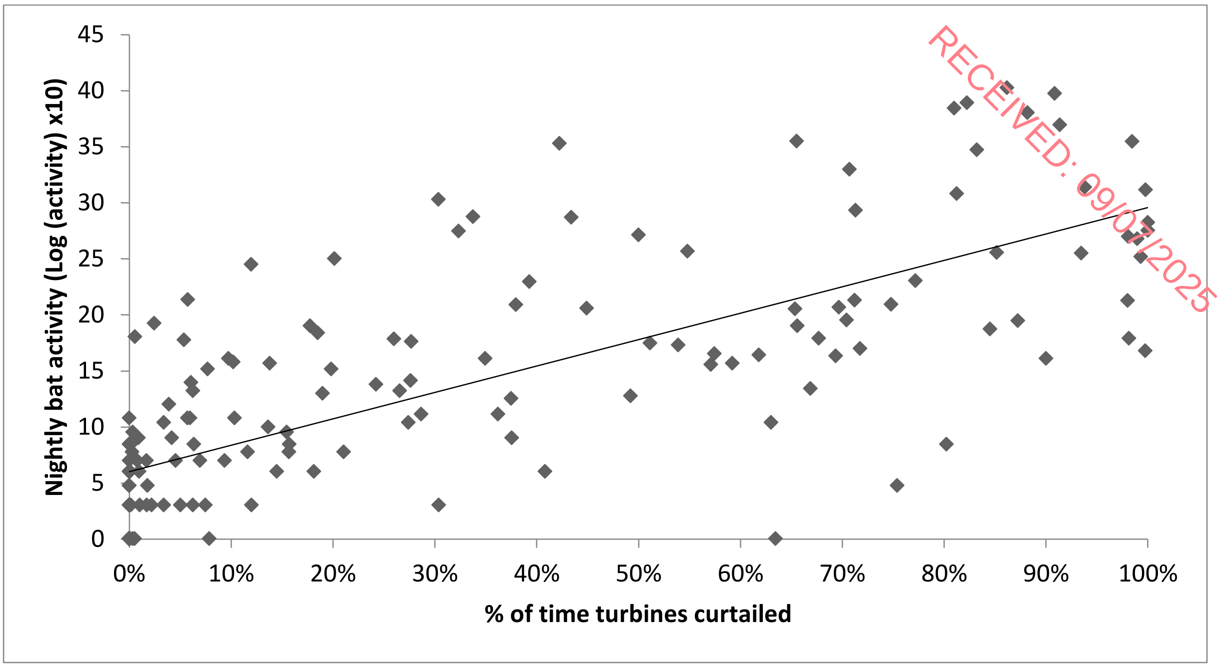

Figure 3: Scatterplot % time all turbines were curtailed on a single night against the recorded number of bat passes during the same period. The solid line is a simple linear regression.

Operationally the system has been working without causing consequences for the windfarm. The “restart” wind speed was increased to 5.5m/s to avoid short-term cycling on/off of the curtailment, so the behaviour of the system is to curtail below 5m/s (when nightly temperatures >11.5°C) but will not restart until the wind speed is >5.5m/s.

Given the performance of the system in minimising fatalities the curtailment system is deemed to be adequate and will continue to be in place for the duration of the project life, with no further bat monitoring proposed.

Appendix 2 – Enercon SCADA Bat Protection Technical Description

Technical description

ENERCON SCADA Bat Protection

ENERCON
ENERGY FOR THE WORLD

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Table of contents

1 Introduction

The wind energy converter operating permit may contain special stipulations for bat protection. It may therefore be necessary to shut down wind energy converters during the time the bats are in flight.

Site-specific and species-specific bat flight times depend on various parameters including wind speed, temperature and precipitation. These parameters are included in the operating permit or are determined by monitoring. The parameters must be taken into consideration for bat-friendly and permit-compliant operation of the wind energy converter.

With ENERCON SCADA Bat Protection, the conditions for a wind energy converter stop can be defined with regard to the hours during which bats are in flight. Depending on the defined conditions, the wind energy converters are stopped or restarted in normal operation.

ENERCON SCADA Bat Protection is available for the ENERCON SCADA Server and for the ENERCON SCADA Edge Server.

Preconditions

The following preconditions must be satisfied to ensure proper operation of ENERCON SCADA Bat Protection:

- The sensors or data required for the applicable conditions are present
- Installation and configuration of ENERCON SCADA Bat Protection on the ENERCON SCADA Server or the ENERCON SCADA Edge Server

For the data request by file *.btt, ENERCON SCADA Remote 3 version ≥ 3.4.0 is required.

Interaction between control actions

When a number of functions and systems that are authorised to start or stop the wind energy converters are operating in parallel, interactions between these control actions can occur.

The status resulting from a start and stop of the wind energy converter must be monitored. Responsibility for monitoring this status lies with the customer or the operator/owner.

2 Function

With ENERCON SCADA Bat Protection, the conditions for a wind energy converter stop can be defined with regard to the hours during which bats are in flight. The conditions must thereby be defined separately for each wind energy converter.

The conditions can be defined using the following parameters:

- Time
- Sensor data (see ch. 2.2, p. 6)
- Combination of time and sensor data

2.1 Control system

Time-dependent control action

Conditions for a stop of the wind energy converters can be defined for both relative time values (sunrise, sunset), as well as for absolute time values (date, time, duration). All relative time values are calculated using the site data (time zone, geographical longitude and latitude).

An absolute time value (offset) can be added to or subtracted from relative time values. The relative Sunset time value can, for example, be preceded by the absolute time value of 1 hour. This makes it possible to define starting times for bat protection that are, for example, 1 hour before sunset. This applies analogously to sunrise. Intervals in the night cannot be assigned an offset.

Night tenths shutdown

The duration of a night is the time period between the calculated sunset and sunrise. This time period is taken as the 100 % value for the night, from 0.00 to 1.00. A night can be divided into equal intervals (e.g. 10 intervals as 0.1 parts of the night) for each of which conditions can be defined for a stop of the wind energy converter. The first interval can start before the defined sunset (< 0.00) and the last interval can end after the defined sunrise (> 1.00).

Sensor-based control action

Conditions for a stop of the wind energy converter can also be defined on the basis of meteorological sensor data (see ch. 2.2, p. 6).

Control groups

Conditions can be assigned to a control group. This allows control actions due to different regulatory requirements to be implemented for a time period.

2.2 Data

The following wind energy converter data is available for the evaluation performed by ENERCON SCADA Bat Protection:

Tab. 1: Wind energy converter data for evaluation

Data	Scale	Unit	Wind energy converter control system		
			CS48, CS82, CS101, CS126, EP3-CS-02, EP4-CS-01	EP5-CS-03	PI-CS[1]
Wind speed	0.1	m/s	X	X	X
Nacelle position	1	°	X	X	X
Air humidity	1	%	X[2]		X[2]
Precipitation	0.001	mm/min	X[2]		
Visibility	0.1	km	X[2]		X[2]
Ambient brightness	1	lx	X[2]		X
Nacelle ambient temperature	1	°C	X	X	X
Ambient temperature, tower	1	°C	X		

2.3 Malfunctions

Communication fault

In the event of a communication fault between a wind energy converter and the ENERCON SCADA Server or the ENERCON SCADA Edge Server, control via ENERCON SCADA Bat Protection is not possible.

Improper behaviour

If ENERCON SCADA Bat Protection is operated before the the entire wind farm is completed, this could result in non-occurrence of stops or unnecessary stops of the wind energy converters. Possible causes include communication faults or the absence of sensors.

2.4 Data capture

To be able to trace control actions executed by ENERCON SCADA Bat Protection at a later date, this information is written on a monthly basis to a file with the following naming convention yyyymm00.btt.

The file can be downloaded using ENERCON SCADA Remote 3 via the *Data request* tab. The file is downloaded when data is requested for months that have already been completed.

[1] Only compatible with the ENERCON SCADA Edge Server.

[2] Only present if the wind energy converter has the corresponding optional sensors. More detailed information is available from your point of contact at ENERCON Sales.

Tab. 2: *.btt field names

Field name	Description
Date	Date
Hour	Hour
Minute	Minute
Second	Second
Error	Error code
Line	Number of configuration row
PlantNo	Plant number of controlled wind energy converter
Control	Control action (stop), an empty field indicates that the WEC is not being stopped by Bat Protection.
StartTime	Configured start time (with absolute time or the calculated time)
EndTime	Configured end time (with absolute time or the calculated time)
Sunset	Calculated sunset
Sunrise	Calculated sunrise
DataType	Data type/sensor type (wind speed, nacelle position, etc.)
ActVal	Measured value (current sensor value, mean value)
Operator	Comparison operator
ConfigVal	Configured shutdown value
TestBit	Specifies the status of test mode: ■ 0: Test mode inactive ■ 1: Test mode active
State	Main status of plant
SubState	Substatus of plant
Information	Free text field
CtrGroup	Control group

2.5 Bat Protection tab in ENERCON SCADA Remote 3

The *Bat Protection* tab can be used to view the control actions configured for the wind energy converters using ENERCON SCADA Bat Protection.

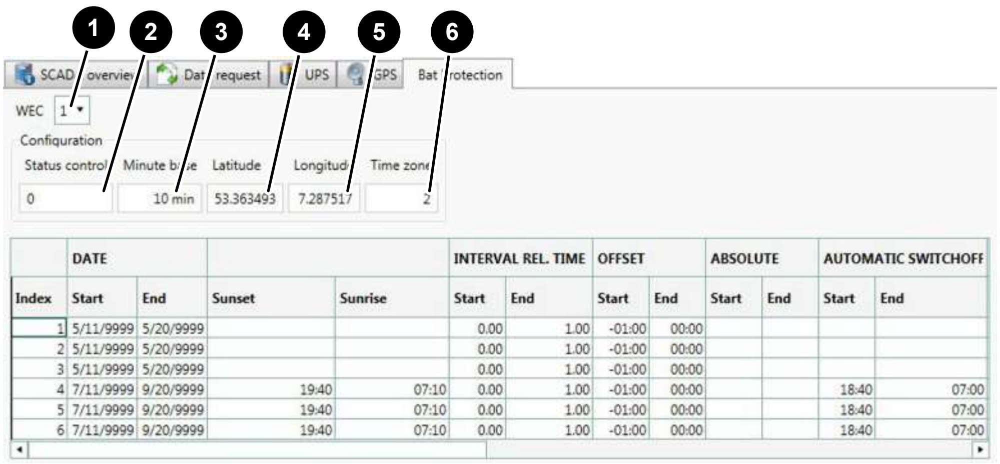


Fig. 1: *Bat Protection* tab (1)

1	*WEC* list box	2	*Status control* display field
3	*Minute base* display field	4	*Latitude* display field
5	*Longitude* display field	6	*Time zone* display field

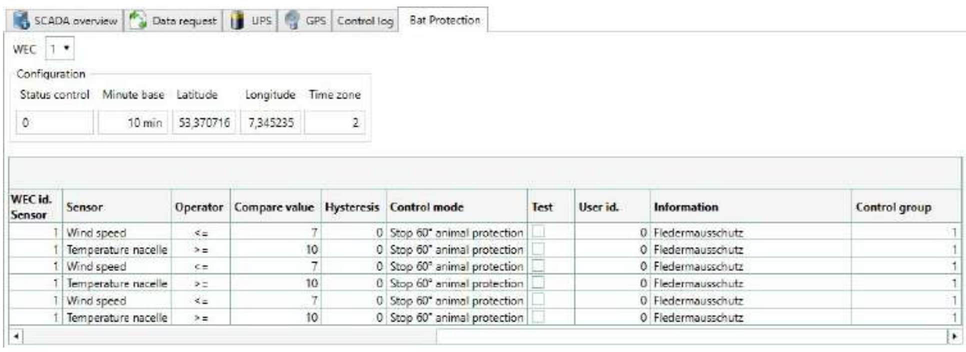


Fig. 2: *Bat Protection* tab (2)

WEC list box

The wind energy converter can be selected here.

Status control display field

Indicates the control value currently output by ENERCON SCADA Bat Protection to the selected wind energy converter.

- 0: Start
- 1: Stop 60°
- 2: Stop 90°
- 3: Gradient stop 60°
- 4: Gradient stop 90°
- 5: Stop 60° animal protection
- 6: Stop 90° animal protection

Minute base **display field**

Indicates the time period used for averaging the minute data provided by the sensors.

Latitude **display field**

Indicates the latitude entered in the configuration.

Longitude **display field**

Indicates the longitude entered in the configuration.

Time zone **display field**

Indicates the time zone entered in the configuration.

Tab. 3: Information on table contents

Column	Description
Index	Indicates the row within the configuration file.
Date Start/End	Indicates the time period during which Bat Protection control is active. Only during this defined time period does the system evaluate conditions and support Bat Protection control.
Sunset	Indicates the calculated sunset. During the defined time period only.
Sunrise	Indicates the calculated sunrise. During the defined time period only.
Interval Rel. Time Start/End	Indicates the selected interval for the night (0.00 = sunset; 1.00 = sunrise). The interval can start before the defined sunset (< 0.00) and end after the defined sunrise (> 1.00).
Offset Start/End	An absolute time value (offset) can be added to or subtracted from relative time values. The relative *Sunset* time value can, for example, be preceded by the absolute time value of 1 hour. This makes it possible, for example, to define starting times for bat protection that are 1 hour before sunset. This applies analogously to sunrise.
Absolute Start	Indicates the configured absolute start time.
Absolute End	Indicates the configured absolute end time.
Automatic Switchoff Start/End	Indicates the resulting time period for the control action.
WEC id. Sensor	Indicates the wind energy converter whose sensor data is to be used for control.
Sensor	Indicates the sensor whose data is to be used for control.
Operator	Indicates the operator (e.g. ≥) for comparing the measured value with the control system comparison value.
Compare value	Indicates the control system comparison value with which the measured sensor value is compared.
Hysteresis	Indicates the hysteresis of the control system comparison value.
Control mode	Indicates the control action (if the condition is satisfied).
Test	Indicates whether test mode is activated (check box activated) or deactivated (check box deactivated).

Column	Description
User id.	Indicates whether the control system is a farm control system (User id. = 0) or a customer control system (User id. = customer id.).
Information	Indicates the free text stored in the configuration for information purposes.
Control group	Indicates the control group.

3 Configuration

For safety reasons, only ENERCON staff are allowed to make the necessary modifications to the configuration file.

An entry must be made in the configuration for each control action of a wind energy converter. The data value of a sensor and/or a time value can be evaluated for each entry. If a control action is only to be performed once in a time period when several conditions are satisfied, then a line with the same time period must be created in the configuration file for each condition. The desired control action is then only performed when all conditions for the time period are satisfied.

In addition to the control action to be carried out, a default control action must be defined that is carried out if the condition is not satisfied. Because, under normal circumstances, stops are carried out by ENERCON SCADA Bat Protection, the control action when the conditions are not satisfied is usually the start of the wind energy converter.

3.1 Mean values

The data provided by the wind energy converters are converted by the ENERCON SCADA Server and the ENERCON SCADA Edge Server into 10-minute mean values. ENERCON SCADA Bat Protection uses these 10-minute mean values.

3.2 Several conditions for a shutdown

If several conditions are configured for the shutdown of a wind energy converter, all the conditions must be satisfied (e.g. time 23:00 h **and** wind speed < 6 m/s **and** ambient temperature > 10 °C **and** precipitation < 0.004 mm/min). If one of the conditions is no longer satisfied, ENERCON SCADA Bat Protection triggers the start of the wind energy converter. The start can be delayed using a hysteresis and a deadband so that the wind energy converter is not constantly stopping and starting.

Within a time period, control actions can be implemented due to different regulatory requirements. For this, the conditions of the respective regulatory requirement and the corresponding control action are assigned to separate control groups.

3.3 Control groups

During configuration of the conditions, they can be assigned to a control group (1 to 9). If no control group is assigned during configuration, the condition is automatically assigned to control group 1. Control groups allow several conditions to be combined in different groups for a time period. This allows control actions due to different regulatory requirements to be implemented for a time period.

One control group in the time period

If several conditions are configured for one control group for a time period, all the conditions of the control group must be satisfied for a stop in this time period. As soon as a condition is no longer satisfied, the wind energy converters are restarted.

Several control groups in the time period

If several conditions are configured for different control groups for a time period, only all the conditions of one control group must be satisfied for a stop. The conditions within a control group have an AND logic for a stop, the control groups for a time period have an

OR logic. As soon as all the conditions of at least one control group are satisfied, the wind energy converters are stopped. As soon as all the conditions of none of the control groups are satisfied, the wind energy converters are started again.

Tab. 4: Example of control groups

Control group 1	Control group 2	Control action
0	0	Start
0	1	Stop
1	1	Stop

0 = Not all the conditions have been satisfied, 1 = All the conditions have been satisfied

3.4 Hysteresis

Using a stop condition as the basis, the hysteresis can be used to define a range in which the wind energy converter is not started.

If, for example, a wind energy converter is supposed to stop at wind speeds of < 5.0 m/s and not restart until wind speeds are above 5.5 m/s, the hysteresis must be set to 0.5 (5.5 - 5.0 = 0.5).

If the wind energy converter is not at a standstill and the wind speed drops from, for example, 5.9 m/s to 5.2 m/s, i.e. in the range defined by hysteresis, the wind energy converter remains in operation. The wind energy converter is not actively stopped in the range defined by hysteresis. The hysteresis only takes effect after the wind energy converter has already been stopped by ENERCON SCADA Bat Protection.

3.5 Deadband

In order to prevent undesirable dynamics, and hence continuous stopping and starting of the wind energy converter, the conditions can be extended by a deadband. The start of the wind energy converter can alternatively also be delayed by the hysteresis.

The 10-minute mean values can be multiplied by a factor during the configuration and thus create the deadband. Control actions are then only executed for conditions with a deadband when the conditions for the time period defined by the deadband (mean value x factor) are satisfied.

For example, if the deadband is set to 3, the wind energy converter is only stopped when all the conditions have been satisfied for 3 consecutive 10-minute mean values. The wind energy converter is restarted when at least one condition has no longer been satisfied for 3 consecutive 10-minute mean values.

3.6 Test mode

For test purposes, the conditions can be configured so that the information is recorded when a condition is satisfied, but the control action is not transmitted to the wind energy converter.

3.7 Free text

Freely selectable information can be assigned to each condition during configuration using a free text field. This information is displayed in the evaluation by ENERCON SCADA Bat Protection. The free text can, for example, contain information on the control action performed or the condition.

APPENDIX 10.3
BATS TRANSECTS AND EMERGANCE SURVEY REPORT

VOLUME III
APPENDICES TO ENVIRONMENTAL IMPACT ASSESSMENT REPORT

RFI Response July 2025

ENVIRONMENTAL CONSULTANTS

BAT ROOSTING AND TRANSECT SURVEY REPORT

Cloonanny Windfarm Development

Cloonanny, Co. Longford

January 2024

ID Environmental Consultants

Document Details

Client:	Natural forces
Project Title:	Longford Windfarm
Project Code:	15-NF-2023
Document Title:	Longford Windfarm Bat Survey
Prepared By:	Ian Douglas and Ita Sherlock

Rev	Status	Date
01	Draft 1	02/01/2023
02	Final	24/05/2024

Table of Contents

1 Introduction

The following report has been completed to provide information regarding the distribution of foraging and roosting bats at the site through emergence surveys conducted at dusk along transects through the site and in addition to information gathered through emergence surveys at potential roosting features. These surveys were conducted within the optimal period for ground-level bat activity surveys (Collins, 2023). Surveys were completed on the 16th of August and the 14th of September 2023.

These surveys and data assessments were conducted with reference to the guidelines in:

- Bat Surveys for Professional Ecologists – Good Practice Guidelines (3rd edn.) (Collins, 2023),
- Identification Guide to Ireland's Bats (Roche & Torsney, 2021),
- Bats and onshore wind turbines - survey, assessment and mitigation (NatureScot, 2021),
- Bat mitigation guidelines for Ireland v2. (Marnell, Kelleher & Mullen, 2022).

1.1 Background

Wind energy provides a clean, sustainable alternative to fossil fuels in generating electricity. However, bat fatalities have been reported at wind energy facilities around the world, raising concern about the cumulative impacts of such developments on bat populations (Arnett *et al.,* 2016). Indeed, Common Pipistrelles (*Pipistrellus pipistrellus),* our most abundant species, have been found to have significantly average nightly activity levels at turbine sites versus controls (Richardson *et al.,* 2021). A study from the UK, where bat species and behaviour are very similar, estimated bat fatalities at between 0 – 5.25 bats per turbine per month (Mathews *et al*., 2016).

EU member states are obliged to monitor the conservation status of natural habitats and species listed in the Annexes of the Habitats Directive. Under Article 17, they are required to report to the European Commission every six years. In April 2019, Ireland submitted the third assessment of conservation status for Annex-listed habitats and species, including all species of bats (NPWS, 2019). The most recent NPWS assessment (Table 1) notes a largely positive conservation status for bats. It is worth noting that this may reflect undercounting in the past when more basic technologies were available for counting and that it represents data from at least five years ago.

Table 1: List of Irish bat species along with their conservation status (NPWS, 2019)

Bat Species	Overall Assessment of Conservation Status	The overall trend in Conservation Status
Brown Long-eared Bat *(Plecotus auritus)*	Favourable	Improving
Daubenton's Bat *(Myotis daubentonii)*	Favourable	Improving
Leisler's bat *(Nyctalus leisleri)*	Favourable	Improving
Nathusius's Pipistrelle *(Pipistrellus nathusii)*	Unknown	N/A
Natterer's Bat *(Myotis nattereri)*	Favouring	Stable
Pipistrelle *(Pipistrellus pipistrellus)*	Favourable	Improving

Soprano Pipistrelle (Pipistrellus pygmaeus)	Favourable	Improving
Lesser horseshoe bat (*Rhinolophus hipposideros*)	Inadequate	Deteriorating
Whiskered bat (*Myotis mystacinus)*	Favourable	Stable

Pre-construction bat surveys were undertaken to provide a baseline to gain insight into bat activity in the absence of turbines and to predict and mitigate against any future risks identified. Survey design and analyses of results at the Proposed Development were undertaken with reference to the latest policy and legislation, scientific literature and industry guidelines. Any spatial, temporal or behavioural factors that may put bats at risk were fully considered.

1.2 Statement of Authority

This survey was completed by Ian Douglas (MSc, BSc, H Cert.Ag) of ID Environmental Consultants. Ian is an Ecologist and Environmental consultant with over ten years' experience in appropriate assessment, ecological impact assessment, habitats assessment, soil science, GIS mapping and regenerative agriculture. Ian has worked on projects including large road developments, power infrastructure projects, planning applications, planning and design of nature trails, constructed wetland creation and on farm habitat development. Ian previously worked in Ecology and Agriculture in England and Australia before taking a position with Flynn, Furney Environmental Consultants in 2018. With whom he retains a position as Associate Director. Ian formed ID Environmental Consultants in 2021.

Ita Sherlock also assisted with the completion of this survey. She has a degree in Environmental Science (BSc (Hons), Level 8). She has practical skills for general field/habitat surveying and has also gained knowledge in bat surveying and GIS software. She has done further training and field volunteering with the Biodiversity Data Centre and the Irish Peat Conservation Council. She performs the annual Daubenton bat survey volunteering for Bat Conservation Ireland and has attended their bat detector and survey training.

1.3 Irish Bats- Relevant Legislation and Background

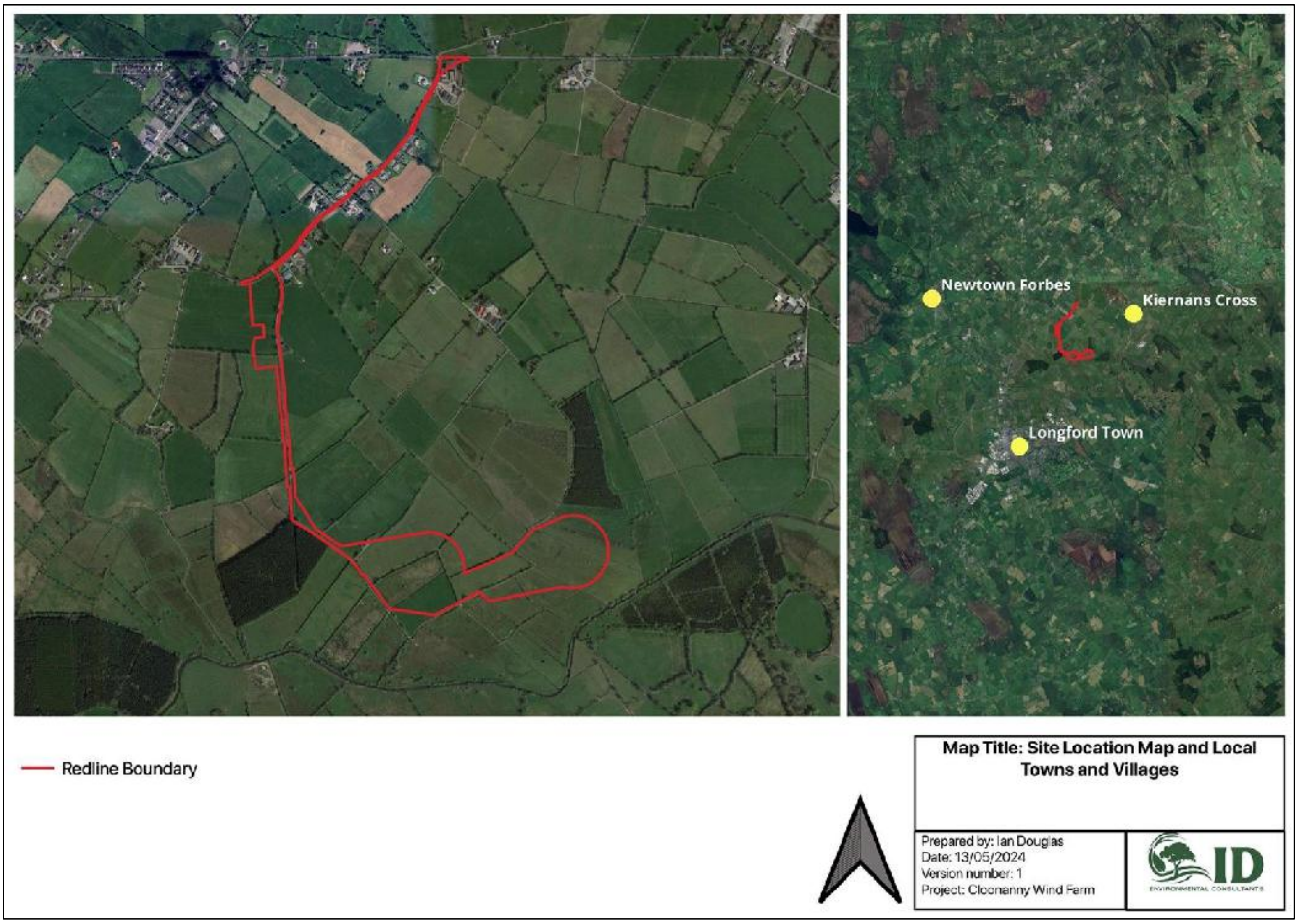
All nine species of Irish bats (Roche and Torsney, 20210 are protected under the Habitats Directive 92/43/EEC' (European Commission, 2019), with all species listed under Annex IV of the Directive, meaning that there is protection for bats, their breeding and resting sites. Also, the lesser horseshoe bat (*Rhinolophus hipposideros)* is an Annex II-listed species. The Directive was enacted into Irish law though by the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. No. 477 of 2011).

In addition, Irish species are further protected by national legislation (Wildlife Acts 1976-2022). Under this legislation, it is an offence to intentionally disturb, injure, or kill a bat or its roost. Any work at a roost site must be carried out with the agreement of the National Parks and Wildlife Service (NPWS).

2 Project description

A 10-year permission is being sought by Natural Forces Renewable Energy 2 Limited for the development of a 14MW wind farm to be located in the townland of Cloonanny Glebe, Co. Longford. The Proposed Development will have an operational lifespan of 35-years from the date of commissioning and will consist of the construction of two E175 EP5 wind energy converters with an overall tip height of 199.9 meters, associated foundations and hard-standing areas, a permanent internal site access road; construction of an on-site 20kV substation compound, a meteorological mast with height of 32 meters, a Battery Energy Storage System (BESS); and all associated development and ancillary works. A site location map can be seen in Figure 1. Please see Chapter 2 of this EIAR for the full Development Description.

Figure 1: Site Location Map



3 Methodologies

3.1 Desktop Study

Prior to the main fieldwork contributing to this report, a desktop survey of available information sources was carried out to identify species likely to be found at the site and the surrounding area.

These included:

- The National Bat Database of Ireland, maintained by Bat Conservation Ireland,
- The National Biodiversity Data Centre Online Database,
- The NPWS Protected Species Database and Online Mapping.

3.1.1 Bat Records

The Irish National Bat Database, maintained by the Bat Conservation Ireland (BCI), holds records of bat sightings and observations made across the country. These records include findings from national monitoring programs, roost registrations, and casual observations. A recent search specifically examined bat presence and roosting locations within a 10-kilometer radius of a central point within the Proposed Development (Grid Reference: N 15123 78052) (BCI, 2012, NatureScot, 2021). Moreover, data from the National Biodiversity Data Centre (NBDC) was investigated to identify the bat species inhabiting the relevant 10-kilometer grid squares encompassing the Proposed Development. Additionally, information on the distribution range and habitat preferences of bat species, as described in the 2019 Article 17 Reports (NPWS, 2019), was analysed to assess the presence of any high-risk species at the periphery of their distribution range.

3.1.2 Bat Species Range

The 2019 Article 17 Reports were reviewed for information on bat species' range and distribution in relation to the location of the Proposed Development. The aim was to identify any high-risk species at the edge of their range (NatureScot, 2021).

3.1.3 Designated sites

The National Parks and Wildlife Service (NPWS) map viewer and website provides information on rare and protected species, sites designated for nature conservation and their conservation objectives. A search was undertaken of sites designated for the conservation of bats within a 10 km radius of the Proposed Development. This included European designated sites, i.e. SACs, and nationally designated sites, i.e. NHAs and pNHAs.

3.2 Landscape Assessment

3.2.1 Cave roost sites

The Geological Survey Ireland (GSI) online mapping tool and the University of Bristol Speleological Society (UBSS) Cave Database for the Republic of Ireland were consulted for any indication of natural subterranean bat sites, such as caves, within 10 km of the Proposed Development (BCI, 2012) (last searched on December 5, 2023).

3.2.2 NBDC Bat Landscape Mapping

The National Biodiversity Data Centre (NBDC) map viewer presents "Bat Landscape" maps for individual species and for all species combined. The resulting map provides a 5-point scale, ranging from the highest habitat suitability index (presented in red) to the lowest suitability index (presented in green). However, squares highlighted as less favourable may still have local areas of abundance. The location of the Proposed Development was reviewed in relation to bat habitat suitability indices. It is worth noting that these results are based on a modelling exercise and not confirmed bat species records. Regardless, they may provide a useful indication of potential favourable bat associations within the Proposed Development.

3.3 Roost Surveys

A search for roosts was undertaken within 200m plus the rotor radius (i.e. 85m) of the Proposed Development footprint (NatureScot, 2021), including access routes. The aim was to determine the presence of roosting bats and the need for further survey work or mitigation. Surveys for rooting potential were conducted in January and March 2022. A walkover was carried out, and all structures and trees were assessed for their potential to support roosting bats. Guidelines to evaluate the potential suitability of a site for bats, based on the presence of habitat features (taken from Collins, 2023).

Table 1: Collins (2023) roosting and foraging definitions

Suitability	Description of roosting habitat	Description of commuting and foraging habitats
Negligible	Negligible habitat features on site likely to be used by roosting bats	Negligible habitat features on site likely to be used by commuting or foraging bats
Low	A structure with one or more potential roost sites that could be used by individual bats opportunistically. However, these potential roost sites do not provide enough space, shelter, protection, appropriate conditions5 and/or suitable surrounding habitat to be used on a regular basis or by larger numbers of bats (i.e. unlikely to be suitable for maternity or hibernation). A tree of sufficient size and age to contain PRFs but with none seen from the ground or features seen with only very limited roosting potential.	Habitat that could be used by small numbers of commuting bats such as a gappy hedgerow or un-vegetated stream, but isolated, i.e. not very well connected to the surrounding landscape by other habitat. Suitable but isolated habitat that could be used by small numbers of foraging bats, such as a lone tree (not in a parkland situation) or a patch of scrub
Moderate	A structure or tree with one or more potential roost sites that could be used by bats due to their size, shelter, protection, conditions and surrounding habitat but unlikely to support a roost of high conservation status	Continuous habitat connected to the wider landscape that could be used by bats for commuting, such as a line of trees and scrub or linked back gardens. Habitat that is connected to the wider landscape that could be used by bats for foraging, such as trees, scrub, grasslands or water
High	A structure or tree with one or more potential roost sites that are obviously suitable for use by larger numbers of bats in a	Continuous habitat connected to the wider landscape that could be used by bats for commuting, such as lines of trees and scrub hedgerows, linked back gardens, river valleys, streams and woodland edge. Habitats that are connected

	more regular basis and potentially for longer periods of time due to their size, shelter, protection, conditions and surrounding habitat.	to the wider landscape could be used by foraging bats, such as tree scrub, grassland, or water. The site is close to and connected to a known roost.

Any potential tree roosts were examined for the presence of rot holes, hazard beams, cracks and splits, partially detached bark, knot holes, gaps between overlapping branches and any other potential roost features (i.e. PRFs) identified by Andrews (2018).

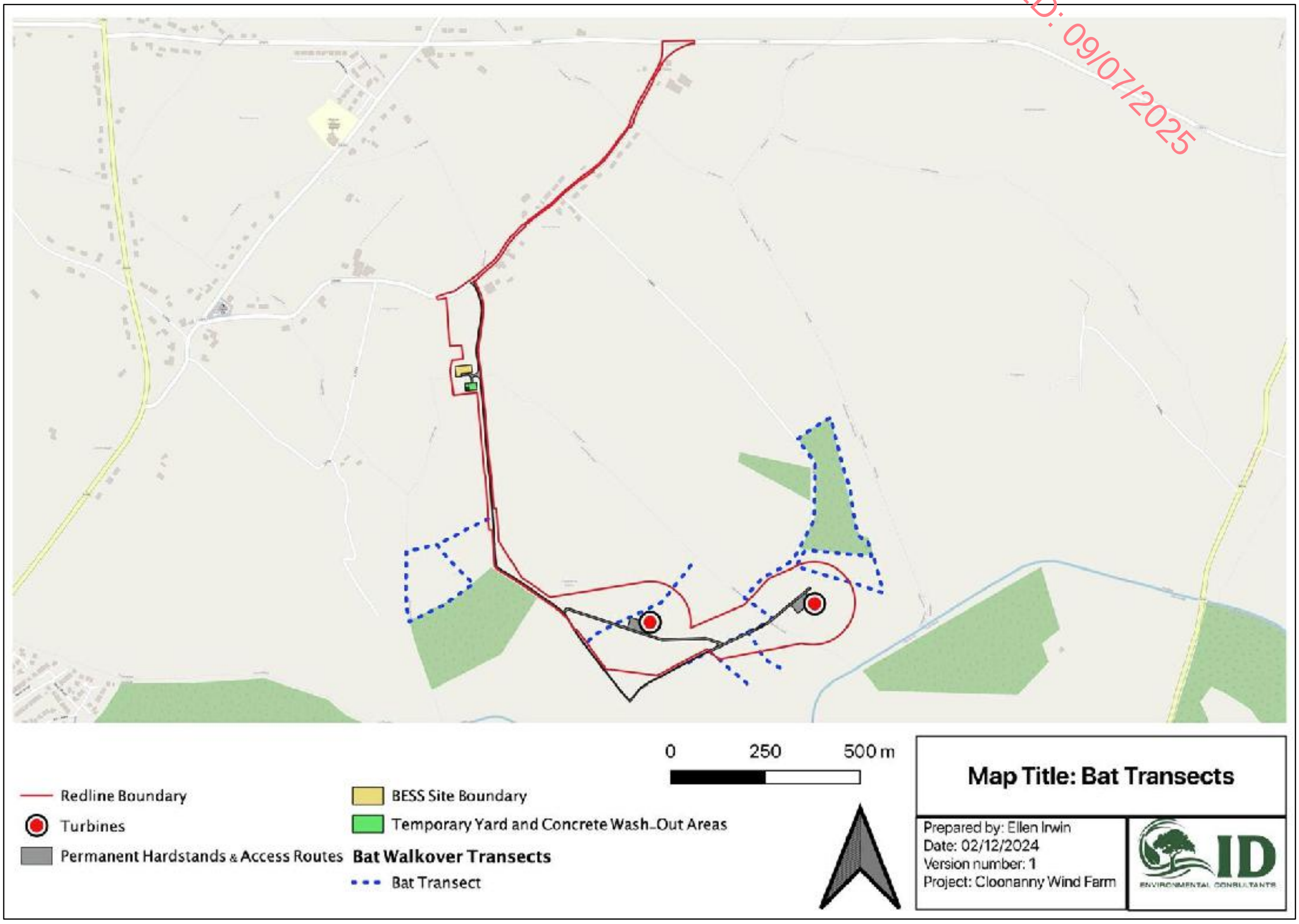
3.4 Dusk Activity Transect Surveys

Dusk activity transect surveys were carried out on the 16th of August and 14th of September 2023 with the aim of understanding the distribution of foraging bats across the Proposed Development and what species were present. The survey ran transects near and around the Proposed Development's turbine locations as well as covering a broad proportion of the surrounding area (see Figure 1). The aim of these surveys was to identify bat species using the site and gather any information on bat behaviour and important features used by bats.

Two surveyors with a full spectrum logger (Echometer Touch 2) walked the route, recording bat calls along its length. The start and end of each recording was determined by the device's software. In the absence of a standard (Collins, 2016, p16), each recording is treated as a bat pass for the purposes of this report.

Each survey started approximately 30 minutes after sunset and ran for approximately 1.5 hours. Weather conditions were suitable for bat surveys (Collins, 2023), with warm, dry weather with little to no wind. Whilst light pollution from Longford was visible on the horizon, there was no direct light pollution along the transect routes.

Figure 2: Survey transect routes



3.5 Analysis of the Bat Detector Recordings

The software on the Echometer Touch devices automatically provides species identification for each pass based on the echolocation call's characteristics, such as start and end frequency, signal shape and inter-pulse interval. Further to this, a proportion of call recordings were manually checked, in line with advice from Bat Conservation Ireland's Detector and Survey training, which recommends checking the following proportions of the auto-identified calls:

- All recordings auto-identified as Nathusius pipistrelle (*Pipistrellus nathusii),*
- All recordings auto-identified as brown long eared bats *(Plecotus auritus),*
- 20% of recordings auto-identified as either Common pipistrelles (*Pipistrellus pipistrellus)*, Soprano pipistrelles (*Pipistrellus pygmaeus)* and Leisler's (*Nyctalus leisleri),*
- All recordings auto-identified as unidentified,
- 20% of recordings auto-identified as noise.

These were manually checked based on typical call characteristics for each species (Roche and Torsney, 2021). Individual bats of the same species cannot be distinguished by their echolocation alone. Thus, 'bat passes' is used as a measure of activity (Collins, 2023).

3.6 Survey Limitations

The information provided in this report accurately and comprehensively describes the baseline environment. The specialist studies, analysis and reporting have been undertaken in accordance with the appropriate guidelines. This report does not include information from static detector surveys. These have been compiled and are provided by Blackstaff Ecology (2023) and are provided as a separate report.

Early-season surveys in June and July could not be conducted due to continued and prolonged periods of rainfall during this period. Although the weather in September is slightly outside the optimal period (Collins, 2016), the unseasonably warm weather negated this limitation.

This report, when considered in conjunction with the static detector survey (2023), concludes that no limitations in the scope, scale or context of the assessment have been identified. Overall, a comprehensive assessment has been achieved.

4 Results

4.1 Consultation

Bat Conservation Ireland was invited to comment on the potential of the Proposed Development to affect bats. As of 13/03/2024, no response has been received. NPWS were also consulted in relation to this project. Again no consultation was received.

4.2 Desktop Survey Results

4.2.1 Bat Records

Records of nearby bat observations from the National Biodiversity Data Centre include several from 2004 at approximately 1km distance from the Proposed Development: brown long-eared bat, common pipistrelle, leisler's, Nathusius' pipistrelle and natterer's bats. A more recent record for Soprano pipistrelles from 2009 is located approximately 800m from the Proposed Development.

A search was made with The National Bat Database of Ireland for bat records within a 10km radius of the proposed site (N17). Seven bat species were recorded within a 10km radius of the site. The results of the database search are provided in Table 3.

Table 3:NDBC Records within 10km of Proposed Site (N17 hectad).

Species name	Date of last record	Title of dataset	Designation
Brown Long-eared Bat *(Plecotus auritus)*	17/06/2014	National Bat Database of Ireland	EU Habitats Directive, Annex IV Wildlife Acts
Daubenton's Bat *(Myotis daubentonii)*	27/08/2013	National Bat Database of Ireland	EU Habitats Directive, Annex IV Wildlife Acts
Lesser Noctule *(Nyctalus leisleri)*	17/07/2004	National Bat Database of Ireland	EU Habitats Directive, Annex IV Wildlife Acts
Nathusius's Pipistrelle *(Pipistrellus nathusii)*	20/07/2004	National Bat Database of Ireland	EU Habitats Directive, Annex IV Wildlife Acts
Natterer's Bat *(Myotis nattereri)*	22/07/2004	National Bat Database of Ireland	EU Habitats Directive, Annex IV Wildlife Acts
Pipistrelle *(Pipistrellus pipistrellus sensu lato)*	11/08/2006	National Bat Database of Ireland	EU Habitats Directive, Annex IV Wildlife Acts
Soprano Pipistrelle (Pipistrellus pygmaeus)	18/09/2009	National Bat Database of Ireland	EU Habitats Directive, Annex IV Wildlife Acts

4.2.2 Bat species range

The Proposed Development site is outside the range of the highest-risk bat species, the Lesser horseshoe bat (Table 1). It is also outside the range of Nathusius' Pipistrelle, a bat with an unknown conservation status.

4.2.3 Designated sites

The presence of the Lesser Horseshoe bat requires a Special Area of Conservation (SAC) designation, and its absence means that there are no SACs with this qualifying interest near the Proposed Development.

Natural Heritage Areas (NHAs) and proposed Natural Heritage Areas (pNHAs) may be designated for any bat species. A search of NHAs and pNHAs within a 10km radius of the Study Area found no sites designated for the conservation of bats.

There are no SACs with bats as a qualifying interest within 15km of the Proposed Development.

4.2.4 Cave roost sites

A search of the UBSS Cave Database for the Republic of Ireland found no caves within 10km of the Proposed Development site.

4.2.5 NBDC Bat Landscape Mapping

The NDBC's bat Landscape maps indicate the habitat suitability of specific areas for different bat species. The Proposed Development is in an area highly suitable for brown long-eared bats, common pipistrelles, soprano pipistrelles, and leisler's bats. The NDBC bat landscape map provided a habitat suitability index of 28.1 to 36.4 (orange). This indicates that the Proposed Development area has high habitat suitability for bat species.

4.3 Roost Surveys

No potential roosting sites were identified. No buildings or other structures are found within or surrounding the Proposed Development. Overall, the majority of trees within the site did not provide optimal habitat for roosting bats and were assessed as having Negligible –Low roosting potential. Trees with low potential included several small ivy-covered ash trees located within the hedgerows to be removed along the main access road. One mature Oak was noted as having moderate roosting potential. Several limbs on this tree will be removed to facilitate access to turbine hard stands. Emergence surveys were carried out at this tree on the 16th of August and the 14th of September 2023. No emergence was observed on either occasion.

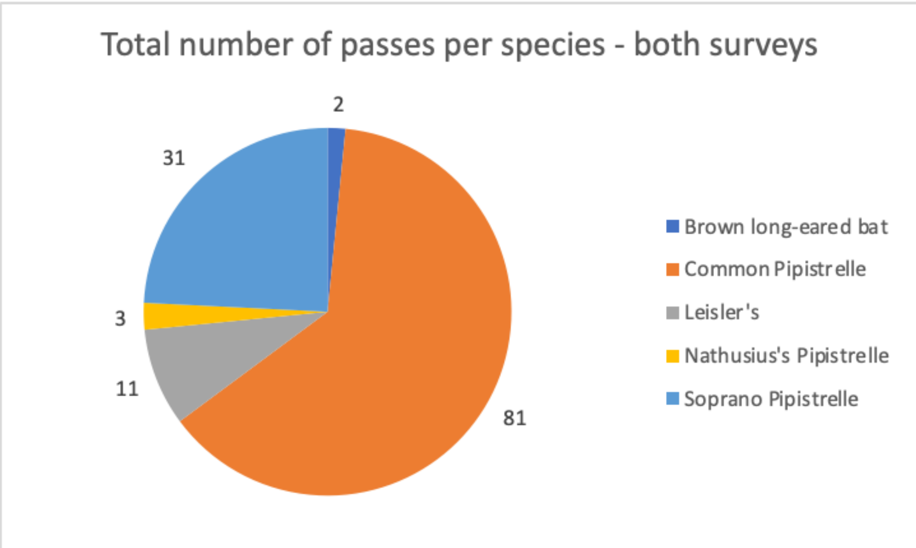
4.4 Grid Connection and Haul Route

No possible roosting features were found within or surrounding this area. The potential grid connection routes are located primarily within the existing road infrastructure classified as buildings and artificial surfaces (BL3). Small areas of improved agricultural grassland (GA1), in addition to hedgerow (WL1) and grassy verge (GS2) habitat, will be removed along the access road. With regard to commuting and foraging bats, features along the grid connection and haul route were assessed as having moderate suitability, i.e. Habitat that is connected to the broader landscape that could be used by bats for foraging, such as trees, scrub, grassland or water (Collins, 2023). No roosting features were identified. Please refer to the Biodiversity chapter (Chapter 10) for the full assessment regarding the grid and haul route.

4.5 Dusk Activity Transect Surveys

Manual transect surveys were undertaken in 2023. Bat activity was recorded on all surveys. A total of 128 bat passes were recorded, as shown in Figure 2. The largest number of passes on both surveys were for common pipistrelles (Survey 1: n = 28, Survey 2: n = 53)

Figure 3: The proportion of different bat species observed across both surveys

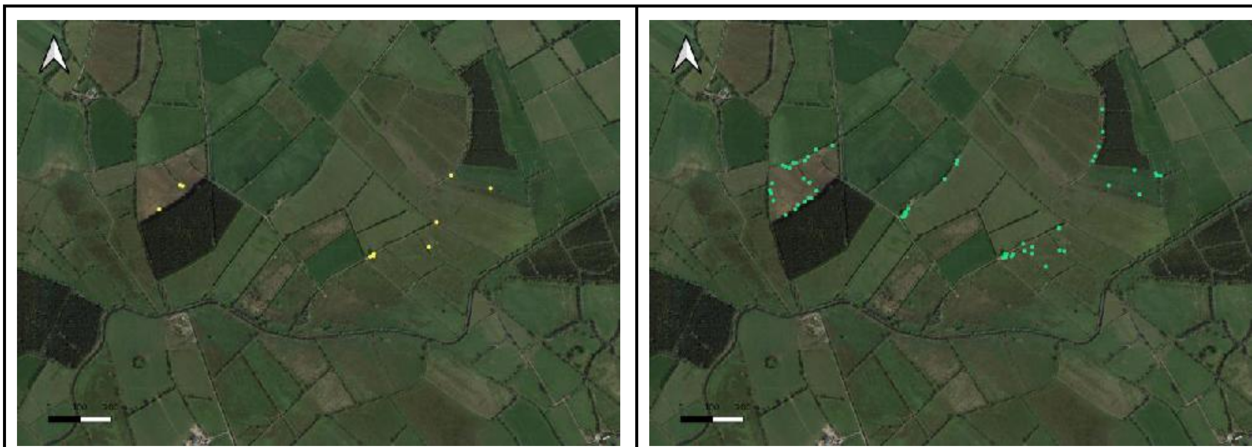


Bats were found throughout the site along hedgerows (figure 3), as would be expected from edge species such as common pipistrelle (Roche and Torsney, 2021).

Figure 4: Bat locations are indicated with a yellow dot

In terms of species distribution, leisler's, common pipistrelle and soprano pipistrelles were widely distributed across the transect routes (figure 4 a, b,c). Brown Long-eared bats were recorded on just one night, in just a single woodland edge location (figure 4, d). Nathusius's pipistrelle was also recorded in a single location on one night.

Figure 5: Bat distribution by species



a) Leisler's bat | *b) Common Pipistrelle*

c) *Soprano Pipistrelle*

d) *Brown Long-Eared bat*

e) *Nathusius Pipistrelle*

5 Importance of Bat Population Recorded at the Site

The ecological evaluation presented in this section adheres to the methodology outlined in Chapter Three of the "Guidelines for Assessment of Ecological Impacts of National Roads Schemes" (NRA, 2009).

All Irish bat species are protected under the Wildlife Act (1976) and Wildlife Amendment Act (2000). Also, the EC Directive on The Conservation of Natural Habitats and of Wild Fauna and Flora (Habitats Directive 1992) seeks to protect rare species, including bats, and their habitats and requires that appropriate monitoring of populations be undertaken. Across Europe, they are further protected under the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention 1982), which, in relation to bats, exists to conserve all species and their habitats. The Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention 1979, enacted 1983) was instigated to protect migrant species across all European boundaries. The Irish government has ratified both of these conventions. All bats are listed in Annex IV of the Habitats Directive and the greater horseshoe bat and lesser horseshoe bat are further listed under Annex II.

During the assessment, no bat roosts were identified within the Proposed Development site. Bats, as an ecological receptor, have been assigned a local importance (higher value) based on the presence of regularly occurring bat populations of local importance.

No roosting sites of national importance (i.e., sites with more than 100 individuals) were recorded within the study area. Therefore, the Proposed Development site does not support any significant roosting sites for bats.

6 References

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APPENDIX 10.4

BOTANICAL REPORT

VOLUME III

APPENDICES TO ENVIRONMENTAL IMPACT ASSESSMENT REPORT

RFI Response July 2025

ENVIRONMENTAL CONSULTANTS

BOTANICAL SURVEY REPORT

Cloonanny Wind Farm Development

Cloonanny, Co. Longford

October 2024

Document Details

Client:	Natural Forces
Project Title:	Cloonanny Wind Farm Development, Co. Longford
Project Code:	12-NF-2024
Document Title:	Botanical Survey Report
Prepared By:	ID Environmental Consultants

Rev	Status	Date
01	Final	06/11/2024

1. Introduction

This Botanical Survey report has been prepared by ID Environmental Consultants on behalf of Natural Forces for the Proposed Development located in Co. Longford. The survey aims to provide an assessment of the vegetation within the site, with a particular focus on identifying any habitats of ecological importance, including potential EU Habitats Directive Annex I habitats.

The botanical survey was carried out on the 7th of June, 2023, under dry and sunny conditions. A total of 24 2x2m relevés were established at key locations across various habitat types, allowing for a detailed inventory of plant species and habitat characteristics. Data collected from these relevés included species richness, cover percentages, and habitat conditions.

This report outlines the methodology used for the survey, the results of the botanical assessment, and the significance of the identified habitats in relation to the Proposed Development.

2. Vegetation Survey Methodology

A survey was conducted on the 7th of June 2023 on lands at the Proposed Development in Co. Longford. Conditions during the survey conducted were exceptionally dry and sunny. Follow up walk over surveys were conducted in August 2024 to ensure that there had been no alteration to any habitats on site since the time of the 2023 survey. No significant changes were noted. Twenty-Six 2x2m relevé were established at locations provided within various habitats. The following information was obtained within each relevé:

- GPS reference,
- Soil type,
- Soil depth,
- % cover exposed soils,
- % litter cover,
- % standing water,
- Species inventory,
- Species richness,
- % cover of each species.

- Domin scores as follows:

Table 1: Domin Scoring System

Domin Score	% Cover
10	91-100
9	76-90
8	51-75
7	34-50
6	26-33
5	11-25
4	5-10
3	1-4
2	<1
1	<1
+	<1

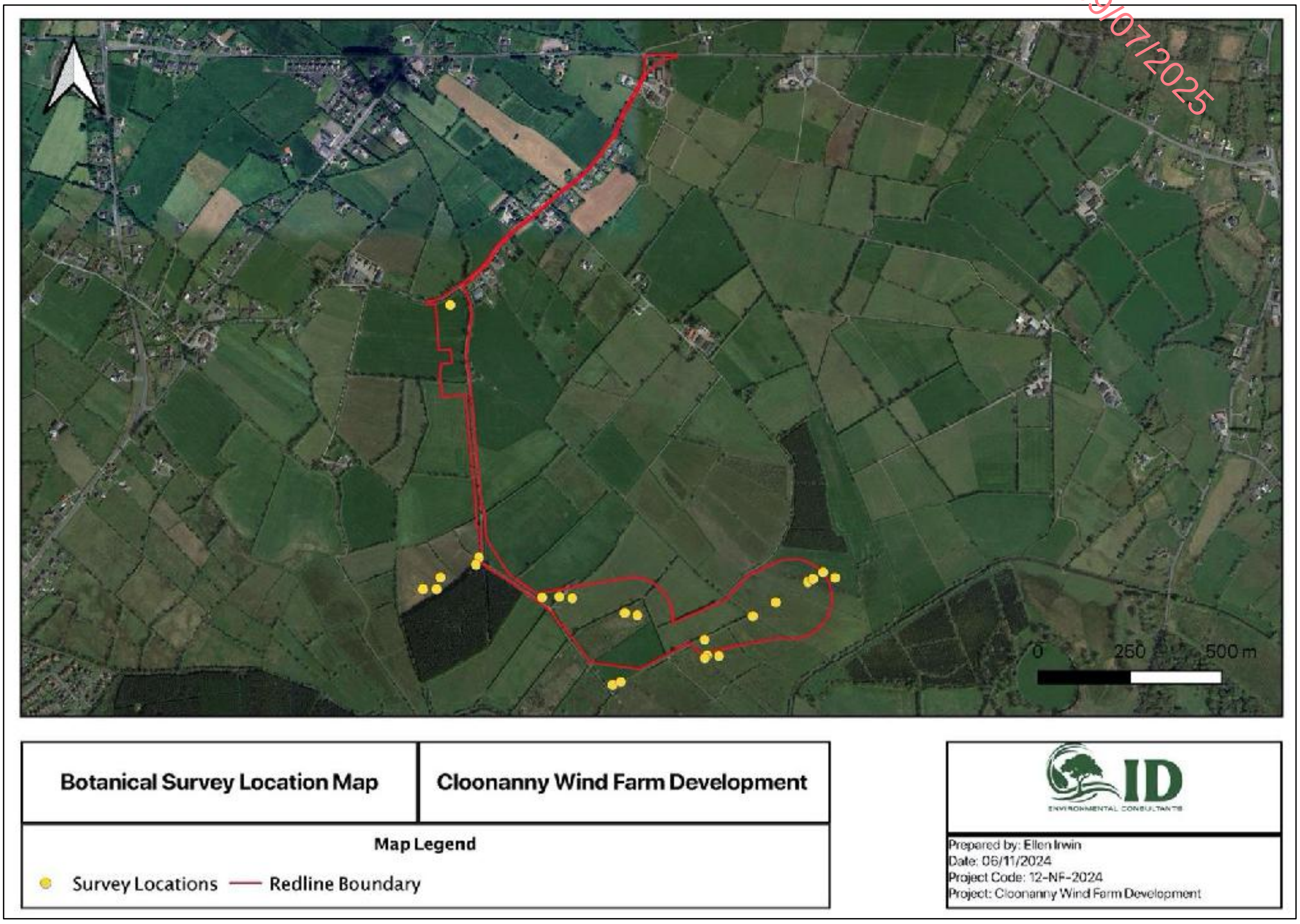
- Fossit (2000) habitat code,
- Notes including additional notes on immediate surrounds which may impact the biodiversity value of the habitat present,
- Photographs of relevé,

Any suspected Annex I habitat was subject to assessment as per:

- Fossitt, J.A. (2000) A Guide to Habitats in Ireland. The Heritage Council, Kilkenny.
- Smith, G.F., O'Donoghue, P., O'Hora, K. and Delaney, E., 2011. Best practice guidance for habitat survey and mapping. The Heritage Council: Ireland.
- Martin, J.R., O'Neill, F.H. & Daly, O.H. (2018) The monitoring and assessment of three EU Habitats Directive Annex I grassland habitats. Irish Wildlife Manuals, No. 102. National Parks and Wildlife Service, Department of Culture, Heritage and the Gaeltacht, Ireland.
- Perrin, P. "ERICA: Engine for Relevés to Irish Communities Assignment." (2020).

Following the survey, the data was analysed using The Irish Vegetation Classification tool ERICA (Engine for Relevés to Irish Communities) (Perrin, 2020) to most appropriately identify the vegetation community present.

Figure 1: Botanical Survey Locations



3. Vegetation Survey Results

Relevé No.	1	
Sample Number	20	
GPS Reference (ITM)	615524	778008
Soil Type	Peaty Silts	
Soil Depth	30cm+	
% Cover Exposed Soils	No	
Average Veg. Height (cm)	5cm	
% Litter Cover	0	
% Standing Water	None at the time of the survey. Known to flood	
Species Inventory	**% Cover**	**Domin**
Alopecurus pratensis	*30*	*6*
Ranunculus repens	*<1*	*2*
Agrostis stolonifera	*30*	*6*
Anthoxanthum odoratum	*18*	*5*
Cardamine pratensis	*3*	*3*
Ranunculus acris	*42*	*7*
Poa annua	*19*	*5*
Galium palustre	*13*	*5*
Juncas effusus	*37*	*7*
Species Richness	9	
Annex 1 Association	No	
Fossitt Classification	GA1/GS4 Improved Agricultural Grassland/Wet Grassland	
Relevé No. 1		

Relevé No.	2	
Sample Number	17	
GPS Reference (ITM)	615361	777907
Soil Type	Peaty Silts	
Soil Depth	30cm+	
% Cover Exposed Soils	No	
Average Veg. Height (cm)	10cm	
% Litter Cover	0	
% Standing Water	None at the time of the survey.	
Species Inventory	**% Cover**	**Domin**
Urtica dioica	*13*	*5*
Equisetum arvense	*3*	*3*
Filipendula ulmaria	*11*	*5*
Phragmites australis	*37*	*7*
Iris pseudacorus	*4*	*3*
Valeriana officinalis	*2*	*3*
Lycopus europaeus	*15*	*5*
Vicia sepium	*3*	*3*
Galium palustre	*<1*	*1*
Juncas effusus	*80*	*9*
Species Richness	10	
Annex 1 Association	No	
Fossitt Classification	FW4 Drainage Ditch	
Relevé No. 2		

Relevé No.	3	
Sample Number	22	
GPS Reference (ITM)	615552	778026
Soil Type	Peaty Silts	
Soil Depth	30cm+	
% Cover Exposed Soils	No	
Average Veg. Height (cm)	3cm	
% Litter Cover	0	
% Standing Water	None at the time of the survey.	
Species Inventory	**% Cover**	**Domin**
Poa annua	80	9
Lolium Perenne	39	7
Ranunculus repens	21	5
Rumex obtusifolius	6	4
Taraxacum officinalis	<1	1
Species Richness	5	
Annex 1 Association	No	
Fossitt Classification	GA1 Improved Agricultural Grassland	
Relevé No. 3		

Relevé No.	4	
Sample Number	21	
GPS Reference (ITM)	615584	778011
Soil Type	Peaty Silts	
Soil Depth	30cm+	
% Cover Exposed Soils	No	
Average Veg. Height (cm)	3cm	
% Litter Cover	0	
% Standing Water	None at the time of the survey.	
Species Inventory	**% Cover**	**Domin**
Poa annua	*80*	*9*
Lolium Perenne	*39*	*7*
Ranunculus repens	*21*	*5*
Rumex obtusifolius	*6*	*4*
Taraxacum officinalis	*<1*	*1*
Juncas spp.	*7*	*4*
Species Richness	6	
Annex 1 Association	No	
Fossitt Classification	GA1 Improved Agricultural Grassland	
Relevé No. 4		

Relevé No.	5	
Sample Number	18	
GPS Reference (ITM)	615423	777944
Soil Type	Peaty Silts	
Soil Depth	30cm+	
% Cover Exposed Soils	No	
Average Veg. Height (cm)	6cm	
% Litter Cover	0	
% Standing Water	None at the time of the survey.	
Species Inventory	**% Cover**	**Domin**
Juncas effusus	*42*	*7*
Galium aparine	*<1*	*2*
Ranunculus repens	*15*	*1*
Rumex obtusifolius	*<1*	*2*
Cardamine pratensis	*<1*	*5*
Rumex acetosa	*<1*	*2*
Molinia caerulea	*39*	*7*
Alopecurus pratensis	*29*	*6*
Species Richness	8	
Annex 1 Association	No	
Fossitt Classification	GA1/GS4 Improved Agricultural Grassland/Wet Grassland	

Relevé No. 5

Relevé No.	6	
Sample Number	17	
GPS Reference (ITM)	615361	777907
Soil Type	Peaty Silts	
Soil Depth	30cm+	
% Cover Exposed Soils	No	
Average Veg. Height (cm)	9cm	
% Litter Cover	0	
% Standing Water	None at the time of the survey.	
Species Inventory	**% Cover**	**Domin**
Phragmites australis	*60*	*8*
Urtica dioica	*47*	*7*
Galium palustre	*<1*	*1*
Lycopus europaeus	*<1*	*1*
Chamaenerion angustifolium	*<1*	*2*
Ranunculus repens	*<1*	*2*
Filipendula ulmaria	*<1*	*1*
Calystegia sepium	*<1*	*1*
Species Richness	8	
Annex 1 Association	No	
Fossitt Classification	FW4 Drainage Ditches	
Relevé No.6		

Relevé No.	7	
Sample Number	13	
GPS Reference (ITM)	615230	777842
Soil Type	Peaty Silts	
Soil Depth	30cm+	
% Cover Exposed Soils	No	
Average Veg. Height (cm)	9cm	
% Litter Cover	0	
% Standing Water	None at the time of the survey.	
Species Inventory	**% Cover**	**Domin**
Juncas effusus	*43*	*7*
Holcus lanatus	*20*	*5*
Agrostis capillaris	*10*	*4*
Rumex obtusifolius	*2*	*3*
Ranunculus repens	*<1*	*2*
Poa annua	*3*	*3*
Cerastium glomeratum	*<1*	*2*
Veronica agrestis	*<1*	*2*
Cirsium palustre	*6*	*4*
Molinia caerulea	*2*	*3*
Species Richness	10	
Annex 1 Association	No	
Fossitt Classification	BL3/GS4 Buildings And Artificial Surfaces/Wet Grassland	
Relevé No.7		

Relevé No.	8	
Sample Number	14	
GPS Reference (ITM)	615269	777798
Soil Type	Peaty Silts	
Soil Depth	30cm+	
% Cover Exposed Soils	No	
Average Veg. Height (cm)	10cm	
% Litter Cover	0	
% Standing Water	None at the time of the survey.	
Species Inventory	**% Cover**	**Domin**
Juncas effusus	*65*	*8*
Ranunculus acris	*4*	*3*
Trifolium repens	*57*	*8*
Anthoxanthum odoratum	*<1*	*2*
Luzula campestris	*<1*	*2*
Bryophyta	*81*	*9*
Holcus lanatus	*<1*	*2*
Molinia caerulea	*2*	*3*
Potentilla erecta	*<1*	*1*
Cynosurus cristatus	*2*	*3*
Species Richness	10	
Annex 1 Association	No	
Fossitt Classification	GS4 Wet Grassland	
Relevé No. 8		

Relevé No.	9	
Sample Number	15	
GPS Reference (ITM)	615237	777800
Soil Type	Peaty Silts	
Soil Depth	30cm+	
% Cover Exposed Soils	No	
Average Veg. Height (cm)	10cm	
% Litter Cover	0	
% Standing Water	None at the time of the survey.	
Species Inventory	**% Cover**	**Domin**
Juncas effusus	*3*	*3*
Ranunculus acris	*<1*	*2*
Trifolium repens	*<1*	*2*
Ranunculus repens	*4*	*3*
Ranunculus flammula	*7*	*4*
Juncas spp.	*14*	*5*
Holcus lanatus	*<1*	*2*
Bryophyta	*82*	*9*
Jacobaea aquatica	*<1*	*1*
Cynosurus cristatus	*2*	*3*
Molinia caerulea	*28*	*6*
Alopecurus geniculatus	*<1*	*2*
Species Richness	12	
Annex 1 Association	No	
Fossitt Classification	GS4 Wet Grassland	

Relevé No.	10	
Sample Number	16	
GPS Reference (ITM)	615231	777793
Soil Type	Peaty Silts	
Soil Depth	30cm+	
% Cover Exposed Soils	No	
Average Veg. Height (cm)	10cm	
% Litter Cover	0	
% Standing Water	None at the time of the survey.	
Species Inventory	**% Cover**	**Domin**
Juncas effusus	*4*	*3*
Rubus fructicosus	*85*	*9*
Filipendula ulmaria	*8*	*4*
Vicia sepium	*<1*	*2*
Agrostis stolonifera	*3*	*3*
Anthoxanthum odoratum	*3*	*3*
Holcus lanatus	*4*	*3*
Species Richness	7	
Annex 1 Association	No	
Fossitt Classification	WL1 Hedgerow	
Relevé No. 10		

Relevé No.	11	
Sample Number	12	
GPS Reference (ITM)	615003	777727
Soil Type	Peaty Silts	
Soil Depth	30cm+	
% Cover Exposed Soils	No	
Average Veg. Height (cm)	<10cm	
% Litter Cover	0	
% Standing Water	None at the time of the survey.	
Species Inventory	**% Cover**	**Domin**
Arrhenatherum elatius	*22*	*5*
Setaria italica	*6*	*4*
Chamaenerion angustifolium	*20*	*5*
Urtica dioica	*7*	*4*
Vicia sepium	*3*	*3*
Rubus spp.	*3*	*3*
Fern Spp.	*6*	*4*
Cirsium arvense	*2*	*3*
Prunus spinosa	*6*	*4*
Species Richness	9	
Annex 1 Association	No	
Fossitt Classification	WL1/GS2 Hedgerow/Dry Meadows and Grassy Verges	
Relevé No. 11		

Relevé No.	12	
Sample Number	11	
GPS Reference (ITM)	614980	777719
Soil Type	Peaty Silts	
Soil Depth	30cm+	
% Cover Exposed Soils	No	
Average Veg. Height (cm)	>3cm	
% Litter Cover	0	
% Standing Water	None at the time of the survey.	
Species Inventory	**% Cover**	**Domin**
Poa annua	*40*	*7*
Lolium perenne	*39*	*7*
Ranunculus repens	*7*	*4*
Ranunculus acris	*<1*	*1*
Species Richness	4	
Annex 1 Association	No	
Fossitt Classification	GA1 Improved Agricultural Grassland	
Relevé No. 12		

Relevé No.	13	
Sample Number	2	
GPS Reference (ITM)	614588	778049
Soil Type	Peaty Silts	
Soil Depth	30cm+	
% Cover Exposed Soils	No	
Average Veg. Height (cm)	5cm	
% Litter Cover	0	
% Standing Water	None at the time of the survey.	
Species Inventory	**% Cover**	**Domin**
Potentilla anserina	*5*	*4*
Carex rostrata	*2*	*3*
Ranunculus repens	*80*	*9*
Ranunculus acris	*3*	*3*
Holcus lanatus	*19*	*5*
Poa annua	*20*	*5*
Trifolium repens	*24*	*5*
Trifolium pratense	*16*	*5*
Lotus corniculatus	*13*	*5*
Rumex obtusifoius	*<1*	*2*
Species Richness	10	
Annex 1 Association	No	
Fossitt Classification	GA1 Improved Agricultural Grassland	
Relevé No. 13		

Relevé No.	14	
Sample Number	2	
GPS Reference (ITM)	614616	778063
Soil Type	Peaty Silts	
Soil Depth	30cm+	
% Cover Exposed Soils	No	
Average Veg. Height (cm)	10cm	
% Litter Cover	0	
% Standing Water	None at the time of the survey.	
Species Inventory	**% Cover**	**Domin**
Urtica dioica	*80*	*9*
Anthriscus sylvestris	*3*	*3*
Galium aparine	*17*	*5*
Euonymus europaeus	*7*	*4*
Crataegus monogyna	*5*	*4*
Rubus fructicosus	*21*	*5*
Rosa cania	*2*	*3*
Lonicera periclymenum	*2*	*3*
Crataegus monogyna	*2*	*3*
Salix caprea	*3*	*3*
Species Richness	10	
Annex 1 Association	No	
Fossitt Classification	WL1 Hedgerow	
Relevé No. 14		

Relevé No.	15	
Sample Number	3	
GPS Reference (ITM)	614607	778044
Soil Type	Peaty Silts	
Soil Depth	30cm+	
% Cover Exposed Soils	No	
Average Veg. Height (cm)	7cm	
% Litter Cover	0	
% Standing Water	None at the time of the survey.	
Species Inventory	**% Cover**	**Domin**
Juncas spp.	*84*	*9*
Ranunculus repens	*2*	*3*
Holcus lanatus	*3*	*3*
Centaurea nigra	*<1*	*2*
Trifolium repens	*<1*	*2*
Silene flos-cuculi	*2*	*3*
Ranunculus flammula	*2*	*3*
Ranunculus acris	*3*	*3*
Anthoxanthum odoratum	*3*	*3*
Trifolium campestre	*<1*	*1*
Species Richness	10	
Annex 1 Association	No	
Fossitt Classification	GS4 Wet Grassland	
Relevé No. 15		

Relevé No.	16	
Sample Number	4	
GPS Reference (ITM)	614511	778009
Soil Type	Peaty Silts	
Soil Depth	30cm+	
% Cover Exposed Soils	No	
Average Veg. Height (cm)	5cm	
% Litter Cover	0	
% Standing Water	None at the time of the survey.	
Species Inventory	**% Cover**	**Domin**
Carex echinata	2	*3*
Dactylorhiza maculata	7	*4*
Succisa pratensis	29	*6*
Pedicularis sylvatica	8	*4*
Luzula multiflora	10	*4*
Potentilla erecta	43	*7*
Trifolium repens	2	*3*
Leontodon spp.	2	*3*
Anthoxanthum odoratum	28	*6*
Juncas spp.	22	*5*
Holcus lanatus	4	*3*
Carex pilulifera	15	*5*
Trifolium campestre	17	*5*
Molinia caerulea	<1	*2*
Hypnales	87	*9*
Carex hirta	2	*3*
Species Richness	16	
Annex 1 Association	No	
Fossitt Classification	GS4 Wet Grassland	

Relevé No. 16	

Relevé No.	17	
Sample Number	5	
GPS Reference (ITM)	614501	777977
Soil Type	Peaty Silts	
Soil Depth	30cm+	
% Cover Exposed Soils	No	
Average Veg. Height (cm)	6cm	
% Litter Cover	0	
% Standing Water	None at the time of the survey.	
Species Inventory	**% Cover**	**Domin**
Luzula multiflora	<1	*1*
Dactylorhiza maculata	<1	*1*
Carex nigra	<1	*1*
Cirsium dissectum	13	*5*
Juncas Spp.	67	*8*
Mentha aquatica	14	*5*
Filipendula ulmaria	5	*4*
Potentilla erecta	5	*4*
Ranunculus acris	6	*4*
Plantago	<1	*2*
Succisa pratensis	<1	*2*
Anthoxanthum odoratum	7	*4*
Cynosurus cristatus	5	*4*
Lathyrus pratensis	<1	*2*
Trifolium repens	7	*4*
Ranunculus flammula	<1	*2*
Carex hirta	2	*3*
Species Richness	17	
Annex 1 Association	No	
Fossitt Classification	GS4 Wet Grassland	

Relevé No.	18	
Sample Number	6	
GPS Reference (ITM)	614464	777977
Soil Type	Peaty Silts	
Soil Depth	30cm+	
% Cover Exposed Soils	No	
Average Veg. Height (cm)	7cm	
% Litter Cover	0	
% Standing Water	None at the time of the survey.	
Species Inventory	**% Cover**	**Domin**
Equisetum spp.	*<1*	*1*
Silene flos-cuculi	*<1*	*1*
Comarum palustre	*14*	*5*
Cirsium dissectum	*8*	*4*
Succisa pratensis	*12*	*5*
Ranunculus flammula	*3*	*3*
Anthoxanthum odoratum	*<1*	*2*
Carex panicea	*2*	*3*
Juncus conglomeratus	*8*	*4*
Mentha aquatica	*6*	*4*
Ranunculus acris	*3*	*3*
Cardamine pratensis	*<1*	*2*
Carex nigra	*<1*	*2*
Plantago	*<1*	*1*
Hypochaeris	*<1*	*2*
Cirsium palustre	*<1*	*2*
Trifolium pratense	3	*3*
Potentilla erecta	5	*4*
Filipendula ulmaria	<1	*2*
Cyperus esculentus	<1	*2*
Trifolium campestre	2	*3*
Lathyrus pratensis	3	*3*
Galium palustre	3	*3*
Luzula multiflora	4	*3*
Calliergonella cuspidata	62	*8*
Species Richness	25	
Annex 1 Association	No	
Fossitt Classification	GS4 Wet Grassland	

Relevé No.	19	
Sample Number	6B	
GPS Reference (ITM)	614462	778043
Soil Type	Peaty Silts	
Soil Depth	30cm+	
% Cover Exposed Soils	No	
Average Veg. Height (cm)	7cm	
% Litter Cover	0	
% Standing Water	None at the time of the survey.	
Species Inventory	**% Cover**	**Domin**
Plantago	8	*4*
Juncas Spp.	70	*8*
Ranunculus repens	14	*5*
Ranunculus acris	29	*6*
Molinia caerulea	6	*4*
Centaurea nigra	7	*4*
Trifolium repens	8	*4*
Trifolium campestre	8	*4*
Filipendula ulmaria	6	*4*
Lathyrus pratensis	5	*4*
Plantago major	3	*3*
Succisa pratensis	3	*3*
Dactylorhiza maculata	2	*3*
Galium palustre	<1	*2*
Holcus lanatus	9	*4*
Festuca pratensis	<1	*2*
Species Richness	16	
Annex 1 Association	No	
Fossitt Classification	GS4 Wet Grassland	

Relevé No.	20	
Sample Number	6C	
GPS Reference (ITM)	614458	777986
Soil Type	Peaty Silts	
Soil Depth	30cm+	
% Cover Exposed Soils	No	
Average Veg. Height (cm)	7cm	
% Litter Cover	0	
% Standing Water	None at the time of the survey.	
Species Inventory	**% Cover**	**Domin**
Luzula multiflora	5	*4*
Cynosurus cristatus	15	*5*
Ranunculus repens	6	*4*
Juncas Spp.	82	*9*
Anthoxanthum odoratum	29	*6*
Carex panicea	26	*6*
Filipendula ulmaria	<1	*2*
Trifolium campestre	7	*4*
Ranunculus repens	8	*4*
Cyperus esculentus	<1	*2*
Carex nigra	<1	*2*
Lotus corniculatus	6	*4*
Plantago lanceolata	15	*5*
Lathyrus pratensis	14	*5*
Molinia caerulea	3	*3*
Ranunculus flammula	2	*3*
Centaurea	6	*4*
Species Richness	17	
Annex 1 Association	No	
Fossitt Classification	GS4 Wet Grassland	

Relevé No.	21	
Sample Number	7	
GPS Reference (ITM)	614788	777956
Soil Type	Peaty Silts	
Soil Depth	30cm+	
% Cover Exposed Soils	No	
Average Veg. Height (cm)	3cm	
% Litter Cover	0	
% Standing Water	None at the time of the survey.	
Species Inventory	**% Cover**	**Domin**
Lolium Perenne	95	*10*
Rumex spp.	4	*3*
Holcus lanatus	4	*3*
Poa annua	8	*4*
Ranunculus repens	3	*3*
Species Richness	5	
Annex 1 Association	No	
Fossitt Classification	GA1 Improved Agricultural Grassland	
Relevé No. 21:		

Relevé No.	22	
Sample Number	8	
GPS Reference (ITM)	614835	777958
Soil Type	Peaty Silts	
Soil Depth	30cm+	
% Cover Exposed Soils	No	
Average Veg. Height (cm)	10cm	
% Litter Cover	0	
% Standing Water	None at the time of the survey.	
Species Inventory	**% Cover**	**Domin**
Rubus fructicosus	69	*8*
Vicia sepium	43	*7*
Arrhenatherum elatius	40	*7*
Holcus lanatus	28	*6*
Urtica dioica	4	*3*
Galium aparine	<1	*2*
Species Richness	6	
Annex 1 Association	No	
Fossitt Classification	WL1 Hedgerow	
Relevé No. 22:		

Relevé No.	23	
Sample Number	9	
GPS Reference (ITM)	614869	777954
Soil Type	Peaty Silts	
Soil Depth	30cm+	
% Cover Exposed Soils	No	
Average Veg. Height (cm)	3cm	
% Litter Cover	0	
% Standing Water	None at the time of the survey.	
Species Inventory	**% Cover**	**Domin**
Lolium Perenne	86	*9*
Holcus lanatus	3	*3*
Poa annua	4	*6*
Trifolium repens	<1	*1*
Taraxacun officinale	<1	*2*
Species Richness	5	
Annex 1 Association	No	
Fossitt Classification	GA1 Improved Agricultural Grassland	
Relevé No: 23		

Relevé No.	24	
Sample Number	1	
GPS Reference (ITM)	614535	778749
Soil Type	Peaty Silts	
Soil Depth	30cm+	
% Cover Exposed Soils	No	
Average Veg. Height (cm)	4cm	
% Litter Cover	0	
% Standing Water	None at the time of the survey.	
Species Inventory	**% Cover**	**Domin**
Lolium Perenne	30	*6*
Holcus lanatus	3	*3*
Poa annua	4	*6*
Species Richness	3	
Annex 1 Association	No	
Fossitt Classification	GA1 Improved Agricultural Grassland	
Relevé No: 24		

Relevé No.	25	
Sample Number	T1	
GPS Reference (ITM)	615050	777917
Soil Type	Peaty Silts	
Soil Depth	30cm+	
% Cover Exposed Soils	No	
Average Veg. Height (cm)	5cm	
% Litter Cover	0	
% Standing Water	None at the time of the survey.	
Species Inventory	**% Cover**	**Domin**
Juncas acutiflorus	*13*	*5*
Holcus lanatus	*64*	*8*
Festuca rubra	*30*	*6*
Ranunculus repens	*3*	*3*
Agrostis stolonifera	*7*	*4*
Anthoxanthum odoratum	*5*	*4*
Ranunculus acris	*6*	*4*
Trifolium repens	*27*	*6*
Potentilla erecta	*15*	*5*
Trifolium pratense	*2*	*3*
Lotus corniculatus	*26*	*6*
Succisa pratensis	*4*	*3*
Juncas bufonius	*<1*	*2*
Species Richness	13	
Annex 1 Association	No	
Fossitt Classification	GA1/GS4 Improved Agricultural Grassland/Wet Grassland	
Relevé No: 25		

Relevé No.	26	
Sample Number	T1 B	
GPS Reference (ITM)	615005	777918
Soil Type	Peaty Silts	
Soil Depth	30cm+	
% Cover Exposed Soils	No	
Average Veg. Height (cm)	5cm	
% Litter Cover	0	
% Standing Water	None at the time of the survey.	
Species Inventory	**% Cover**	**Domin**
Rumex acetosa	*3*	*3*
Chamaenerion angustifolium	*2*	*3*
Holcus lanatus	*84*	*9*
Ranunculus repens	*3*	*3*
Agrostis stolonifera	*4*	*3*
Rubus fruticosus	*<1*	*2*
Ranunculus acris	*2*	*3*
Trifolium repens	*2*	*3*
Juncas bufonius	*<1*	*2*
Plantago major	*<1*	*2*
Lotus corniculatus	*4*	*3*
Festuca rubra	*6*	*4*
Juncas acutiflorus	*<1*	*2*
Species Richness	13	
Annex 1 Association	No	
Fossitt Classification	GA1/GS4 Improved Agricultural Grassland/Wet Grassland	
Relevé No: 26		

APPENDIX 10.5
ANNEX I GRASSLAND

VOLUME III
APPENDICES TO
ENVIRONMENTAL IMPACT ASSESSMENT REPORT

RFI Response July 2025

Annex I Grassland
Molinia meadows Surveys
(EU Habitats Directive code 6410)

Date: 26/07/2023
By: Louise Mac Elwain

1 Background

Molinia meadow is a distinctive wet grassland community characterised by a relatively species-rich sward which is generally between 20 and 60 cm tall. The grass *Molinia caerulea* is usually prominent, however the species should not dominate. Many areas of Molinia meadow are grazed by livestock which helps maintain the species-richness of the vegetation. The habitat is widely distributed in Ireland however most examples are in the west and north of the island. The main threats to the habitat are generally agricultural intensification, under-grazing and afforestation.

2 Statement of Authority

Field assessment surveys were undertaken by Louise Mac Elwain (B.Sc., M.Sc.) of Flynn Furney Environmental Consultants and Ian Douglas (B.Sc., M.Sc.) of ID Environmental Consultants.

Ian is an Ecologist and Environmental consultant with over 10 years' experience in appropriate assessment, ecological impact assessment, habitats assessment, soil science, GIS mapping and regenerative agriculture. Ian has worked on projects including large road developments, power infrastructure projects, planning applications, planning and design of nature trails, constructed wetland creation and on farm habitat development. Ian previously worked in Ecology and Agriculture in England and Australia before taking a position with Flynn, Furney Environmental Consultants in 2018. With whom he retains a position as Associate Director. Ian formed ID Environmental Consultants in 2021.

3 Site

The Proposed Development is located in the townlands of Cloonanny Glebe (Cluain Eanaigh), Corragarrow, Derryharrow and Gorteenorna in Co. Longford. The site has been used as agricultural grassland for grazing and shows signs of soil compaction due to high stocking density which has reduced species richness in the sward. Part of the site contains alluvium soil which can be indicative of wetland habitats and increased species richness (See Figure 1).

Figure 1: Wetland indicating sediment (alluvium soil) is indicated in peach

4 Methodology

The species listed in Appendix A are characteristic of Molinia meadows in Ireland. They have been developed based on scientific analysis of hundreds of relevés (=vegetation surveys) (Conaghan *et al.*, 2020). If a Molinia meadow is in good condition, it will typically have at least seven positive indicator species, with at least one of these being a high-quality indicator. For further info: Irish Semi-natural Grasslands Survey (O'Neill *et al.,* 2013).

Five different survey plots were randomly chosen using a 2x2 meter quadrat. The Domin scale (Figure 2) was used to identify the percentage cover of all species within the quadrat. Results were compared to the positive indicator species listed in the table in Appendix B.

Domin Scale Number	Cover Percentage (%)
10	91–100%
9	76–90%
8	51–75%
7	34–50%
6	26–33%
5	11–25%
4	4–10%
3	<4% (many individuals)
2	<4% (several individuals)
1	<4% (few individuals)

Figure 2: The Domin Scale.

5 Results

The results from each of the 5 quadrats are listed below.

*Table 1: The table below lists species identified in each quadrat and their Domin number. * Designates a positive indicator species, ** indicated a HQ indicator species.*

Quadrat 1		Quadrat 2		Quadrat 3		Quadrat 4		Quadrat 5	
Species	**D**	**Species**	**D**	**Species**	**D**	**Species**	**D**	**Species**	**D**
Star Sedge*	3	Heath woodrush*	3	Horsetail	3	Plantain	4	Heath Woodrush *	4
Heath Orchid**	1	Heath Orchid**	3	Ragged Robin	3	Meadow buttercup	6	Crested dogstail	5
Devils-bit*	6	Common sedge *	3	Marsh cinquefoil	5	Creeping buttercup	5	Sharp-flowered rush	9
Lousewort	4	Meadow Thistle **	5	Meadow Thistle **	4	Purple Moore grass *	4	Sweet vernal grass	6
Heath Woodrush *	4	Sharp-flowered rush *	8	Devils-bit Scabious *	5	Jointed Rush *	2	Carnation sedge *	6
Tormentil *	7	Water mint *	5	Lesser spearwort *	3	Knapweed	3	Meadowsweet *	2
Sweet vernal grass	6	Meadowsweet*	4	Sweet vernal grass	2	Clover	4	Creeping Buttercup	4
Sharp-flowered rush*	5	Tormentil *	4	Carnation sedge *	3	Meadowsweet *	4	Yellow sedge *	2
Yorkshire fog	3	Meadow buttercup	4	Compact Rush **	4	Meadow vetchling	4	Common sedge *	3
Yellow sedge*	5	Ribwort Plantain	2	Water mint *	4	Broadleaf plantain	3	Birds foot trefoil	4
Hop trefoil	3	Devils-bit Scabious *	3	Meadow buttercup	3	Devils-bit scabious *	3	Ribwort planting	5
White clover	3	Sweet vernal grass	4	Lady's Smock	3	Heath spotted orchid **	3	Meadow vetchling	5
Hairy sedge	3	Crested dogs-tail	4	Common sedge	3	Marsh bedstraw *	2	Purple moor grass *	3
Moss	8	Meadow vetchling	2	Plantain	2	Yorkshire Fog	4	Lesser spearwort *	3
		White Clover	3	Cat's ear	2	Meadow fescue	3	Knapweed	2
		Lesser spearwort *	2	Marsh thistle	3				
		Hairy sedge *	3	Red Clover	3				
				Tormentil *	4				

				Meadowsweet *	2				
				Yellow sedge *	2				
				Hop trefoil	3				
				Meadow vetchling	3				
				Marsh bedstraw *	3				
				Heath Woodrush *	3				
				Moss cover	8				
3 PI species		**9 PI species**		**9 PI species**		**3 PI species**		**6 PI species**	
1 HQ species		**2 HQ species**		**2 HQ species**		**1 HQ species**		**0 HQ species**	

6 Conclusion

Both quadrat 2 and quadrat 3 have sufficient number of species to qualify as Annex 1 Molinia meadow. The area is also suffering from soil compaction due to high stocking densities which have negative impacts on wetland habitats.

Areas of grassland marked by alluvium (wetland indicating) soils in figure 1 were the most species rich areas and should be prioritised for conservation.

The presence of marsh fritillary in this grassland habitat is an additional reason for its conservation. Marsh fritillary is found in wet or marshy areas. It is Ireland's only protected species of butterfly and is protected under Annex II of the European Union Habitats and Species Directive.

7 References

Conaghan, J., Hamilton, J., Cole, E. & Pierce, S..(2020). BSBI Ireland Annex I Grassland Resources. The Irish Grasslands Project.

O'Neill, F.H., Martin, J.R., Devaney, F.M. & Perrin, P.M. (2013) The Irish semi-natural grasslands survey 2007-2012. Irish Wildlife Manuals, No. 78. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Ireland

Appendix A: Molinia meadow Indicator species.

High Quality Indicator Species		Positive Indicator Species	
Scientific Name	**Common Name**	**Scientific Name**	**Common Name**
Carex pulicaris	Flea Sedge	*Achillea ptarmica*	Sneezewort
Carum verticillatum	Whorled Caraway	*Carex echinata*	Star Sedge
Cirsium dissectum	Meadow Thistle	*Carex flacca*	Glaucous Sedge
Crepis paludosa	Marsh Hawk's-beard	*Carex nigra*	Common Sedge
Galium uliginosum	Fen Bedstraw	*Carex panicea*	Carnation Sedge
Juncus conglomeratus	Compact Rush	*Carex viridula*	Yellow Sedge
Lathyrus palustris	Marsh Pea	*Equisetum palustre*	Marsh Horsetail
Ophioglossum vulgatum	Adder's-tongue Fern	*Filipendula ulmaria*	Meadowsweet
Viola persicifolia	Fen Violet	*Galium palustre*	Marsh Bedstraw
Orchid species		*Juncus acutiflorus*	Sharp-flowered Rush
		Juncus articulatus	Jointed Rush
		Lotus pedunculatus	Greater Bird's-foot-trefoil
		Luzula multiflora	Heath Wood-rush
		Mentha aquatica	Water Mint
		Molinia caerulea	Purple Moor-grass
		Potentilla anglica	Trailing Tormentil
		Potentilla erecta	Tormentil
		Ranunculus flammula	Lesser Spearwort
		Succisa pratensis	Devil's-bit Scabious
		Viola palustris	Marsh Violet

Appendix B: Photos

	
Abundant Heath orchids (High quality indicator)	**Meadow thistle (High Quality Indicator)**
	
Marsh Fritillary (Annex II species)	**Marsh Fritillary (Annex II species)**

RECEIVED: 09/07/2025

APPENDIX 10.6

AQUATIC ECOLOGY REPORT

VOLUME III

APPENDICES TO ENVIRONMENTAL IMPACT ASSESSMENT REPORT

RFI Response July 2025

CLOONANNY WINDFARM, Co LONGFORD

AQUATIC ECOLOGICAL ASSESSMENT

EirEco Environmental Consultants
October 2024

Introduction

This report presents an assessment of the existing aquatic ecological environment at and in the vicinity of the Proposed Development.

A brief summary of the development is outlined below. A detailed description of the Proposed Development is contained within Chapter 2 of this EIAR and the Planning Statement that accompanies the application. The statutory notices should also be referred to.

A 10-year permission is being sought by Natural Forces Renewable Energy 2 Limited for the development of a 14MW wind farm to be located in the townland of Cloonanny Glebe, Co. Longford.

The proposed development will consist of the following:

i. Demolition of a single-storey derelict shed structure (c. 93 sqm GFA) to facilitate the turbine haul route
ii. Construction of two E175 EP5 wind energy converters, each with an electrical rating of 7MW, an overall ground-to-blade tip height of 199.9 metres, a rotor blade diameter of 175 metres, hub height of 112.4 metres, associated foundations and hard-standing areas;
iii. Construction of an 800m permanent internal site access road which will run from the L50462 to the wind energy converter hardstanding areas including a 9.1m clear span bridge crossing a local stream;
iv. Construction of 1 No. meteorological mast with a height of 32 metres, associated foundation and hardstanding area;
v. Construction of 1 No. 20kV substation compound comprising 2 No. Modular Buildings each measuring 13.5 sqm in area and 3.5m in height, a Battery Energy Storage System (BESS) comprising 3 storage modules with a height of 2.8 metres and associated electrical works, foundation and hardstanding area;
vi. Temporary alterations to the L5046 and L50462 public roads and temporary access roads to facilitate the turbine component haul route, including temporary widening of sections of the L5046 and L50462.
vii. Installation of underground collector circuit and communications cabling in underground cable trenches, from the proposed wind energy converter to the proposed on-site substation;
viii. All associated and ancillary site development, excavation, construction, and reinstatement works, including the provision of a temporary construction compound, site drainage, spoil management, fencing, lighting, hedge and operational maintenance and tree trimming and cutting.

ix. This application is seeking a 35- year operational life from the date of commissioning of the entire wind farm.

The Proposed Development will have an operational lifespan of 35-years from the date of commissioning.

The report was prepared by Paul Murphy of EirEco Environmental Consultants. Paul holds an MSc in Environmental Science and a Diploma in Aquatic Biology, is a Chartered Environmentalist (Society for the Environment), a full member of the Chartered Institute of Ecology and Environmental Management and a member of the Institute of Fisheries Management. Paul has been operating in the environmental field for over three decades covering a broad range of projects in a variety of countries.

Methodology

A survey was undertaken to establish the type and distribution of aquatic habitats and ecological sensitivities in the vicinity of the proposed development. Prior to undertaking the field survey, the surface water network was identified from the EPA Map viewer (https://gis.epa.ie/EPAMaps/Water). The habitats along the watercourses within the study area were examined using aerial photography (Bing and Google) to ascertain the distribution and boundaries of aquatic and marginal habitat types.

The survey was undertaken on the 2nd August 2023. This survey follows Transport Ireland Infrastructure guidance (TII, 2009) and aquatic habitats were classified using the Heritage Council classification (Fossitt, 2000).

The survey aimed to identify any rare or protected aquatic plant species listed under the Flora Protection Order (2022) and invasive species listed under the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations 2011.

The survey recorded the following key characteristics along the length of the study area:

- Channel width, depth and bank-side profile.
- Substrate type.
- Flow type (riffle, glide or pool).
- In-stream macrophyte and bryophyte cover.
- Riparian habitats and species composition.

The river channel morphology, substrate and flow regime was used to determine the suitability of the habitat for spawning or as nursery habitat by salmonids and other species including coarse fish and lamprey. Dip-netting was used in areas of soft sediment to check for lamprey ammocoete larvae and also to determine the presence of invasive species. The aquatic macrophyte vegetation was assessed by a combination of visual observation and sampling with a grapnel.

Otter activity was assessed by visually looking for tracks, resting and breeding spots, latrines, etc. Spraints are typically deposited at prominent features (boulders, logs, bridges, etc.) and can remain intact for several weeks. The survey aimed to determine the presence of otter activity, and to identify the location of breeding holts and lie-up couches.

Suitable banks were checked for evidence of Kingfisher nest sites, which are typically found in steep to over-hanging banks with exposed soils or alluvial deposits.

Results

Description of existing Aquatic Environment

The Proposed Development is bounded to the south by the Camlin River. A number of streams and small drains flow in a general southerly direction to the Camlin, the most significant one being the Derryharrow Stream. This flows adjacent to the access road to the site off the L5046 road, and will be crossed on the access to the most easterly turbine. A number of field drains run through the site which discharge into the Camlin River and the Derryharrow Stream. The drainage network with the indicative locations of the proposed turbines is shown in Figure 1 below.

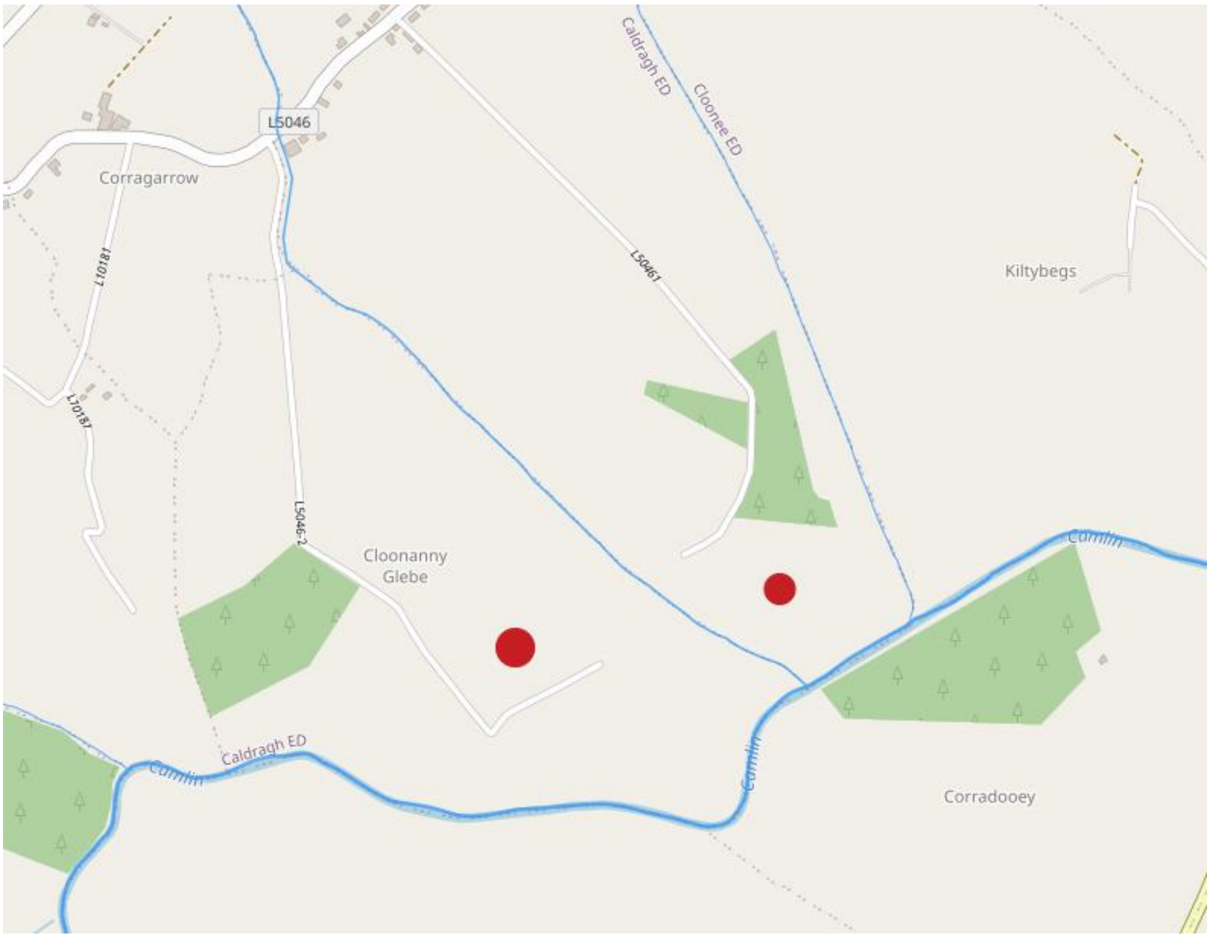


Figure 1. Surface water features in the vicinity of the proposed development (turbines in red). ***(Source: EPA Maps)***

Camlin River

The Camlin River is within the Shannon River Basin District. It rises near Granard, and flows in a westerly direction through Longford, reaching the River Shannon near Newtown Forbes. In the vicinity of the proposed development the river is classified as a Depositing Lowland River (FW2) approximately 12m in width with a depth of c1m (Figure 2). The river has previously been exposed to drainage and artificial straightening, giving it modified banks along the proposed development site and as far down as the N4 bridge. The flow regime is unsuited for spawning by Brown trout which require riffle habitat. A narrow band of Tall Herb Swamp (FS2) Reed-canary Grass (*Phalaris arundinacea*) occurs along the base of the bank, with occasional Water Dock (*Rumex hydrolapathum*), Bulrush (*Schoenoplectus lacustris*) and Branched bur-reed (*Sparganium erectum*).

Figure 2. Camlin River in the vicinity of the proposed development site at Cloonanny.

Inland Fisheries Ireland (IFI) undertook an electro-fishing survey at eighteen sites along the length of the Camlin River in August 2011 (Gordon *et al.*, 2021). A total of ten fish species were recorded during the survey. Three-spined stickleback were the most common species, captured at 14 (78%) sites across the catchment, followed by brown trout, recorded at 12 (67%) sites. Four age classes (0+, 1+, 2+ and 3+) were present, with 0+ the most abundant age class recorded. Stone loach were recorded at four sites (n=19), pike at three sites (n=9), roach (n=119), gudgeon (n=17) and nine-spined stickleback (n=4) at two sites each and perch (n=6), lamprey (n=1) and minnow (n=1) at one site each. While the lamprey species was undifferentiated, in the inland location it is assumed to be Brook Lamprey (*Lampetra planeri*). In addition to the recorded species, it is expected that European Eel (*Anguilla anguilla*) will be present in the river.

Using the Water Framework Directive fish classification tool developed for Irish rivers (SNIFFER 2011), three sites achieved Good status, five achieved Moderate status, and ten were assigned Poor status. The reasons for the failures in fish ecological status were due to lower-than-expected abundance of type specific indicator species (e.g., brown trout), absence of certain age cohorts indicating recruitment failures and/or the presence of a relatively high abundance of tolerant fish species (e.g. three-spined stickleback). Failures and deteriorations in fish ecological status were likely caused by pressures such as nutrient enrichment, habitat modification and fish passage issues.

The Camlin River historically supported a population of the Annex II (EU Habitats Directive) White-clawed Crayfish (*Austropotamobius pallipes*). The most recent records on the National Biodiversity Data Centre website for the river however date to 2014. Over the last decade, outbreaks of Crayfish Plague have decimated populations of crayfish in a number of Irish rivers and lakes, and the lack of more recent records (post 2014) suggest that the Camlin River may have been affected.

No evidence of Otter (*Lutra lutra*) activity was recorded along the river during the survey in August 2023, though regular occurrence is expected on account of the suitability of the habitat and the abundant fish stocks. There was no potentially suitable holt sites recorded in the vicinity of the proposed development.

Kingfisher (*Alcedo athis*), a piscivorous species typically feeding on slow moving waters, are afforded protection on Annex I to the EU Birds Directive and are Amber listed under the Birds of Conservation Concern in Ireland (BoCCI) by BirdWatch Ireland. Their nesting requirements are quite specific, preferring a steep to over-hanging bank of exposed clay or sand adjacent to water. No nest sites were noted on or in the immediate vicinity of the proposed development on any watercourses, though occurrence of Kingfisher is expected along the Camlin River and probably in the lower reaches of the Derryharrow Stream also.

Derryharrow Stream

The Derryharrow Stream rises in the townland of Leitrim, approximately 5km upstream from its confluence with the Camlin River. The stream flows adjacent to the access road to the proposed development from the L5046 road. It has a base width of approx. 1m with a shallow riffle flow over gravel and cobble (Figure 2). The stream runs adjacent to the access road from the L5046 road for a distance of approx. 200m where it is flanked by scattered Ash (*Fraxinus excelsior*) and a low hedge of Hawthorn (*Crataegus monogyna*), Blackthorn (*Prunus spinosa*) and occasional young Sycamore (*Acer pseudoplatanus*), with abundant over-hanging ferns (*Dryopteris* spp.) and herbaceous vegetation along both banks. After it deviates from the access road, the flow regime reverts to a glide and as it runs between the two proposed turbine locations it is in a deep channel (approx. 1m) with very limited flow (Figure 3). Here the channel, which has been dredged and straightened, has developed a dense marginal fringe of Tall herb swamp (FS2) dominated by Reed canary-grass (*Phalaris arundinacea*), with Nettle (*Urtica dioica*), and vetches (*Vicia* sp.) and occasional over-hanging willow.

The habitat conditions in the stretch of stream adjacent to the access road provides potentially suitable spawning habitat for Brown Trout and for Brook Lamprey. In view of the lack of suitable flow conditions within the main channel of the Camlin River, this stream and others like it, may be critical for brown trout in this part of the catchment.

Figure 2. Derryharrow Stream adjacent to the access road to the Cloonanny Site.

Figure 3. Derryharrow Stream in vicinity of proposed bridge crossing location.

The Derryharrow Stream does not appear to support White-clawed Crayfish, though in its lower reaches the extensive marginal vegetation provides suitable habitat for populations (see Figure 3). However, due to the connectivity with the main channel of the Camlin, it would be equally susceptible to the Crayfish Plague.

Other Drainage Ditches

A number of drainage ditches run through the proposed development site which are linked either directly to the Camlin River or the Derryharrow Stream. Due to the low-lying topography, many of these are continuously flooded and support a similar Tall herb swamp (FS2) community similar to the lower reaches of the Derryharrow Stream. In view of their connectivity to the larger watercourses, they are likely to support some fish though likely confined to the smaller, more tolerant species such as Stickleback, Minnow and juvenile coarse fish species.

Impacts on the Aquatic Environment

The layout and design of the proposed development has aimed at avoiding direct impacts on watercourses. In particular, a revised layout has been developed for the access to the Proposed Development in the near the Derryharrow Stream at the junction of the L5046 road. The access to the site during construction will be via a temporary access road to the east of the junction in order to avoid any modification of the stream where it runs adjacent to the existing road.

The crossing of the Derryharrow stream between Turbine 1 and Turbine 2 is located at an existing crossing point (a pipe culvert). A new clear span bridge will be inserted at this location to accommodate the access of plant and materials. The bridge will have abutments setback a minimum of 1.5m from the top of the exiting banks thus avoiding any direct impact or modification to the stream channel at this location. Without mitigation there is a risk of silt run-off and accidental spillage of pollutants (hydrocarbons, concrete laitance, etc.) during the construction process. The bridge when in place will not impede the movement of fish or other fauna within the stream or result in any loss of aquatic habitat.

There will be no direct impacts on the Camlin River and the site works are in excess of 100m from the river banks. The drainage network from the Proposed Development Site is however all linked directly to the Camlin River either via the Derryharrow Stream or the networks of drainage ditches. The principal risk of impact to the aquatic environment is as a result of siltation or other pollutants entering the drainage network during construction and being transferred downstream. A reduction in water quality could affect a range of invertebrate, fish, mammal and bird species within the specific watercourse. This may also impact downstream for a considerable distance depending on the scale of pollution. Without appropriate mitigation during the construction phase, impacts could be moderate to significantly negative. However, adherence to best practice methodologies during construction will avoid such risks.

The principal risk to the aquatic environment during the operation phase of the Proposed Development relates to the potential for road and site run-off entering watercourses leading to deterioration in water quality. While this risk is considered minimal due to the low volumes of associated traffic and the absence of significant potential pollutants, the drainage design for the Proposed Development includes a controlled drainage system that directs all surface water run-off appropriately. This subsequently allows for the settlement of run-off and capture of suspended solids and pollutants.

Mitigation

A Surface Water Management Plan (SWMP) has been prepared as part of the Construction Environmental Management Plan (CEMP) in conjunction with the Environmental Impact Assessment Report (EIAR) which will accompany the planning application for the proposed development. The SWMP outlines the steps which will be taken during the construction phase of the project to ensure compliance with the relevant guidance, legislation and the detailed drainage design. The drainage strategy for the wind farm site will ensure minimal impact on the existing flow regime, water quality, and run-off quantity.

All detailed design, construction and operation will be carried out in accordance with current best practice and guidance including CIRIA (2001), TII (2006) and IFI (2016).

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APPENDIX 11.1

ORNITHOLOGY SURVEY RESULTS

VOLUME III

APPENDICES TO ENVIRONMENTAL IMPACT ASSESSMENT REPORT

RFI Response July 2025

ENVIRONMENTAL CONSULTANTS

RECEIVED: 09/07/2025

Bird Survey Results

Cloonanny Windfarm Development
Cloonanny Glebe, Co. Longford

Document Details

Client:	Natural Forces
Project Title:	Longford Windfarm
Project Code:	15-NF-2023
Document Title:	Bird Survey Results
Prepared By:	Ian Douglas and Ellen Irwin

Rev	Status	Date
01	Draft 1	22/11/2024
02	Final	29/11/2024

11.1.1 Non-breeding Season October 2021 to March 2022

Detailed in Table 1 below, are the 17 species of Conservation Concern recorded during the non-breeding season surveys within the study site between October 2021 and March 2022. Included are species of Section 22 of the Wildlife Act, Amber and Red listed species of BoCCI and EU Birds Directive Annex I species.

Table 1: 17 species of Conservation Concern recorded during the non-breeding season surveys

Species	Code	Conservation status	Association with the site
Whooper Swan	WS	Amber BoCCI, Annex 1	Recorded in October (feeding in site), Jan
Peregrine	PE	Annex 1	Recorded in Mar
Kestrel	K.	Red BoCCI, Section 22	Recorded in Nov
Grey Wagtail	GL	Red BoCCI	Recorded in Feb
Meadow Pipit	MP	Red BoCCI	Recorded in Oct, Nov, Dec, Jan, Feb & Mar
Snipe	SN	Red BoCCI	Recorded in Oct, Nov, Dec, Jan, Feb & Mar
Redwing	RE	Red BoCCI	Recorded in Nov, Dec
Linnet	LI	Amber BoCCI	Recorded in Feb, Mar
Starlings	SG	Amber BoCCI	Recorded in Feb & Mar
Greenfinch	GR	Red BoCCI	Recorded in Feb
Skylark	S.	Amber BoCCI	Recorded Mar
Tufted duck	TU	Amber BoCCI	Recorded in Feb
Wigeon	WN	Amber BoCCI	Recorded in Oct, Dec & Feb
Mute Swan	MS	Amber BoCCI	Recorded in December
Mallard	MA	Amber BoCCI	Recorded in Oct, Nov, Dec, Jan & Feb
Buzzard	BZ	Section 22	Recorded in Oct, Nov, Dec, Feb & Mar
Sparrowhawk	SH	Section 22	Recorded in Oct, Nov, Dec, Jan, Feb & Mar
Whooper Swan	WS	Amber BoCCI, Annex 1	Recorded in October (feeding in site), Jan
Peregrine	PE	Annex 1	Recorded in Mar
Kestrel	K.	Red BoCCI, Section 22	Recorded in Nov
Grey Wagtail	GL	Red BoCCI	Recorded in Feb
Meadow Pipit	MP	Red BoCCI	Recorded in Oct, Nov, Dec, Jan, Feb & Mar
Snipe	SN	Red BoCCI	Recorded in Oct, Nov, Dec, Jan, Feb & Mar

Redwing	RE	Red BoCCI	Recorded in Nov, Dec

11.1.2 Breeding Season April to September 2022

Detailed in Table 2 below, are the 12 species of Conservation Concern recorded during the breeding season surveys within the Proposed Development between April and September 2022. Included are species of Section 22 of the Wildlife Act, Amber and Red listed species of BoCCI and EU Birds Directive Annex I species.

Table 2: 12 species of Conservation Concern recorded during the breeding season surveys

Species	Code	Conservation status	Association with the site
Kestrel	K.	Red BoCCI, Section 22	Recorded in May and August
Snipe	SN	Red BoCCI	Recorded in April, May and July
Meadow Pipit	MP	Red BoCCI	Recorded in April, May and July
Grey Wagtail	GL	Red BoCCI	Recorded in April
Starlings	SG	Amber BoCCI	Recorded in April
Skylark	S.	Amber BoCCI	Recorded April & May
Mallard	MA	Amber BoCCI	Recorded in July
Teal	T.	Amber BoCCI	Recorded in September
Wigeon	WN	Amber BoCCI	Recorded in September
Herring gull	HG	Amber BoCCI	Recorded in April & May
Buzzard	BZ	Section 22	Recorded in April, May, June, July, August and September
Sparrowhawk	SH	Section 22	Recorded in April, May, June, July, August and September

11.1.3 Non-breeding Season October 2022 to March 2023

Detailed in Table 3 below, are the 8 species of Conservation Concern recorded during the non-breeding season surveys within the Proposed Development between October 2022 to March 2023. Included are species of Section 22 of the Wildlife Act, Amber and Red listed species of BoCCI and EU Birds Directive Annex I species.

Table 3: 8 species of Conservation Concern recorded during the non-breeding season surveys

Species	Code	Conservation status	Association with the site
Buzzard	BZ	Section 22	Recorded in Oct, Jan, Feb, March
Whooper Swan	WS	Amber BoCCI, Annex 1	Recorded in Jan
Peregrine	PE	Annex 1	Recorded in Oct, Nov, March
Kestrel	K.	Red BoCCI, Section 22	Recorded in Feb

Snipe	SN	Red BoCCI	Recorded in Oct, Jan, Feb
Mallard	MA	Amber BoCCI	Recorded in Oct, Nov, Jan, Feb
Wigeon	WN	Amber BoCCI	Recorded in March
Sparrowhawk	SH	Section 22	Recorded in Oct, Nov, Jan, Feb, March

11.1.4 Waterbird Distribution Survey January to March 2023

Detailed in table 4 below, are the 4 species of Conservation Concern recorded during Waterbird Distribution between the months of December to March 2023. Added to this list are the species recorded during the migration watches over the same period.

Table 4: 4 species of Conservation Concern recorded during Waterbird Distribution

Species	Code	Conservation status	Association with the site
Herring gull	HG	Amber BoCCI	Recorded in Jan, Feb
Whooper Swan	WS	Amber BoCCI, Annex 1	Recorded in Jan, Feb
Snipe	SN	Red BoCCI	Recorded in Jan, Feb
Mallard	MA	Amber BoCCI	Recorded in Jan, Feb

11.1.5 Non-breeding Season October 2023 to March 2024

Detailed in Table 5 below, are the 15 species of Conservation Concern recorded during the non-breeding season surveys within the Proposed Development between October 2023 to December 2023.

Table 5: 15 species of Conservation Concern recorded during the non-breeding season surveys

Species	Code	Conservation status	Association with the site
Whooper Swan	WS	Amber BoCCI, Annex 1	Recorded in Oct, Jan, Mar
Peregrine	PE	Annex 1	Recorded in Dec
Golden Plover	GP	Annex 1, Red BoCCI	Recorded in Dec, Jan, Feb, Mar
Kestrel	K.	Red BoCCI, Section 22	Recorded in Dec, Feb
Meadow Pipit	MP	Red BoCCI	Recorded in Oct, Nov, Dec
Redwing	RE	Red BoCCI	Recorded in Oct, Nov, Dec
Lapwing	L	Red BoCCI	Recorded in Feb
Snipe	SN	Red BoCCI	Recorded in Oct, Nov, Dec, Feb,
Herring gull	HG	Amber BoCCI	Recorded in Oct, Nov, Dec
Black headed gull	BH	Amber BoCCI	Recorded in Nov
Mute Swan	MS	Amber BoCCI	Recorded in Nov, Dec, Mar

Teal	T.	Amber BoCCI	Recorded in Dec, Jan
Mallard	MA	Amber BoCCI	Recorded in Nov, Dec
Grey Heron	H.	Section 22	Recorded in Nov
Buzzard	BZ	Section 22	Recorded in Oct, Nov, Dec, Jan, Feb, Mar
Sparrowhawk	SH	Section 22	Recorded in Oct, Nov, Jan, Mar
Cormorant	CA	Amber BoCCI	Recorded in Jan

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APPENDIX 11.2

ORNITHOLOGY SURVEY MAPS AND DATA

VOLUME III

APPENDICES TO ENVIRONMENTAL IMPACT ASSESSMENT REPORT

RFI Response July 2025

RECEIVED: 09/07/2025

ENVIRONMENTAL CONSULTANTS

Bird Survey Data

Cloonanny Windfarm Development

Cloonanny Glebe, Co. Longford

Document Details

Client:	Natural Forces
Project Title:	Cloonanny Wind Farm Development
Document Title:	Bird Survey Data
Prepared By:	ID Environmental Consultants

Rev	Status	Date
01	Draft	01/01/2023
02	Final	29/11/2024

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Table of Figures:

Buzzard

Table 1: Buzzard Vantage Point Survey Data

Vantage Point Survey Data												
Date	VP No	Observation No	Species	BTO code	Number	Time	Flight Duration	Band 1 (025m)	Band 2 (25180m)	Band 3 (>180m)	Activity	Comments
25/10/2021	2	1	Buzzard	BZ	1	13:10	180	0	180	0	Circling	
25/10/2021	2	3	Buzzard	BZ	1	14:59	240	240	0	0	Hunting	
05/11/2021	1	1	Buzzard	BZ	1	13:47	167	0	167	0	Circling	Travelling in a SW direction
06/11/2021	2	2	Buzzard	BZ	1	14:16	29	0	29	0	Travelling	
03/12/2021	2	2	Buzzard	BZ	1	14:23	32	32	0	0	Travelling	NW Direction
02/12/2021	1	1	Buzzard	BZ	1	10:43	364	74	290	0	Circling	
17/02/2022	1	2	Buzzard	BZ	1	12:16	244	0	244	0	Circling	Over forestry SW of the site
19/02/2022	2	1	Buzzard	BZ	1	10:31	362	51	311	0	Circling/Travelling	Mobbed by MT
10/03/2022	1	1	Buzzard	BZ	1	12:14	269	0	269	0	Circling	
20/04/2022	1	1	Buzzard	BZ	4	09:06	1440	150	210	1080	Soaring	Mobbed by hooded crows
20/04/2022	1	2	Buzzard	BZ	6	11:32	1140	0	76	1064	Soaring	
20/04/2022	1	3	Buzzard	BZ	1	13:24	743	743	0	0	Flying/On ground	Feeding in fields for 12mins
19/04/2022	2	2	Buzzard	BZ	1	13:07	840	0	0	840	Circling	Lost from view travelling east
01/05/2022	1	1	Buzzard	BZ	1	10:24	673	0	246	427	Soaring	Male calling intermittently
02/05/2022	2	1	Buzzard	BZ	1	10:11	294	0	294	0	Circling	
03/05/2022	3	1	Buzzard	BZ	1	10:11	29	29	0	0	Travelling	Male with nest material
03/05/2022	3	2	Buzzard	BZ	1	12:54	314	0	121	193	Circling	Male circling over NE of site
04/05/2022	3	1	Buzzard	BZ	1	09:42	36	36	0	0	Travelling	Female flying into woodland
26/06/2022	1	1	Buzzard	BZ	1	09:11	232	42	190	0	Circling	Male circling over site
26/06/2022	1	1	Buzzard	BZ	1	09:38	24	24	0	0	Travelling	
26/06/2022	1	2	Buzzard	BZ	1	11:36	349	67	282	0	Circling	
27/06/2022	2	1	Buzzard	BZ	1	12:19	41	0	41	0	Travelling	
25/06/2022	3	1	Buzzard	BZ	1	08:42	461	0	123	338	Circling	Female

25/06/2022	3	2	Buzzard	BZ	1	09:21	29	0	29	0	Travelling	
25/06/2022	3	3	Buzzard	BZ	1	12:02	364	0	364	0	Circling	
27/07/2022	1	1	Buzzard	BZ	1	10:54	396	0	0	396	Soaring/Circling	
27/07/2022	1	2	Buzzard	BZ	1	11:26	32	0	0	32	Soaring/Circling	
28/07/2022	2	1	Buzzard	BZ	1	09:14	263	0	263	0	Circling	
15/08/2022	1	1	Buzzard	BZ	1	10:04	321	156	165	0	Circling	Over forestry @100m
22/09/2022	2	1	Buzzard	BZ	1	11:19	274	0	274	0	Circling	Juvenile female circling
23/09/2022	3	1	Buzzard	BZ	1	12:14	369	0	322	42	Circling	Male circling, mobbed by MT
09/01/2023	1	1	Buzzard	BZ	1	10:23	264	0	264	0	Circling	
09/01/2023	1	2	Buzzard	BZ	1	13:16	34	0	34	0	Travelling	
08/02/2023	1	1	Buzzard	BZ	1	10:13	369	0	369	0	Circling	
28/03/2023	1	1	Buzzard	BZ	1	10:23	90	0	90	0	Soaring	
28/03/2023	1	2	Buzzard	BZ	1	11:16	65	10	55	0	Soaring	
28/03/2023	1	3	Buzzard	BZ	1	11:17	7	7	0	0	Travelling	
27/03/2023	2	1	Buzzard	BZ	2	14:15	165	0	165	0	Soaring	
14/04/2023	1	1	Buzzard	BZ	2	10:33	35	5	30	0	Travelling	Pair flying together
14/04/2023	1	3	Buzzard	BZ	1	11:20	220	0	140	80	Soaring	
14/04/2023	1	5	Buzzard	BZ	1	12:35	28	23	5	0	Travelling	
14/04/2023	1	6	Buzzard	BZ	1	14:32	90	4	86	0	Soaring	
14/04/2023	1	7	Buzzard	BZ	2	14:16	55	3	52	0	Travelling	Pair flying together
15/04/2023	2	1	Buzzard	BZ	2	08:47	10	10	0	0	Travelling	Pair flying through treeline
15/04/2023	2	2	Buzzard	BZ	1	09:30	24	13	11	0	Travelling	
15/04/2023	2	3	Buzzard	BZ	1	10:04	42	5	37	0	Travelling	Dropped behind forestry
15/04/2023	2	4	Buzzard	BZ	1	10:25	38	0	38	0	Travelling	
13/04/2023	3	1	Buzzard	BZ	1	14:26	33	0	33	0	Travelling	

13/04/2023	3	2	Buzzard	BZ	1	14:50	35	17	18	0	Travelling	
13/04/2023	3	3	Buzzard	BZ	1	15:35	78	0	78	0	Soaring	
13/04/2023	3		Buzzard	BZ	1	17:07	80	22	58	0	Travelling	Flying @100m,over forestry
03/05/2023	1	1	Buzzard	BZ	1	09:14	64	0	64	0	Circling	
03/05/2023	1	2	Buzzard	BZ	1	12:42	106	10	96	9	Travelling	
04/05/2023	2	1	Buzzard	BZ	1	09:37	59	0	59	0	Travelling	
05/05/2023	3	2	Buzzard	BZ	1	10:11	49	0	49	0	Travelling	
22/06/2023	1	1	Buzzard	BZ	1	12:11	124	56	68	0	Circling	Lost from view over conifers
23/06/2023	2	1	Buzzard	BZ	1	11:04	43	0	43	0	Travelling	
24/06/2023	3	1	Buzzard	BZ	1	10:11	181	56	125	0	Circling	
09/07/2023	1	1	Buzzard	BZ	1	08:29	204	0	170	34	Soaring	
09/07/2023	1	2	Buzzard	BZ	1	12:24	89	0	89	0	Soaring	
10/07/2023	2	1	Buzzard	BZ	1	11:02	48	0	48	0	Travelling	
08/07/2023	3	2	Buzzard	BZ	1	14:07	84	0	84	0	Soaring	Mobbed intermittently by HC
25/09/2023	1	2	Buzzard	BZ	1	11:46	63	42	21	0	Travelling	Mobbed by Raven
25/09/2023	1	3	Buzzard	BZ	1	14:20	55	0	55	0	Travelling	Mobbed by Corvids
25/09/2023	1	4	Buzzard	BZ	1	14:27	67	25	42	0	Travelling	
26/09/2023	3	1	Buzzard	BZ	1	10:15	68	10	58	0	Travelling	
26/09/2023	3	2	Buzzard	BZ	1	10:15	52	0	52	0	Travelling	
18/10/2023	1	1	Buzzard	BZ	1	10:17	53	10	43	0	Travelling	
18/10/2023	1	2	Buzzard	BZ	1	14:48	25	0	25	0	Travelling	
18/10/2023	1	3	Buzzard	BZ	1	14:48	88	24	64	0	Hunting	Lost from view behind forestry
19/10/2023	2	2	Buzzard	BZ	1	13:04	56	30	26	0	Travelling	
03/11/2023	1	1	Buzzard	BZ	1	09:01	58	16	42	0	Hunting	
03/11/2023	1	3	Buzzard	BZ	1	13:10	46	0	46	0	Travelling	
09/12/2023	1	2	Buzzard	BZ	1	12:40	70	22	48	0	Travelling	
11/12/2023	2	1	Buzzard	BZ	1	10:55	44	16	28	0	Travelling	
03/01/2024	1	1	Buzzard	BZ	1	09:28	34	8	26	0	Travelling	

03/01/2024	1	2	Buzzard	BZ	1	13:03	70	43	27	0	Hunting	
16/01/2024	2	1	Buzzard	BZ	1	10:23	34	0	34	0	Travelling	
16/01/2024	2	2	Buzzard	BZ	1	10:29	49	10	39	0	Travelling	
12/02/2024	1	1	Buzzard	BZ	1	12:05	11	5	6	0	Travelling	
12/02/2024	1	2	Buzzard	BZ	1	12:12	39	0	39	0	Travelling	
13/02/2024	3	1	Buzzard	BZ	1	14:40	27	10	17	0	Travelling	
02/03/2024	1	1	Buzzard	BZ	1	13:41	21	12	9	0	Travelling	
03/03/2024	2	1	Buzzard	BZ	1	14:50	34	5	29	0	Travelling	
04/03/2024	3	1	Buzzard	BZ	1	12:07	39	29	10	0	Travelling	
04/03/2024	3	2	Buzzard	BZ	1	14:31	65	0	65	0	Travelling	

Table 2: Buzzard Walkover Survey Data

Walkover Survey Data						
Survey Date	**Transect No**	**Species**	**BTO code**	**Number**	**Habitat**	**Breeding/Non-breeding**
07/11/2021	T1	Common Buzzard	BZ	1	GA1	Non-breeding
17/04 /2022	T1	Common Buzzard	BZ	1	GA1	Breeding
09/05 /2022	T1	Common Buzzard	BZ	1	WD4	Breeding
09/05/2022	T1	Common Buzzard	BZ	1	WD4	Breeding
13/01/2023	T1	Common Buzzard	BZ	1	GA1	Non-breeding
12/02/2023	T1	Common Buzzard	BZ	1	GA1	Non-breeding
30/03/2023	T1	Common Buzzard	BZ	1	GA1	Non-Breeding
16/04/2023	T1	Common Buzzard	BZ	1	WL2	Breeding
16/04/2023	T1	Common Buzzard	BZ	1	GA1	Breeding
18/05/2023	T1	Common Buzzard	BZ	1	GA1	Breeding
25/06/2023	T1	Common Buzzard	BZ	1	GA1	Breeding
25/06/2023	T1	Common Buzzard	BZ	1	GA1	Breeding

07/07/2023	T1	Common Buzzard	BZ	1	GA1	Breeding
07/07/2023	T1	Common Buzzard	BZ	1	GA1	Breeding
28/09/2023	T1	Common Buzzard	BZ	1	GA1	Breeding
18/11/2023	T1	Common Buzzard	BZ	1	GA1	Non-breeding
12/12/2023	T1	Common Buzzard	BZ	1	GA1	Non-breeding

Table 3: Buzzard Migration Watch Survey Data

Migration Watch Survey Data												
Date	VP No	Observation No	Species	BTO code	Number	Time	Flight Duration	Band 1 (0-25m)	Band 2 (25-180m)	Band 3 (>180m)	Activity	Comments
18/04/2022	1	1	Buzzard	BZ	2	08:42	643	0	0	643	Soaring	Bz pair circling east of site
08/10/2022	1	2	Buzzard	BZ	1	09:33	80	0	80	0	Travelling	Mobbed by hooded crows
08/10/2022	1	3	Buzzard	BZ	1	09:34	65	20	45	0	Travelling	Perched on tree for three mins
08/10/2022	1	4	Buzzard	BZ	1	10:30	55	0	55	0	Hunting	
08/10/2022	1	5	Buzzard	BZ	2	12:57	310	0	0	310	Soaring	Juvenile + Adult

Table 4: Buzzard BRVP Survey Data

BRVP Survey Data							
Survey Date	VP No	Species	BTO code	Number	Time	Activity	Comments
18/04/2022	1	Common Buzzard	BZ	1	14:42	Travelling	Male travelling into wooded area with nesting material

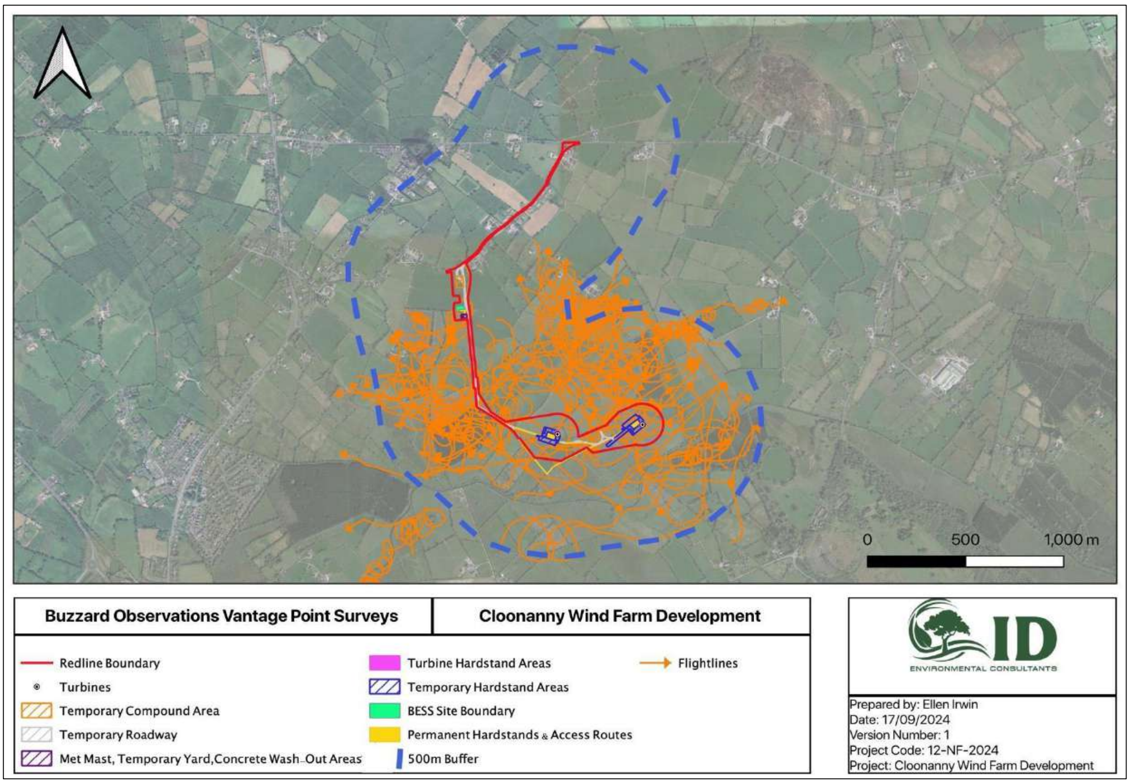

Figure 1: Buzzard Vantage Point Survey Flightlines

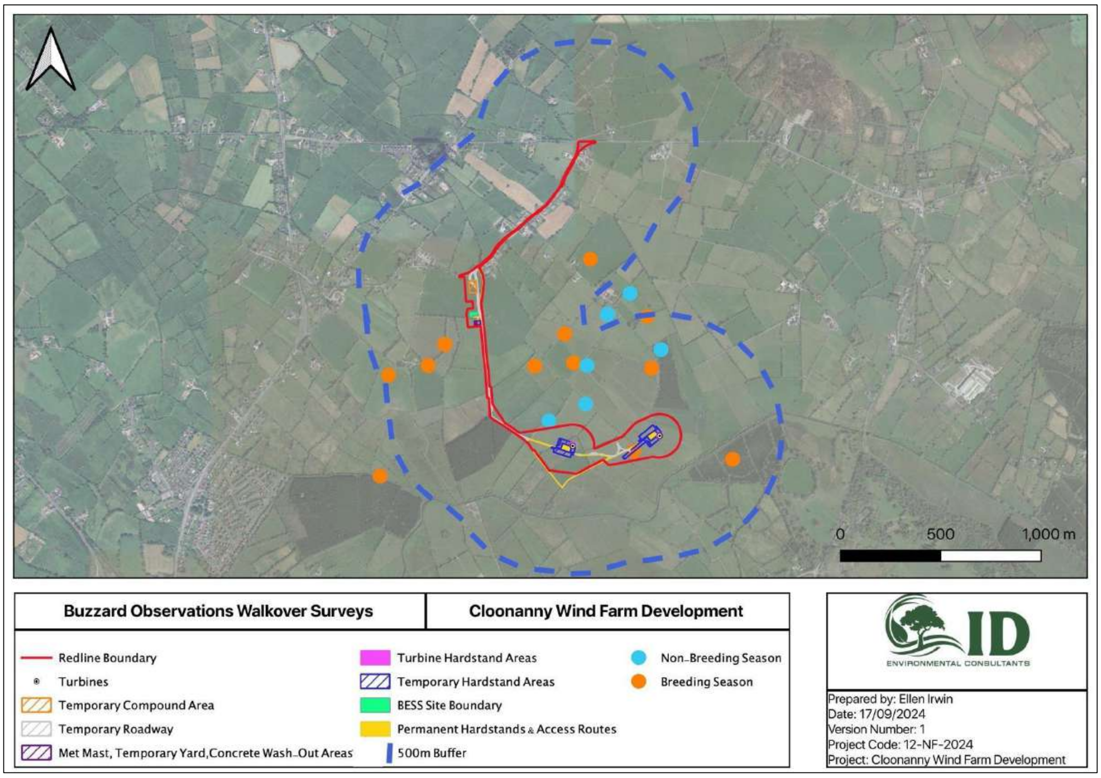

Figure 2: Buzzard Walkover Survey Observation

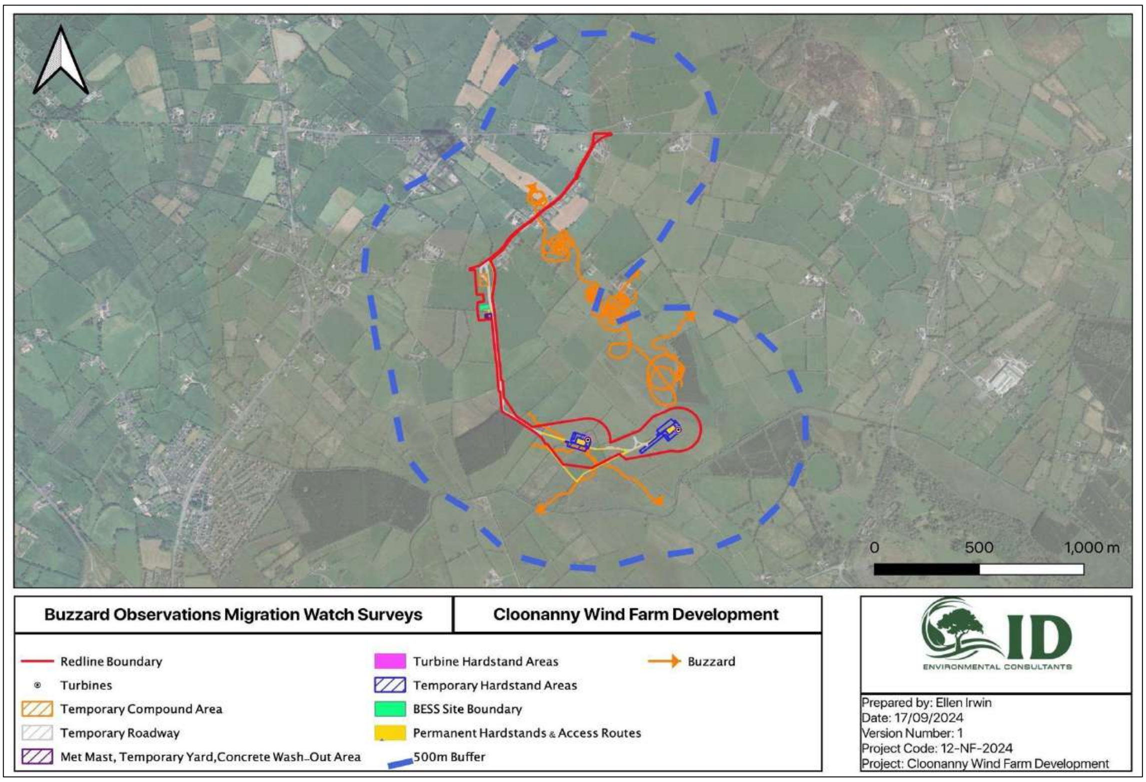

Figure 3: Buzzard Migration Survey Observations

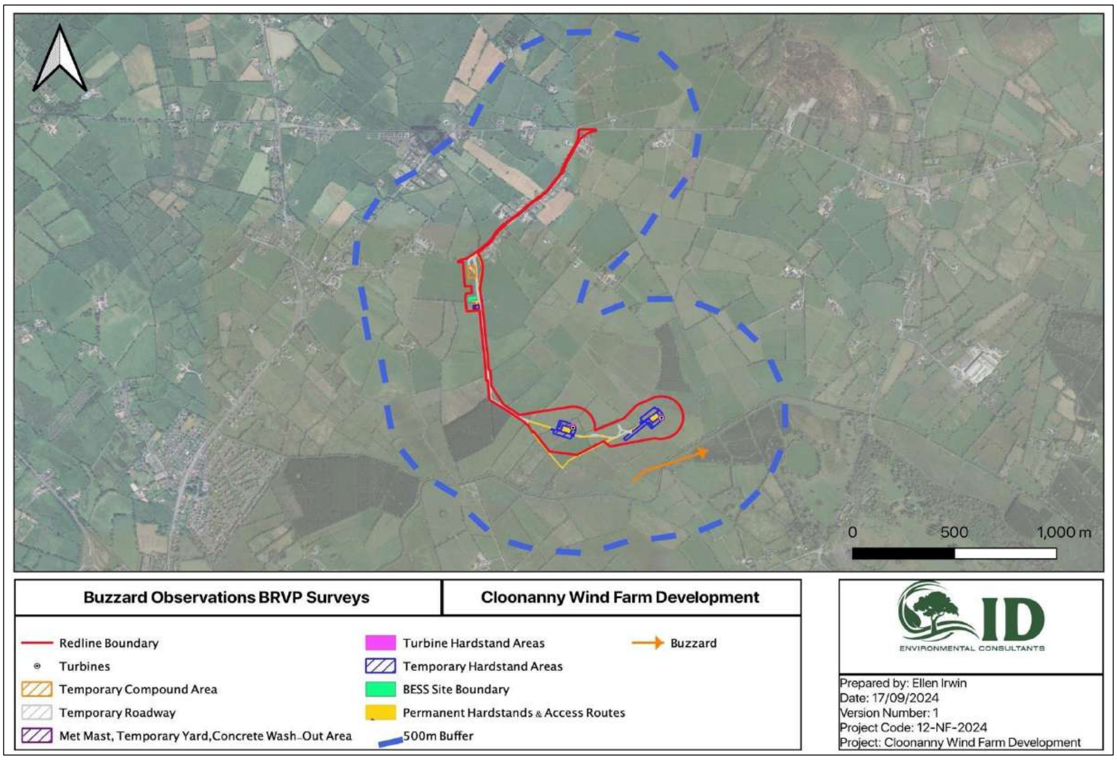

Figure 4: Buzzard BRVP Survey Flightlines

Kestrel

Table 5: Kestrel Vantage Survey Data

Vantage Point Survey Data												
Date	**VP No**	**Observation No**	**Species**	**BTO code**	**Number**	**Time**	**Flight Duration**	**Band 1 (025m)**	**Band 2 (25180m)**	**Band 3 (>180m)**	**Activity**	**Comments**
06/11/2021	2	1	Kestrel	K.	1	10:04	123	101	22	0	Travelling/Hunting	In rough grassland
16/08/2022	2	1	Kestrel	K.	1	11:42	329	127	202	0	Hunting	
14/04/2023	1	4	Kestrel	K.	1	12:04	75	0	75	0	Travelling	Mobbed by Corvids
13/04/2023	3	4	Kestrel	K.	1	15:13	130	0	130	0	Hunting	
05/05/2023	3	1	Kestrel	K.	1	08:49	143	38	105	0	Hunting	
22/06/2023	1	2	Kestrel	K.	1	14:39	84	0	84	0	Hunting	Ad male, mobbed by crows
24/06/2023	3	2	Kestrel	K.	1	13:29	132	0	132	0	Hunting	
08/07/2023	3	1	Kestrel	K.	1	10:14	129	0	129	0	Hunting	
25/09/2023	1	1	Kestrel	K.	1	09:34	44	18	26	0	Travelling	Mobbed by Raven
12/02/2024	1	1	Kestrel	K.	1	14:22	95	55	40	0	Hunting	
04/03/2024	3	1	Kestrel	K.	1	10:24	85	85	0	0	Hunting	

Table 6: Kestrel Walkover Survey Data

Walkover Survey Data						
Survey Date	**Transect No**	**Species**	**BTO code**	**Number**	**Habitat**	**Breeding/Non-breeding**
12/02/2023	T1	Kestrel	K.	1	GA1	Non-breeding
12/12/2023	T1	Kestrel	K.	1	GA1	Non-breeding

Table 7: Kestrel Migration Watch Survey Data

Migration Watch Survey Data												
Date	VP No	Observation No	Species	BTO code	Number	Time	Flight Duration	Band 1 (0-25m)	Band 2 (25-180m)	Band 3 (>180m)	Activity	Comments
05/05/2022	1	1	Kestrel	K.	1	12:14	436	125	311	0	Hunting	Ad Male made several kill attempts

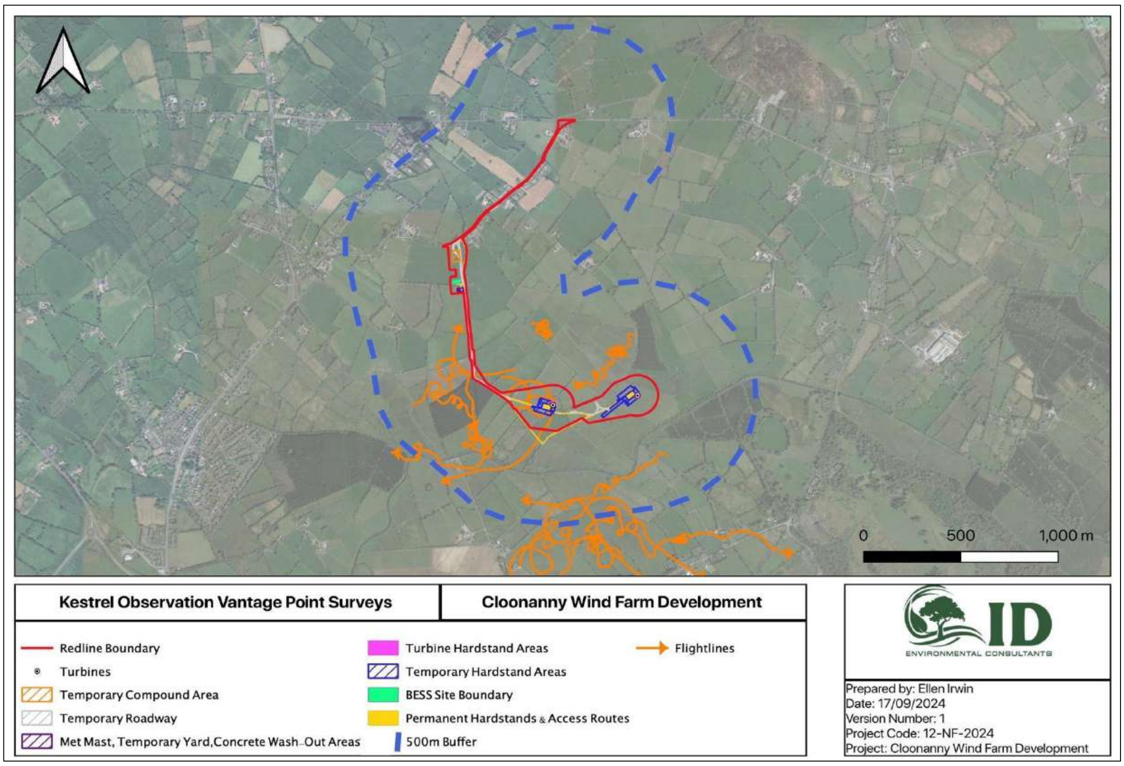

Figure 5: Kestrel Vantage Point Survey Flightlines

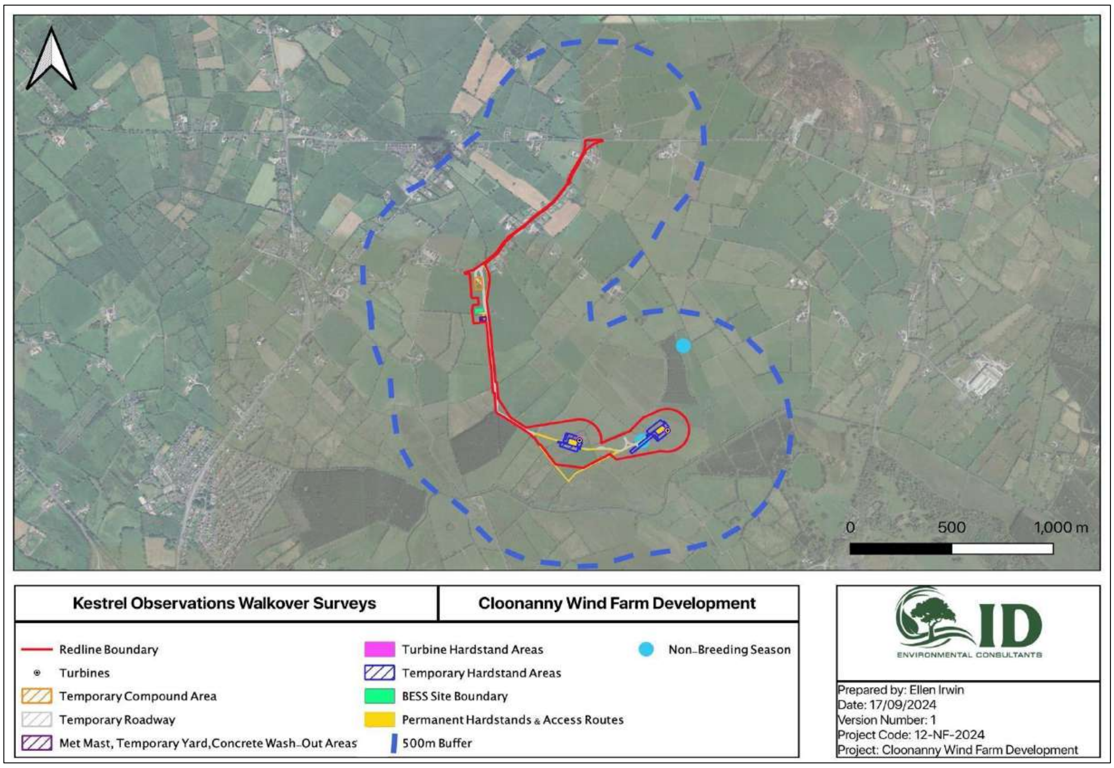

Figure 6: Kestrel Walkover Survey Observation

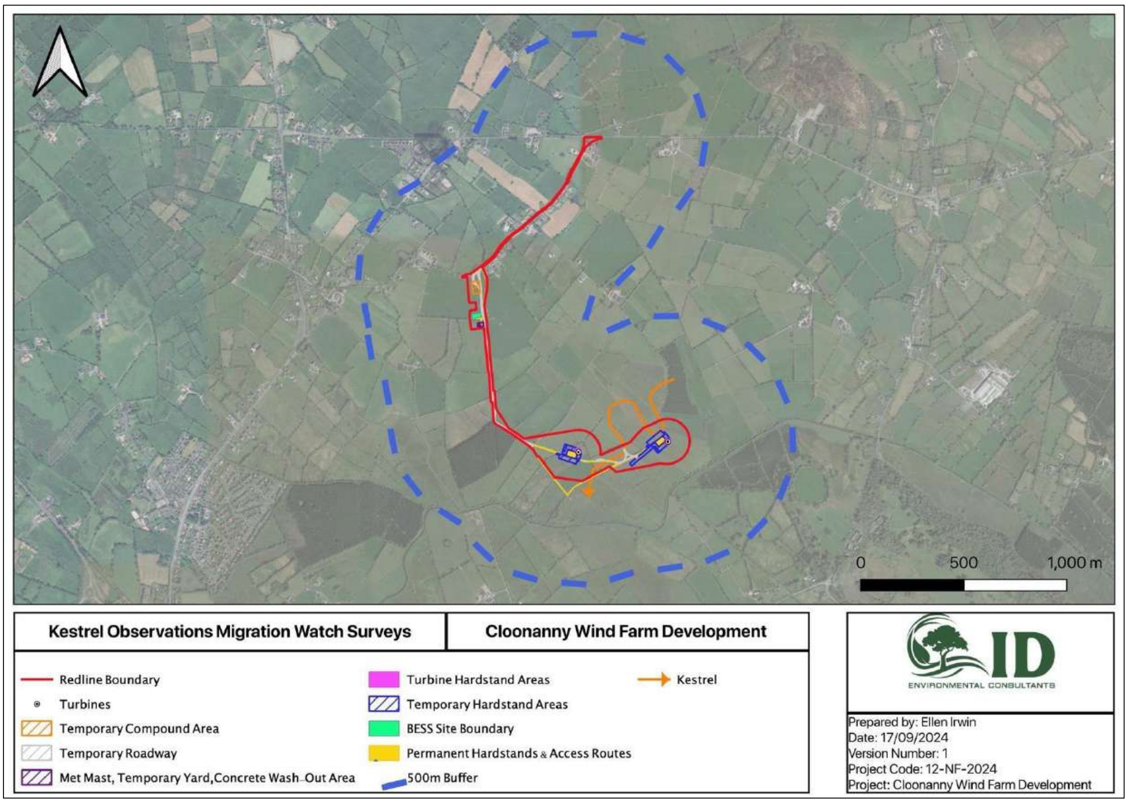

Figure 7: Kestrel Migration Survey Observations

Sparrowhawk

Table 8: Sparrowhawk Vantage Point Survey Data

Vantage Point Survey Data												
Date	VP No	Observation No	Species	BTO code	Number	Time	Flight Duration	Band 1 (025m)	Band 2 (25180m)	Band 3 (>180m)	Activity	Comments
25/10/2021	2	2	Sparrowhawk	SH	1	13:39	25	25	0	0	Hunting	Ad Female hunting along hedgerow
03/12/2021	2	1	Sparrowhawk	SH	1	10:04	192	0	192	0	Circling	Ad female, circling over forestry
04/01/2022	1	1	Sparrowhawk	SH	1	11:22	243	0	243	0	Circling	
17/02/2022	1	1	Sparrowhawk	SH	1	08:57	15	15	0	0	Hunting	
11/03/2022	2	1	Sparrowhawk	SH	1	08:11	312	0	312	0	Circling	Ad female, circling over woodland
19/04/2022	2	1	Sparrowhawk	SH	1	09:43	480	0	85	395	Circling	Ad female,mobbed by hooded crow
01/05/2022	1	2	Sparrowhawk	SH	1	13:09	263	0	263	0	Circling	Ad female, mobbed by jackdaw
04/05/2022	3	2	Sparrowhawk	SH	1	13:04	21	21	0	0	Hunting	
26/06/2022	1	3	Sparrowhawk	SH	1	12:29	18	18	0	0	Travelling	
27/07/2022	1	3	Sparrowhawk	SH	1	11:27	170	70	100	0	Carrying Prey	
30/07/2022	3	1	Sparrowhawk	SH	1	09:12	29	29	0	0	Travelling	
15/08/2022	1	2	Sparrowhawk	SH	1	13:42	20	20	0	0	Hunting	Ad female, hunting along hedgerow
23/09/2022	3	2	Sparrowhawk	SH	1	15:09	13	13	0	0	Travelling	
11/01/2023	2	1	Sparrowhawk	SH	1	10:14	59	9	50	0	Circling	Ad female, circling over forestry
08/02/2023	1	2	Sparrowhawk	SH	1	13:24	13	13	0	0	Travelling	
10/02/2023	2	1	Sparrowhawk	SH	1	10:03	263	0	167	96	Circling	Female circling high
27/03/2023	2	2	Sparrowhawk	SH	1	16:08	11	11	0	0	Hunting	
13/04/2023	3	6	Sparrowhawk	SH	1	17:10	12	12	0	0	Hunting	Chasing passerines low over field
19/10/2023	2	1	Sparrowhawk	SH	1	09:26	13	13	0	0	Travelling	
03/11/2023	1	2	Sparrowhawk	SH	1	12:34	12	12	0	0	Hunting	Chasing passerines along hedgerow

16/01/2024	2	1	Sparrowhawk	SH	1	12:25	8	8	0	0	Travelling	
03/03/2024	2	1	Sparrowhawk	SH	1	14:18	10	10	0	0	Hunting	Chasing passerines along hedgerow

Table 9: Sparrowhawk Walkover Survey Data

Walkover Survey Data						
Survey Date	Transect No	Species	BTO code	Number	Habitat	Breeding/Non-breeding
29/11/2021	T1	Sparrowhawk	SH	1	WD4	Non-breeding
13/01 /2023	T1	Sparrowhawk	SH	1	GA1	Non-breeding
30/03 /2023	T1	Sparrowhawk	SH	1	GA1	Non-breeding
28/09/2023	T1	Sparrowhawk	SH	1	WD4	Breeding

Table 10: Sparrowhawk Migration Watch Survey Data

Migration Watch Survey Data												
Date	VP No	Observation No	Species	BTO code	Number	Time	Flight Duration	Band 1 (0-25m)	Band 2 (25-180m)	Band 3 (>180m)	Activity	Comments
21/11/2022	3	2	Sparrowhawk	SH	1	15:09	11	11	0	0	Travelling	

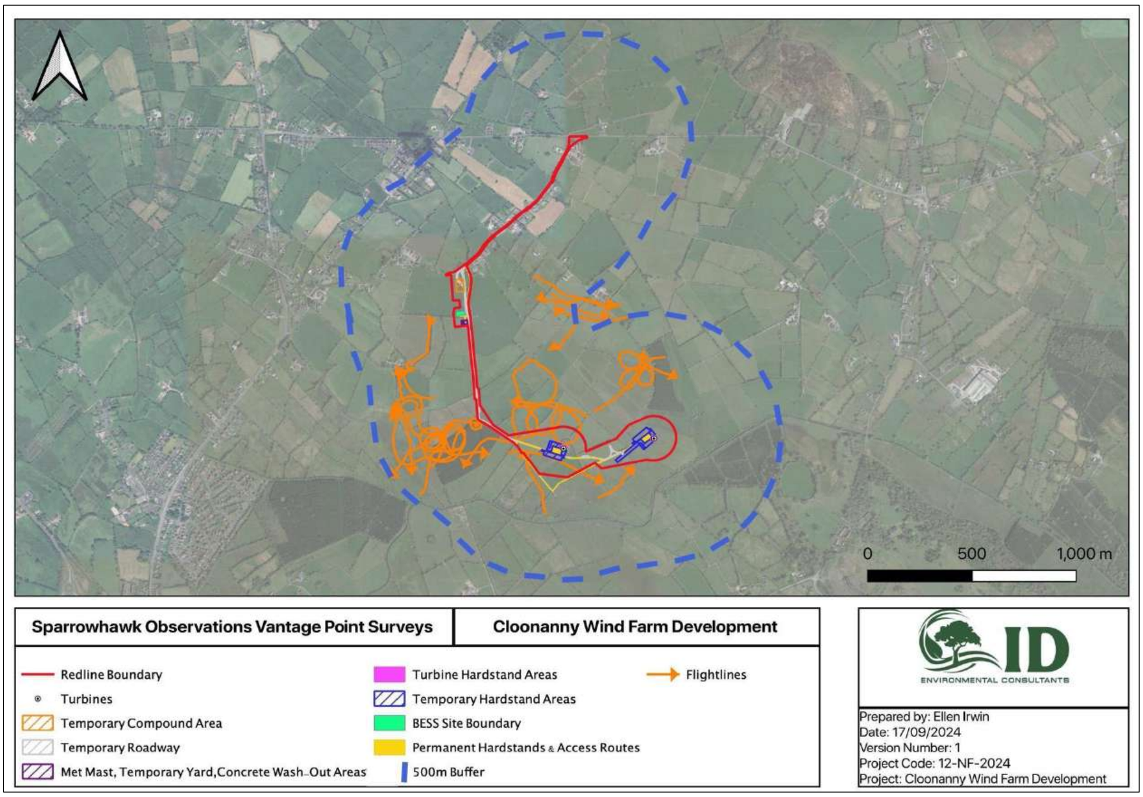

Figure 8: Sparrowhawk Vantage Point Survey Flightlines

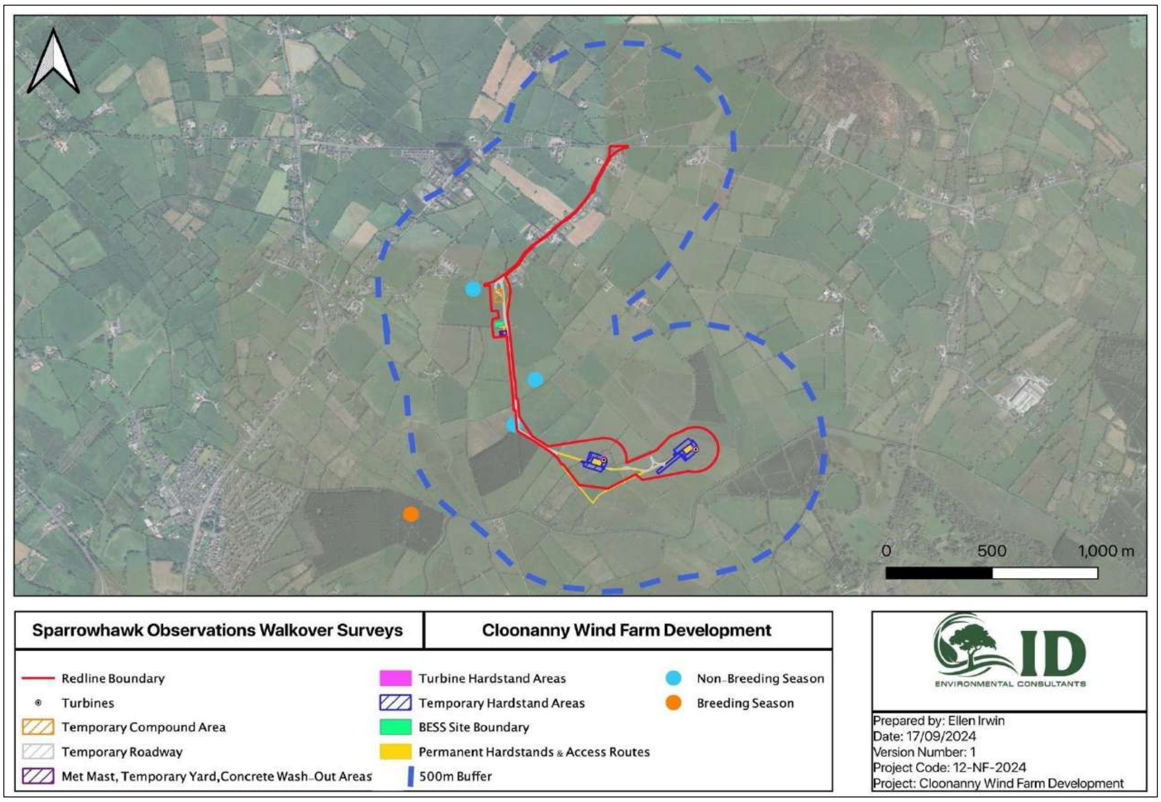

Figure 9: Sparrowhawk Walkover Survey Observations

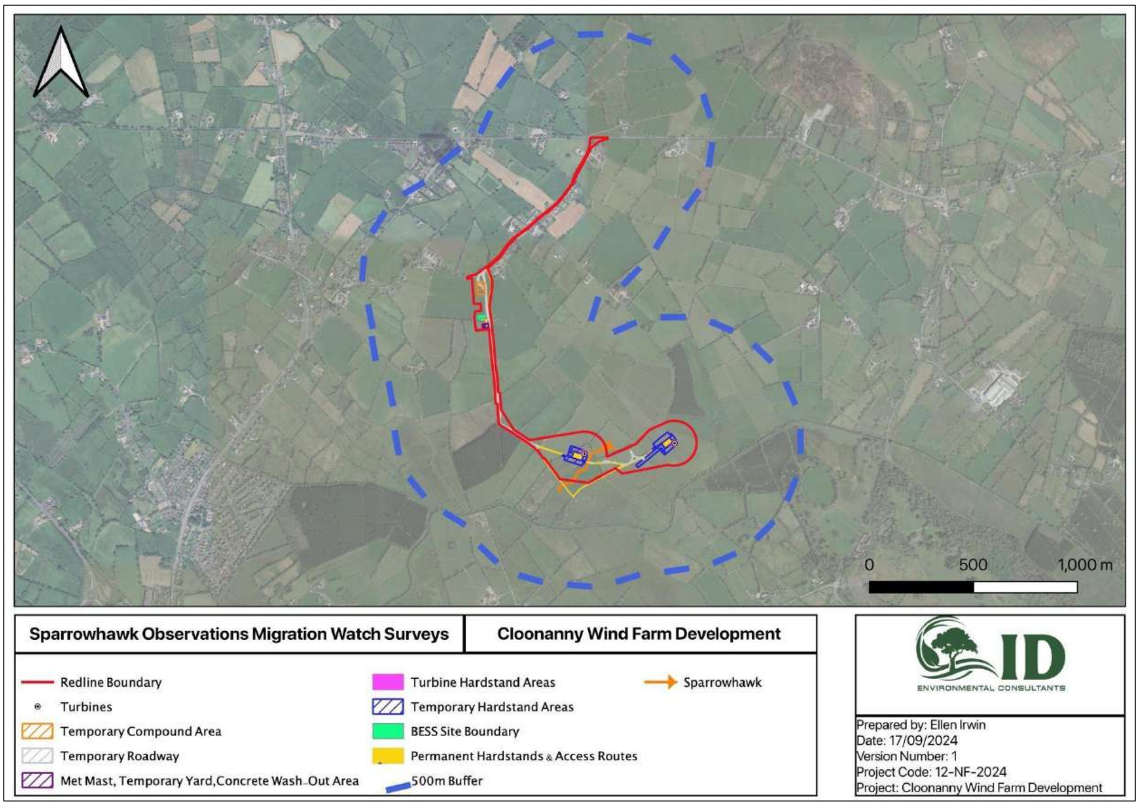

Figure 10: Sparrowhawk Migration Watch Observations

Whooper Swan

Table 11: Whooper Swan Vantage Point Survey Data

Vantage Point Survey Data												
Date	VP No	Observation No	Species	BTO code	Number	Time	Flight Duration	Band 1 (0-25m)	Band 2 (25180m)	Band 3 (>180m)	Activity	Comments
25/10/2021	1	1	Whooper Swan	WS	11	09:47	21,600	21,480	0	0	Feeding	Feeding in flooded fields
05/01/2022	2	1	Whooper Swan	WS	4	09:43	52	0	52	0	Travelling	
04/01/2024	3	1	Whooper Swan	WS	3	09:52	55	0	55	0	Travelling	
02/03/2024	1	1	Whooper Swan	WS	6	09:46	44	0	44	0	Travelling	

Table 12: Whooper Swan Walkover Survey Data

Walkover Survey Data						
Survey Date	Transect No	Species	BTO code	Number	Habitat	Breeding/Non-breeding
26/10/2021	T1	Whooper Swan	WS	11	GA1	Non-breeding
06/01 /2022	T1	Whooper Swan	WS	4	GA1	Non-breeding
13/01 /2023	T1	Whooper Swan	WS	4	GA1	Non-breeding
20/10/2023	T1	Whooper Swan	WS	6	GA1	Non-breeding

Table 13: Whooper Swan WDS Data

WDS Data						
Survey Date	**Time**	**Species**	**BTO code**	**Number**	**Activity/Behaviour**	**Comments**
12/01/2023	10:26	Whooper Swan	WS	8	Foraging	Foraging in GA1
10/03 /2023	09:51	Whooper Swan	WS	2	Foraging	Foraging in flooded GA1
21/10 /2023	13:35	Whooper Swan	WS	7	Foraging	5 adult 2 Juv, flooded field
28/09/2023	T1	Sparrowhawk	SH	1	WD4	Breeding

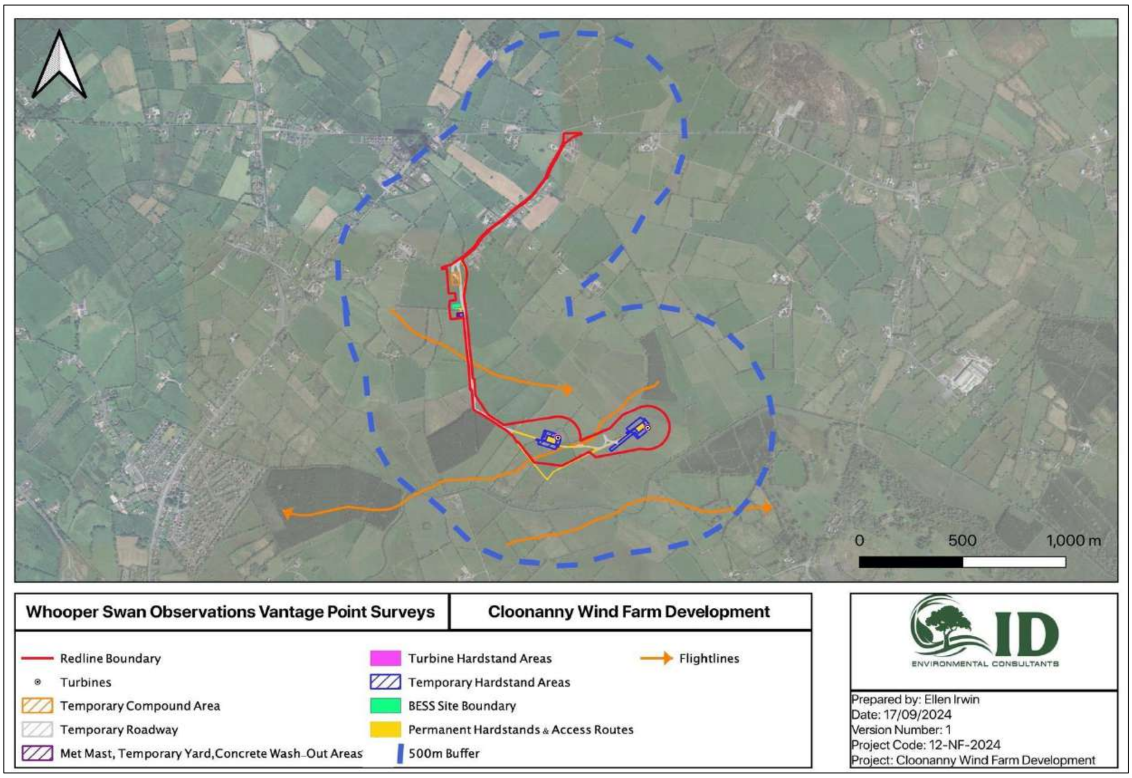

Figure 11: Whooper Swan Vantage Point Survey Flightline

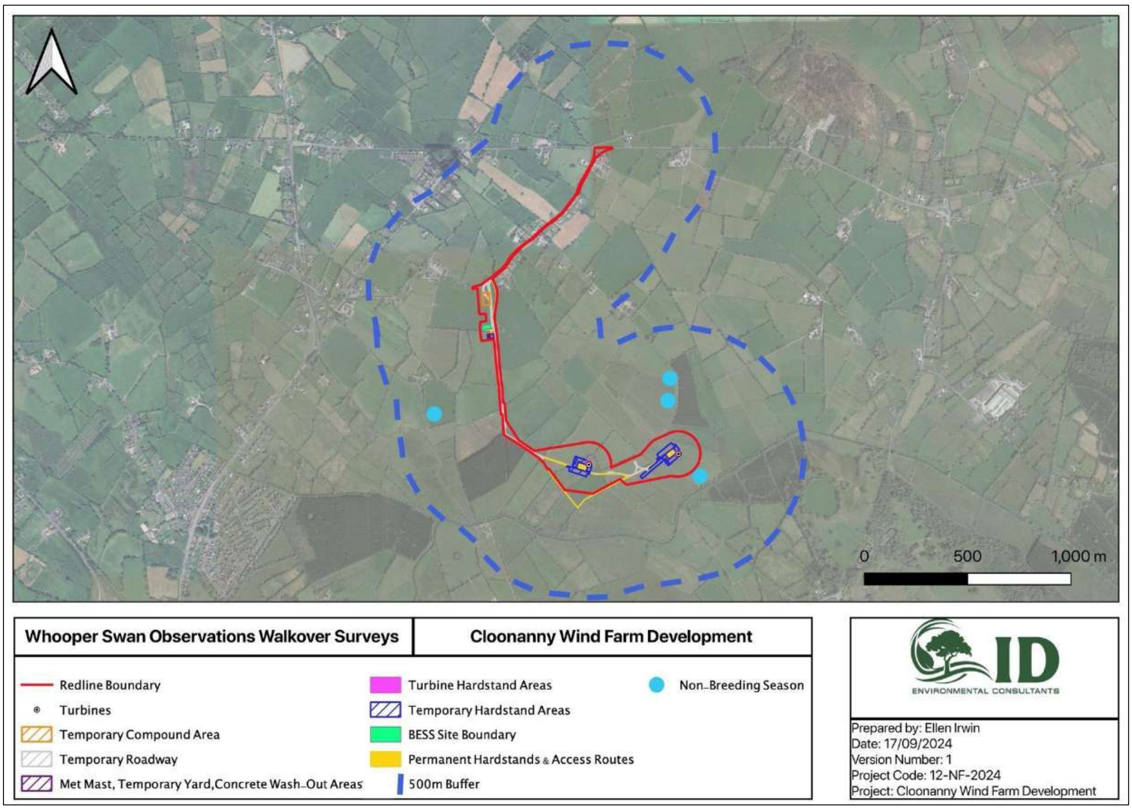

Figure 12: Whooper Swan Walkover Survey Observations

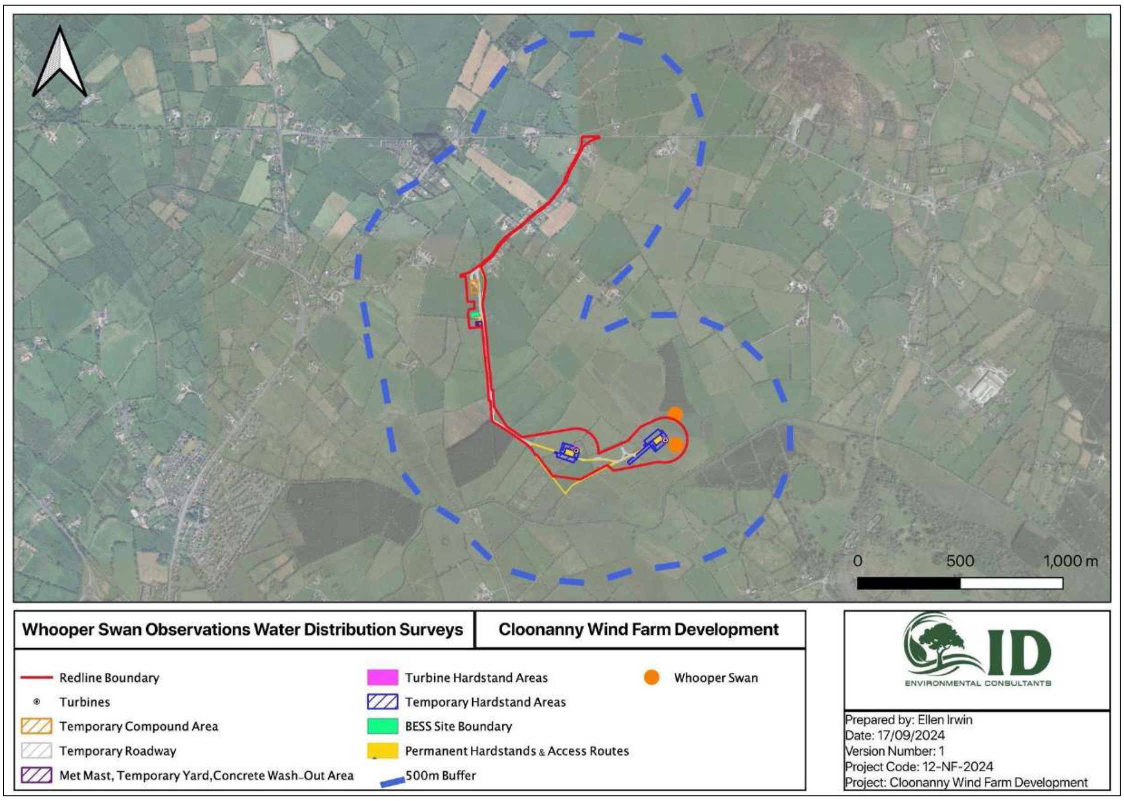

Figure 13: Whooper Swan WDS Observations

Wigeon

Table 14: Wigeon Vantage Point Survey Data

Vantage Point Survey Data												
Date	VP No	Observation No	Species	BTO code	Number	Time	Flight Duration	Band 1 (025m)	Band 2 (25-180m)	Band 3 (>180m)	Activity	Comments
25/10/2021	1	2	Wigeon	WN	39	13:02	216	216	0	0	Feeding	Circling sites before dropping into flooded fields to feed

Table 15: Wigeon Walkover Survey Data

Walkover Survey Data						
Survey Date	Transect No	Species	BTO code	Number	Habitat	Breeding/Non-breeding
04/12/2021	T1	Wigeon	WN	16	GA1	Non-breeding
20/02 /2022	T1	Wigeon	WN	4	GA1	Non-breeding
30/03 /2023	T1	Wigeon	WN	4	GA1	Non-breeding

Table 16: Wigeon Migration Watch Survey Data

Migration Watch Survey Data												
Date	VP No	Observation No	Species	BTO code	Number	Time	Flight Duration	Band 1 (0-25m)	Band 2 (25-180m)	Band 3 (>180m)	Activity	Comments
29/09/2022	1	1	Wigeon	WN	12	08:11	39	29	12	0	Flying	Dropped into flooded fields

Table 17: Wigeon WDS Data

WDS Data						
Survey Date	**Time**	**Species**	**BTO code**	**Number**	**Activity/Behaviour**	**Comments**
29/01/2023	09:49	Wigeon	WN	11	Foraging	Foraging in GA1

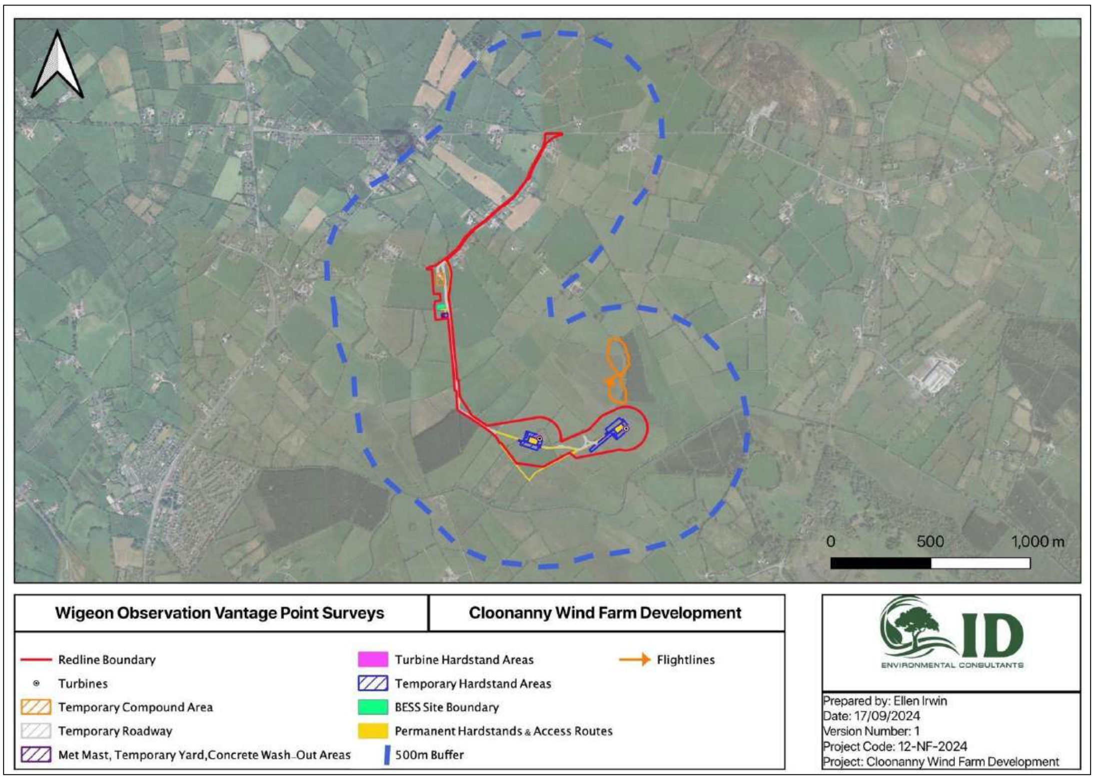

Figure 14: Wigeon Vantage Point Survey Flightlines

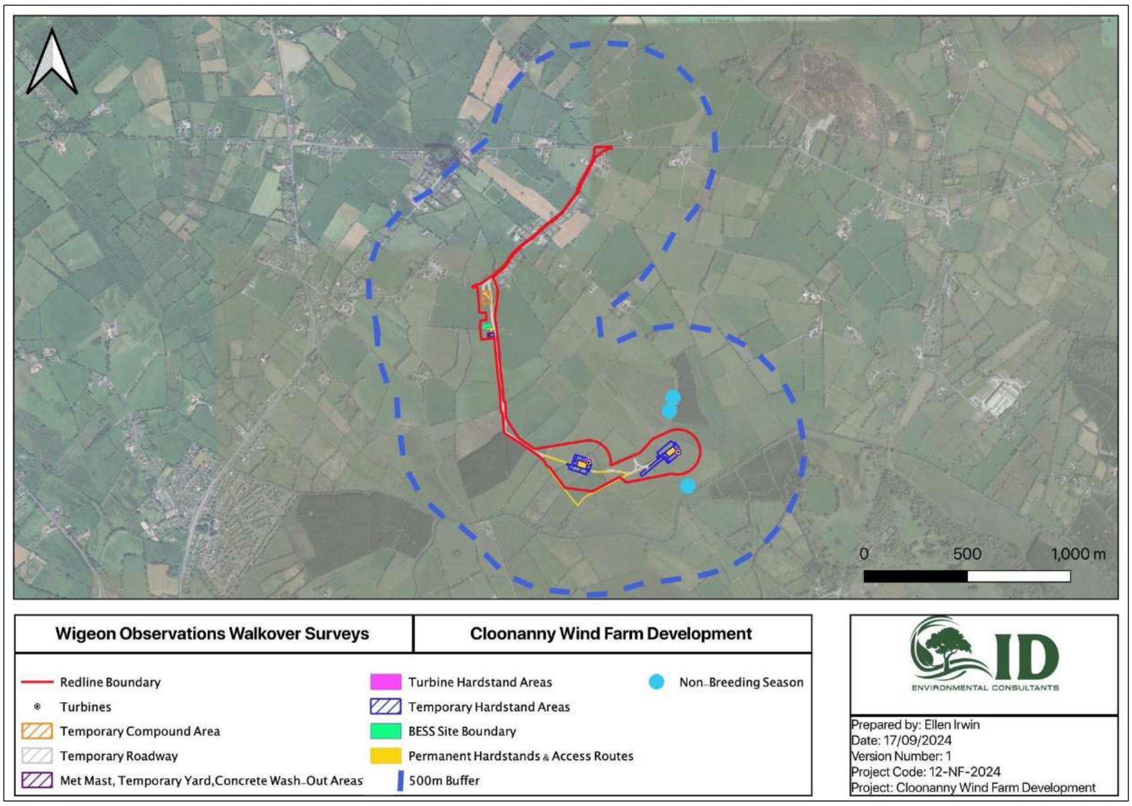

Figure 15: Wigeon Walkover Survey Observations

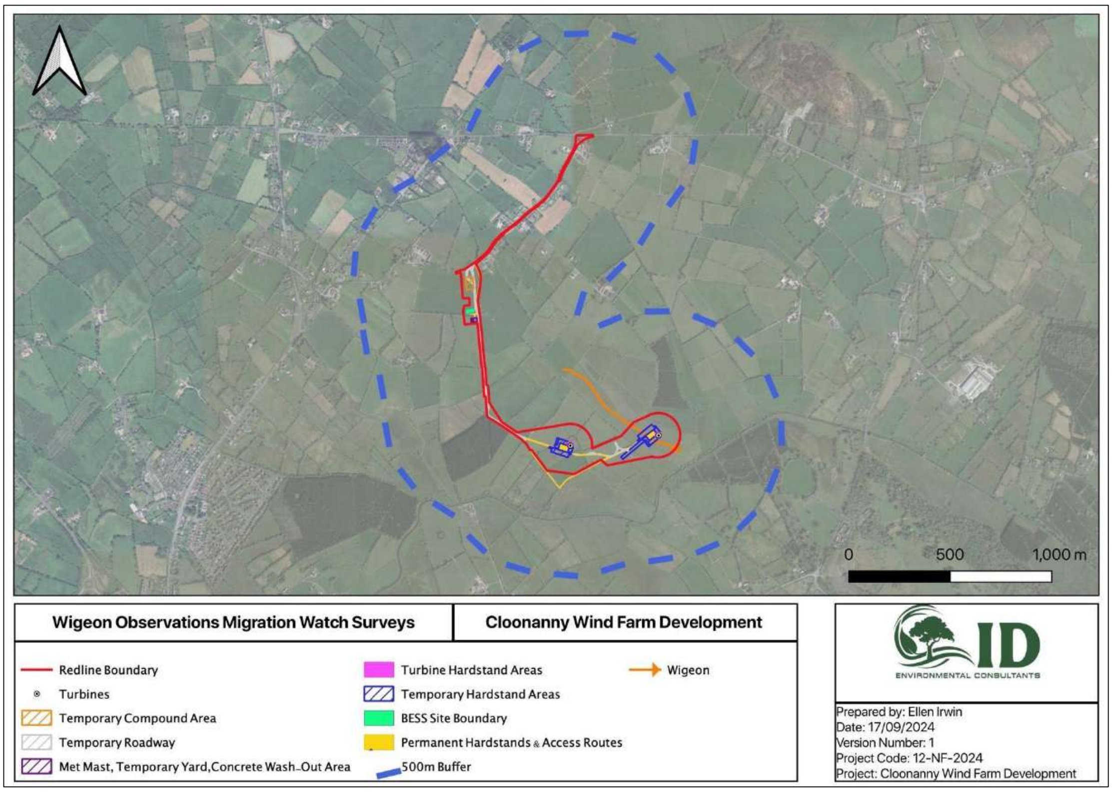

Figure 16: Wigeon Migration Watch Observations

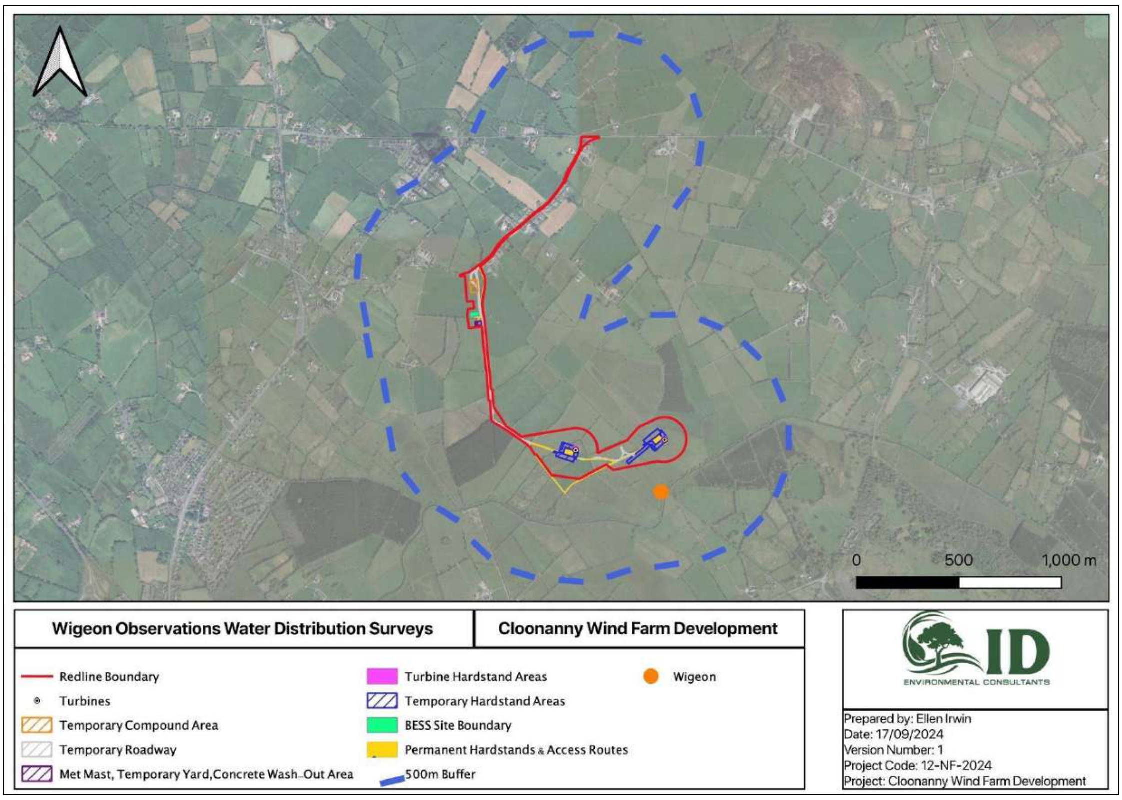

Figure 17: Wigeon WDS Observations

Mallard

Table 18: Mallard Vanatge Point Survey Data

Vantage Point Survey Data												
Date	VP No	Observation No	Species	BTO code	Number	Time	Flight Duration	Band 1 (025m)	Band 2 (25-180m)	Band 3 (>180m)	Activity	Comments
25/10/2021	1	3	Mallard	MA	6	13:39	69	69	0	0	Feeding	Landed in flooded area to forage

Table 19: Mallard Walkover Survey Data

Walkover Survey Data						
Survey Date	Transect No	Species	BTO code	Number	Habitat	Breeding/Non-breeding
26/10/2021	T1	Mallard	MA	2	GA1	Non-breeding
07/11 /2021	T1	Mallard	MA	6	GA1	Non-breeding
04/12 /2021	T1	Mallard	MA	4	GA1	Non-breeding
06/01/2022	T1	Mallard	MA	10	GA1	Non-breeding
20/02/2022	T1	Mallard	MA	2	GA1	Non-breeding
29/07/2022	T1	Mallard	MA	2	GA1	Breeding
13/01/2023	T1	Mallard	MA	2	GA1	Non-Breeding
12/02/2023	T1	Mallard	MA	4	GA1	Non-breeding
07/07/2023	T1	Mallard	MA	2	GS4	Breeding
07/07/2023	T1	Mallard	MA	1	GS4	Breeding
28/09/2023	T1	Mallard	MA	1	GA1	Breeding
18/11/2023	T1	Mallard	MA	2	FW4	Non-breeding
12/12/2023	T1	Mallard	MA	2	GA1	Non-breeding

Table 20: Mallard Migration Watch Survey Data

Migration Watch Survey Data												
Date	VP No	Observation No	Species	BTO code	Number	Time	Flight Duration	Band 1 (0-25m)	Band 2 (25180m)	Band 3 (>180m)	Activity	Comments
08/10/2022	1	1	Mallard	MA	4	07:57	35	10	25	0	Travelling	
08/10/2022	1	6	Mallard	MA	5	13:03	21	21	0	0	Travelling	Landed in flooded field
08/10/2022	1	7	Mallard	MA	3	13:12	60	15	45	0	Travelling	Flew out of flooded field
07/10/2022	3	1	Mallard	MA	3	07:47	26	5	21	0	Travelling	
07/10/2022	3	3	Mallard	MA	7	08:41	33	12	21	0	Travelling	
07/10/2022	3	4	Mallard	MA	5	11:04	25	0	25	0	Travelling	
22/11/2022	1	1	Mallard	MA	4	08:07	33	21	12	0	Travelling	3 Male 1 Female in flooded field

Table 21: Mallard WDS Data

WDS Data						
Survey Date	Time	Species	BTO code	Number	Activity/Behaviour	Comments
12/01/2023	10:42	Mallard	MA	2	Foraging	
12/01/2023	13:06	Mallard	MA	2	In River	
29/01/2023	09:34	Mallard	MA	4	Foraging	GA1
11/02/2023	12:41	Mallard	MA	2	In River	
10/03/2023	09:57	Mallard	MA	1	Foraging	Foraging in flooded GA1
29/03/2023	12:25	Mallard	MA	3	Loafing	In River
05/10/2023	10:37	Mallard	MA	2	Travelling	Females
05/10/2023	14:12	Mallard	MA	2	On Water	Male and female
21/10/2023	10:18	Mallard	MA	3	On water	Male X1 Female X2
30/11/2023	11:06	Mallard	MA	2	On Water	Males
30/11/2023	12:14	Mallard	MA	3	Foraging	Females

Incidental Observations						
Survey Date	**Time**	**Species**	**BTO code**	**Number**	**Activity/Behaviour**	**Comments**
15/07/2023	10:42	Mallard	MA	<100	Foraging	Foraging on flooded grasslands

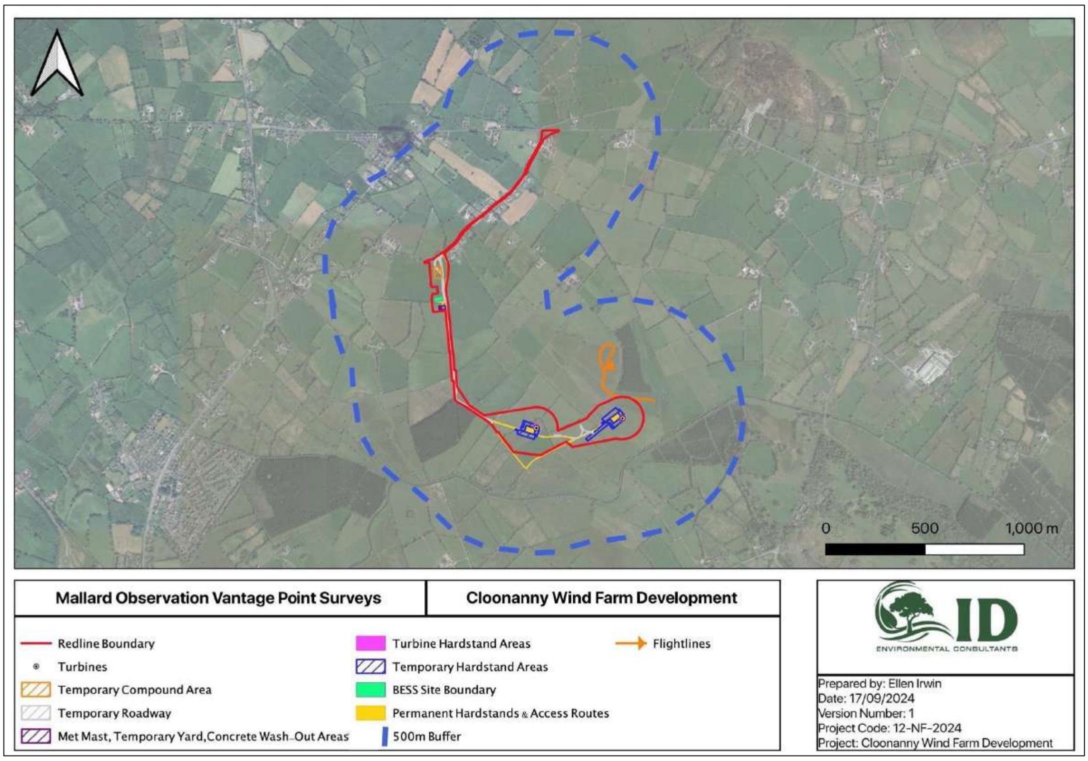

Figure 18: Mallard Vantage Point Survey Flightlines

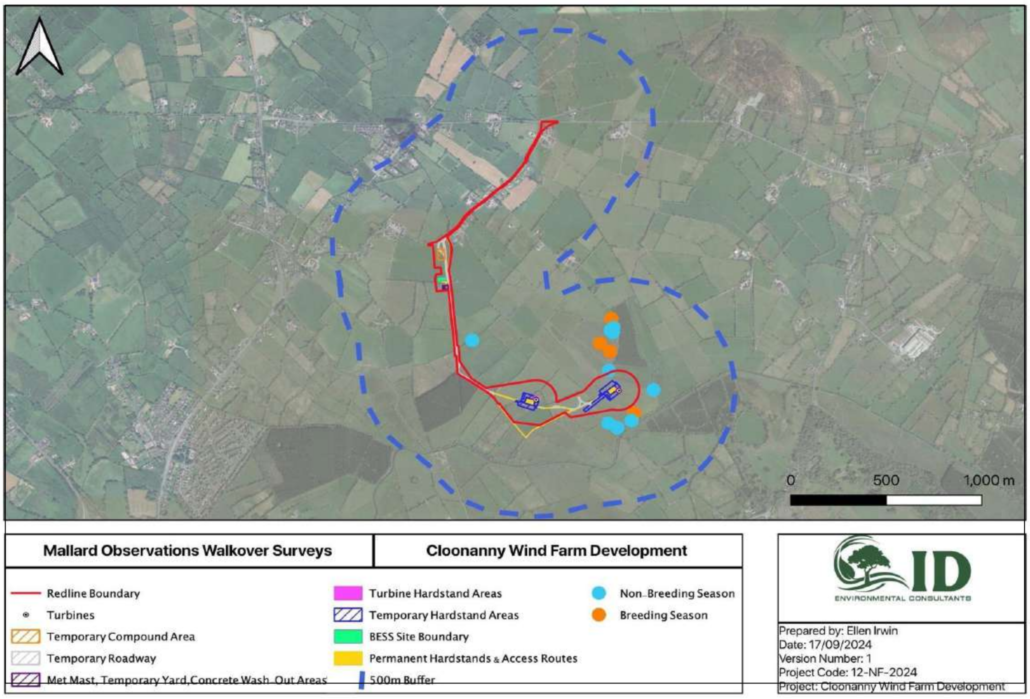

Figure 19: Mallard Walkover Survey Observations

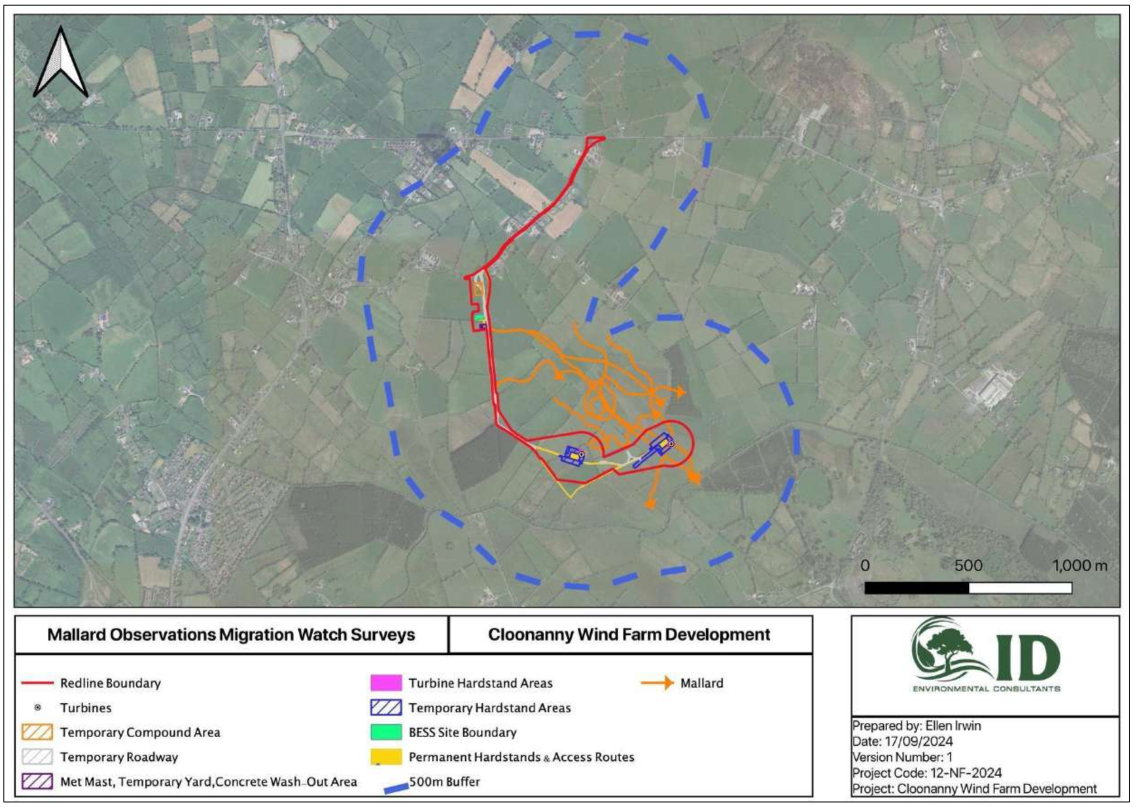

Figure 20: Mallard Migration Watch Observations

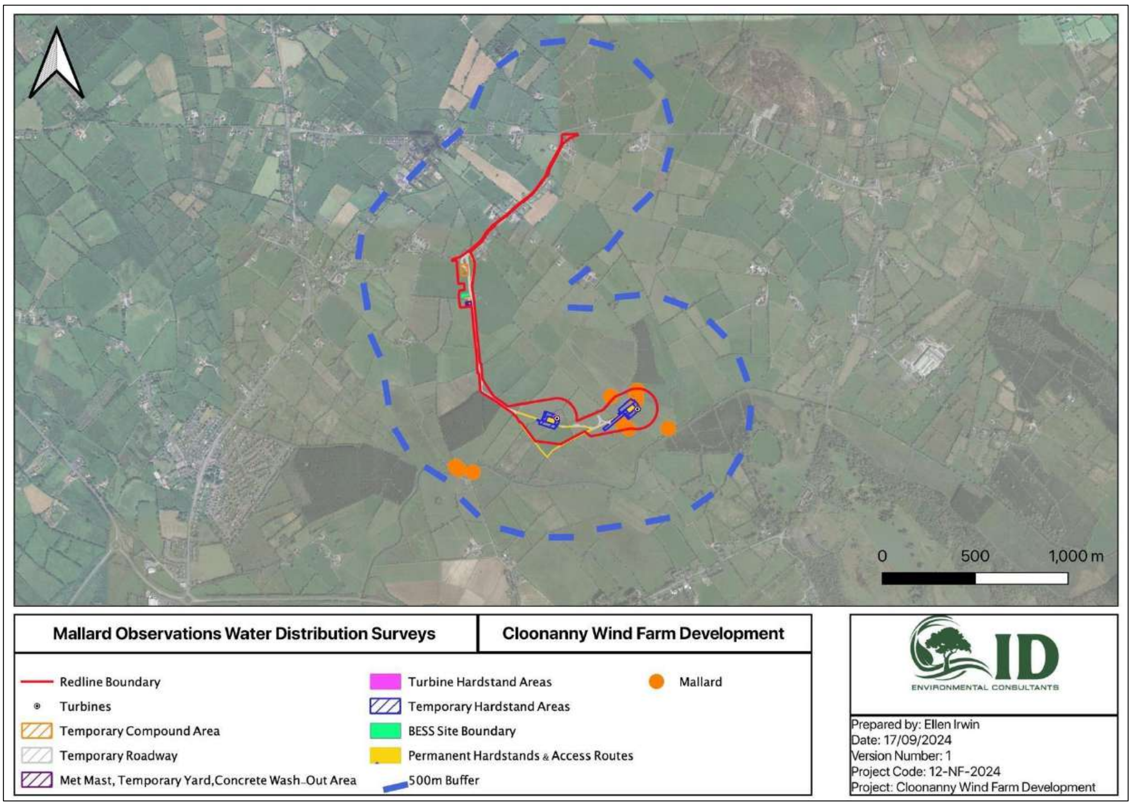

Figure 21: Mallard WDS Observations

Peregrine Falcon

Table 22: Peregrine Falcon Vantage Point Survey Data

Vantage Point Survey Data												
Date	**VP No**	**Observation No**	**Species**	**BTO code**	**Number**	**Time**	**Flight Duration**	**Band 1 (0-25m)**	**Band 2 (25180m)**	**Band 3 (>180m)**	**Activity**	**Comments**
11/03/2022	2	2	Peregrine Falcon	PE	1	11:34	44	0	44	0	Travelling	
28/03/2023	1	4	Peregrine Falcon	PE	1	12:33	35	0	35	0	Travelling	
09/12/2023	1	1	Peregrine Falcon	PE	1	11:24	41	0	41	0	Travelling	Perched on weather station ariel

Table 23: Peregrine Falcon Migration Watch Survey Data

Migration Watch Survey Data												
Date	**VP No**	**Observation No**	**Species**	**BTO code**	**Number**	**Time**	**Flight Duration**	**Band 1 (0-25m)**	**Band 2 (25180m)**	**Band 3 (>180m)**	**Activity**	**Comments**
21/11/2022	3	2	Peregrine Falcon	PE	1	14:48	50	9	41	0	Hunting	Observed at bottom of stoop

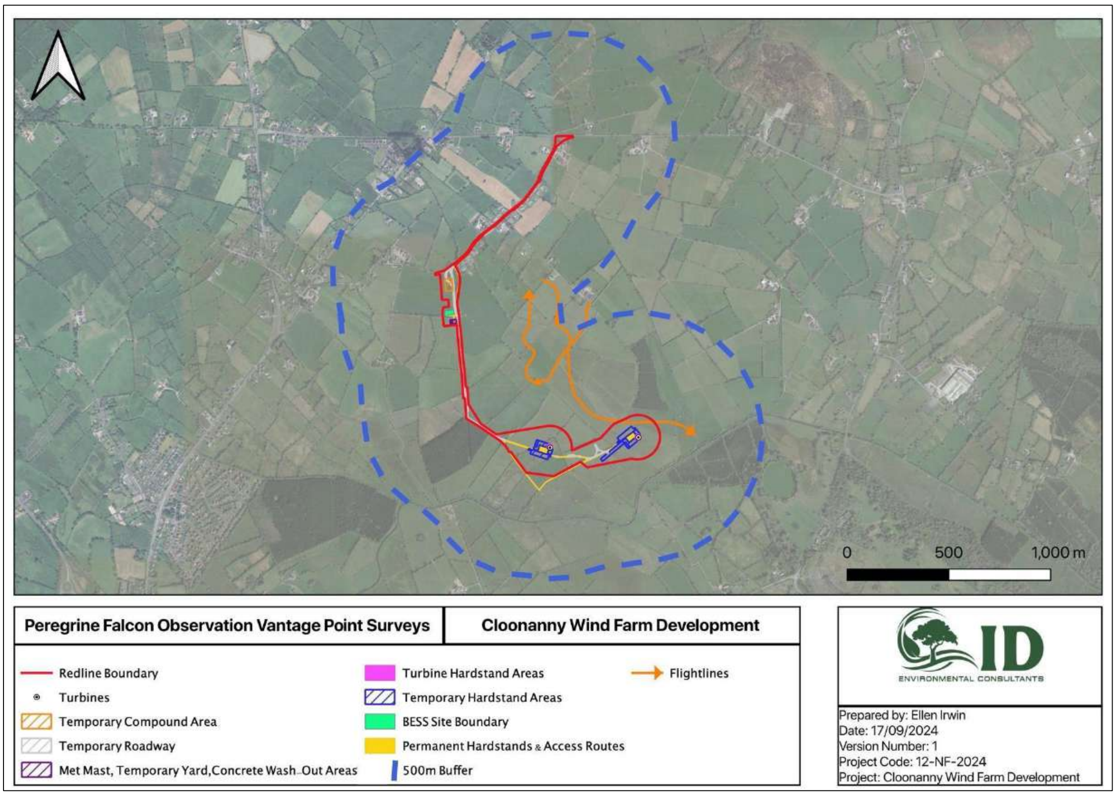

Figure 22: Peregrine Falcon Vantage Point Flightlines

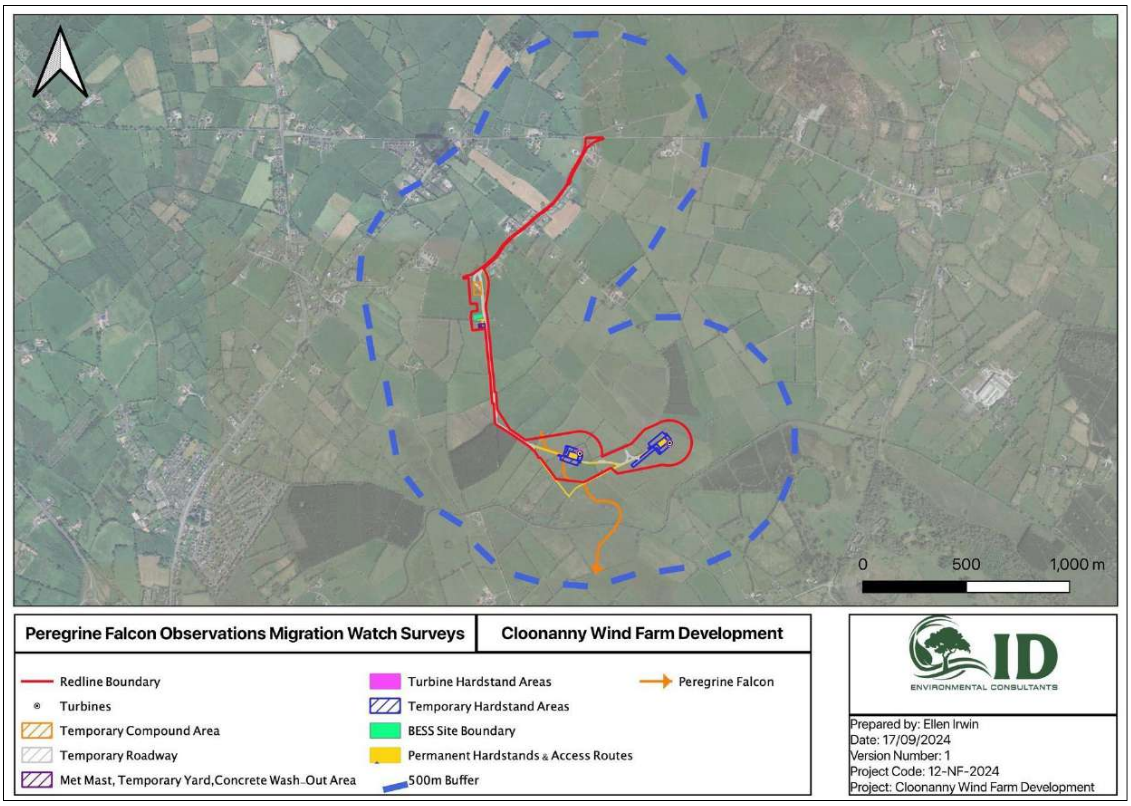

Figure 23: Peregrine Falcon Migration Watch Observations

Golden Plover

Table 24: Golden Plover Vantage Point Survey Data

Vantage Point Survey Data												
Date	VP No	Observation No	Species	BTO code	Number	Time	Flight Duration	Band 1 (0-25m)	Band 2 (25-180m)	Band 3 (>180m)	Activity	Comments
14/04/2023	1	2	Golden Plover	GP	24	10:47	50	0	50	0	Travelling	
11/12/2023	2	2	Golden Plover	GP	15	12:39	37	0	37	0	Travelling	
04/01/2024	3	1	Golden Plover	GP	35	13:15	48	0	48	0	Travelling	
12/02/2024	1	1	Golden Plover	GP	15	10:03	55	0	55	0	Travelling	
02/03/2024	1	1	Golden Plover	GP	30	14:15	50	0	50	0	Travelling	

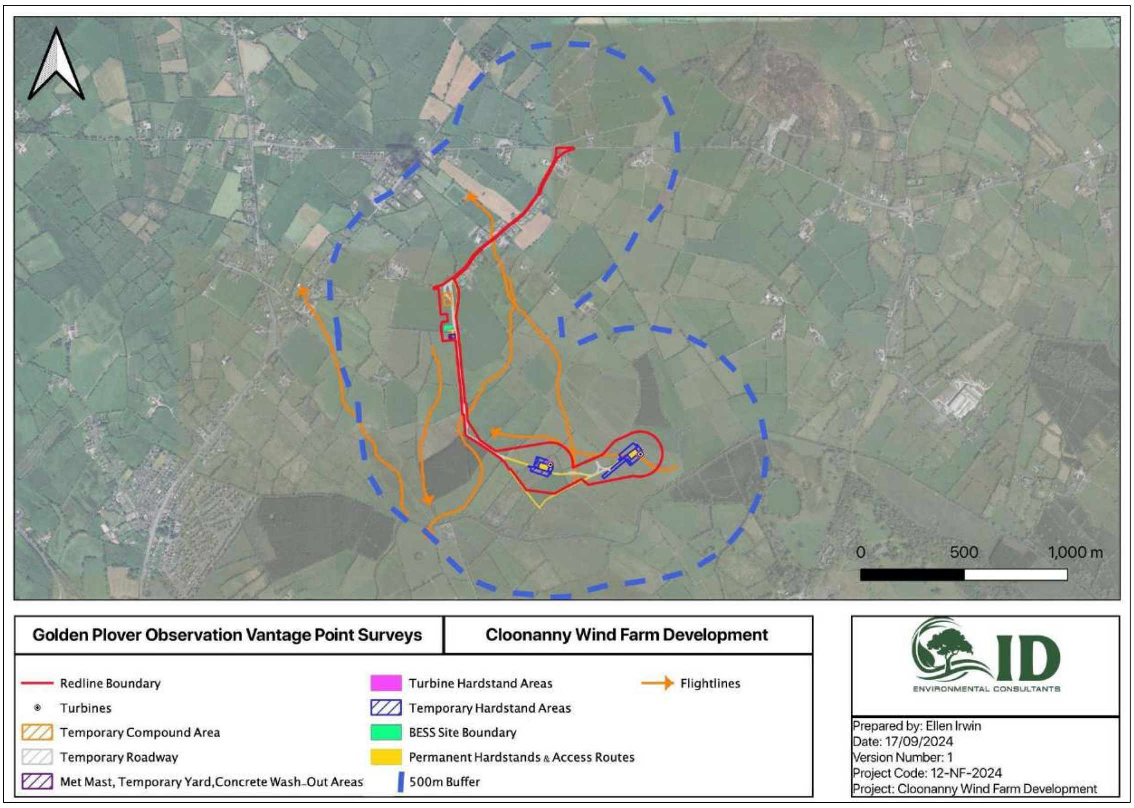

Figure 24: Golden Plover Vantage Point Survey Flightlines

Mute Swan

Table 25: Mute Swan Survey Data

Vantage Point Survey Data												
Date	**VP No**	**Observation No**	**Species**	**BTO code**	**Number**	**Time**	**Flight Duration**	**Band 1 (0-25m)**	**Band 2 (25180m)**	**Band 3 (>180m)**	**Activity**	**Comments**
17/11/2023	3	1	Mute Swan	MS	1	08:42	33	8	25	0	Travelling	Adult
09/12/2023	1	3	Mute Swan	MS	2	14:48	38	0	38	0	Travelling	Adult and Juvenile flying together
04/03/2024	3	1	Mute Swan	MS	1	08:31	23	7	16	0	Travelling	Adult and Juvenile flying together

Table 26: Mute Swan Walkover Survey Data

Walkover Survey Data						
Survey Date	**Transect No**	**Species**	**BTO code**	**Number**	**Habitat**	**Breeding/Non-breeding**
04/12/2021	T1	Mute Swan	MS	2	GA1	Non-breeding
16/04/2023	T1	Mute Swan	MS	2	FW4	Breeding
18/05/2023	T1	Mute Swan	MS	1	GA1	Breeding
07/07 /2023	T1	Mute Swan	MS	2	GS4	Breeding

Table 27: Mute Swan WDS Data

WDS Data

Survey Date	Time	Species	BTO code	Number	Activity/Behaviour	Comments
01/11/2023	12:04	Mute Swan	MS	2	On water	Flooded Field
01/11/2023	15:22	Mute Swan	MS	1	Travelling	
30/11/2023	11:11	Mute Swan	MS	1	Foraging	Adult

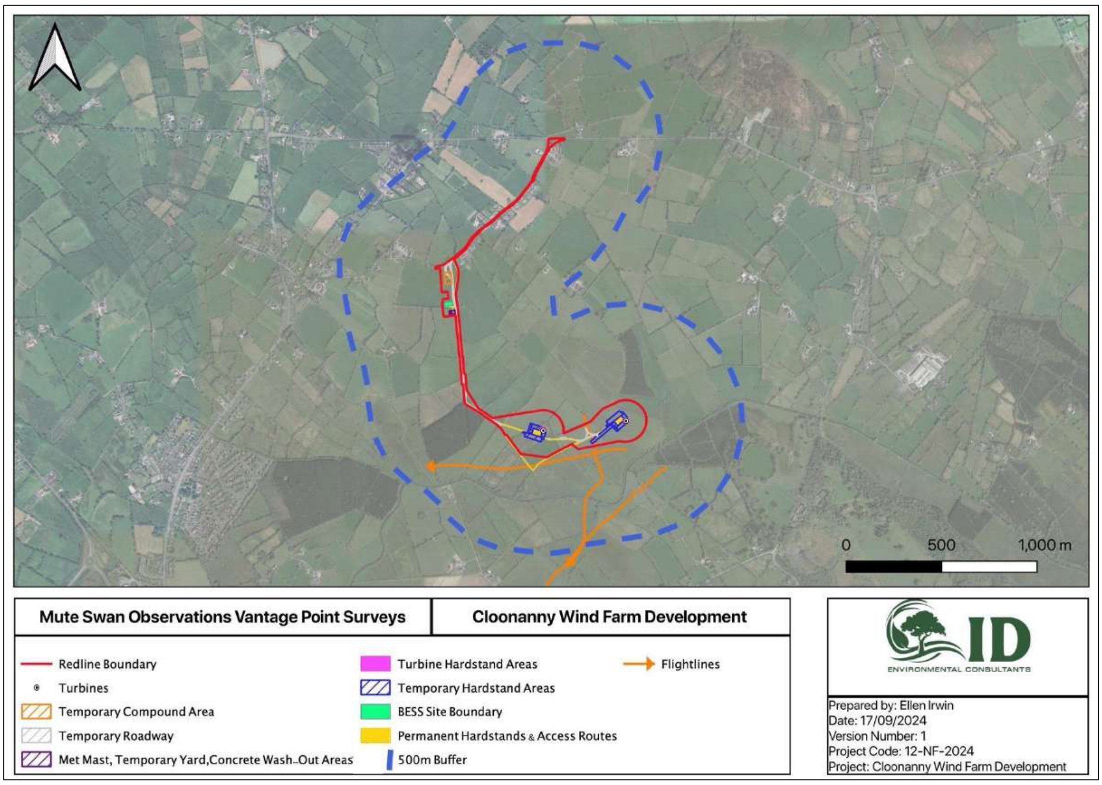

Figure 25: Mute Swan Vantage Point Survey Flightlines

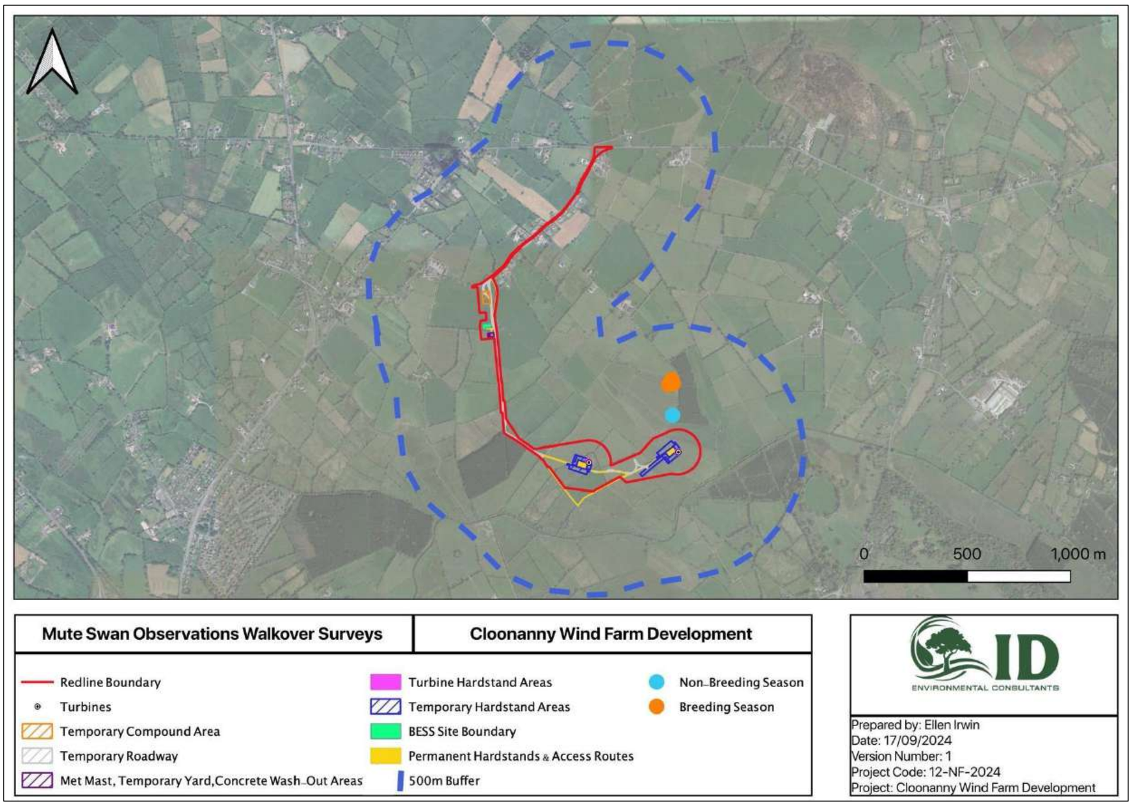

Figure 26: Mute Swan Walkover Survey Observations

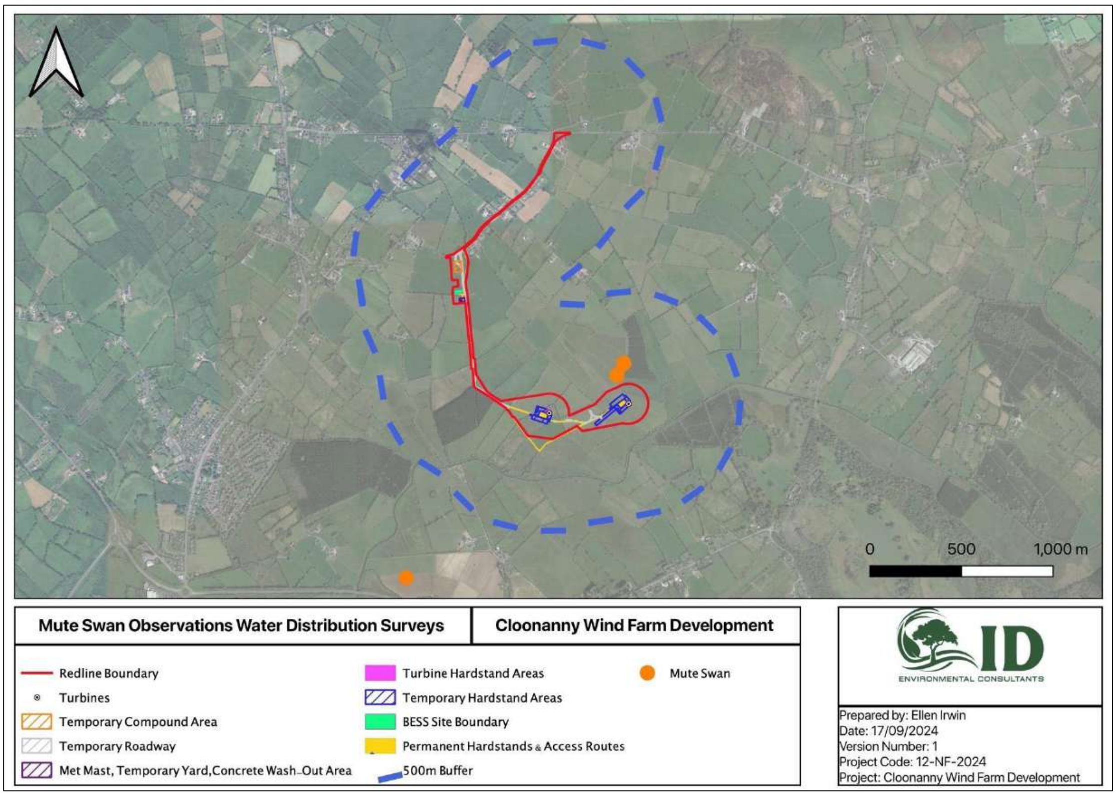

Figure 27: Mute Swan WDS Observations

Snipe

Table 28: Snipe Vantage Point Survey Data

Vantage Point Survey Data												
Date	**VP No**	**Observation No**	**Species**	**BTO code**	**Number**	**Time**	**Flight Duration**	**Band 1 (0-25m)**	**Band 2 (25-180m)**	**Band 3 (>180m)**	**Activity**	**Comments**
17/11/2023	3	2	Snipe	SN	3	09:50	18	0	18	0	Travelling	
17/11/2023	3	3	Snipe	SN	2	11:10	20	7	13	0	Travelling	
12/02/2024	1	1	Snipe	SN	3	09:50	27	6	21	0	Travelling	
13/02/2024	3	2	Snipe	SN	1	08:51	21	9	12	0	Travelling	

Table 29: Snipe Walkover Survey Data

Walkover Survey Data						
Survey Date	**Transect No**	**Species**	**BTO code**	**Number**	**Habitat**	**Breeding/Non-breeding**
26/10/2021	T1	Snipe	SN	1	GA1	Non-breeding
26/10 /2021	T1	Snipe	SN	1	GA1	Non-breeding
26/10 /2021	T1	Snipe	SN	1	GA1	Non-breeding
26/10/2021	T1	Snipe	SN	1	GA1	Non-breeding
29/11/2021	T1	Snipe	SN	1	GA1	Non-breeding
04/12/2021	T1	Snipe	SN	1	GA1	Non-breeding
04/12/2021	T1	Snipe	SN	1	GA1	Non-Breeding
06/01/2022	T1	Snipe	SN	1	GA1	Non-breeding
06/01/2022	T1	Snipe	SN	1	GA1	Non-breeding
20/02/2022	T1	Snipe	SN	1	GA1	Non-breeding
12/03/2022	T1	Snipe	SN	1	GA1	Non-breeding
12/03/2022	T1	Snipe	SN	1	GA1	Breeding

17/04/2022	T1	Snipe	SN	1	GA1	Breeding
17/04/2022	T1	Snipe	SN	1	GA1	Breeding
17/04/2022	T1	Snipe	SN	1	GA1	Breeding
09/05/2022	T1	Snipe	SN	1	GA1	Breeding
29/07/2022	T1	Snipe	SN	1	GA1	Breeding
13/01/2023	T1	Snipe	SN	1	GA1	Breeding
13/01/2023	T1	Snipe	SN	1	GA1	Breeding
13/01/2023	T1	Snipe	SN	1	GA1	Breeding
12/02/2023	T1	Snipe	SN	1	GA1	Breeding
12/02/2023	T1	Snipe	SN	1	GA1	Breeding
12/02/2023	T1	Snipe	SN	1	GA1	Breeding
12/02/2023	T1	Snipe	SN	1	GA1	Breeding
16/04/2023	T1	Snipe	SN	1	GS	Breeding
18/05/2023	T1	Snipe	SN	1	GA1	Breeding
18/05/2023	T1	Snipe	SN	1	GA1	Breeding
25/06/2023	T1	Snipe	SN	1	GA1	Breeding
07/07/2023	T1	Snipe	SN	1	GA1	Breeding
28/09/2023	T1	Snipe	SN	1	GA1	Breeding
20/10/2023	T1	Snipe	SN	2	GA1	Non-breeding
20/10/2023	T1	Snipe	SN	2	GA1	Non-breeding
18/11/2023	T1	Snipe	SN	2	GA1	Non-breeding
18/11/2023	T1	Snipe	SN	3	WL2	Non-breeding
12/12/2023	T1	Snipe	SN	3	GA1	Non-breeding
12/12/2023	T1	Snipe	SN	1	GA1	Non-breeding

Table 30: Snipe Migration Watch Survey Data

Migration Watch Survey Data												
Date	VP No	Observation No	Species	BTO code	Number	Time	Flight Duration	Band 1 (0-25m)	Band 2 (25180m)	Band 3 (>180m)	Activity	Comments

07/10/2022	3	2	Snipe	SN	1	07:59	25	0	25	0	Travelling	

Table 31: Snipe WDS Data

/DS Data						
Survey Date	**Time**	**Species**	**BTO code**	**Number**	**Activity/Behaviour**	**Comments**
12/01/2023	11:29	Snipe	SN	1	Flushed	
29/01/2023	11:51	Snipe	SN	1	Flushed	GA1
29/01/2023	12:51	Snipe	SN	1	Flushed	GA1
11/02/2023	09:43	Snipe	SN	1	Flushed	
11/02/2023	10:26	Snipe	SN	1	Flushed	
24/02/2023	09:46	Snipe	SN	1	Flushed	GA1
24/02/2023	10:22	Snipe	SN	1	Flushed	GA1
24/02/2023	11:43	Snipe	SN	1	Flushed	GA1
24/02/2023	12:19	Snipe	SN	1	Flushed	GA1
10/03/2023	10:49	Snipe	SN	1	Foraging	Foraging in flooded GA1
05/10/2023	09:50	Snipe	SN	1	Flushed	
21/10/2023	10:15	Snipe	SN	3	Flushed	
01/11/2023	12:08	Snipe	SN	2	Flushed	
30/11/2023	12:05	Snipe	SN	2	Flushed	
22/12/2023	11:14	Snipe	SN	3	Flushed	

Table 32: Snipe Survey Data

Snipe Survey Data								
Date	**VP No**	**Observation No**	**Species**	**BTO code**	**Number**	**Time**	**Activity**	**Comments**
02/05/2022	T1	1	Snipe	SN	1	06:41	Chipping	Bird not seen but heard chipping to the east of observer

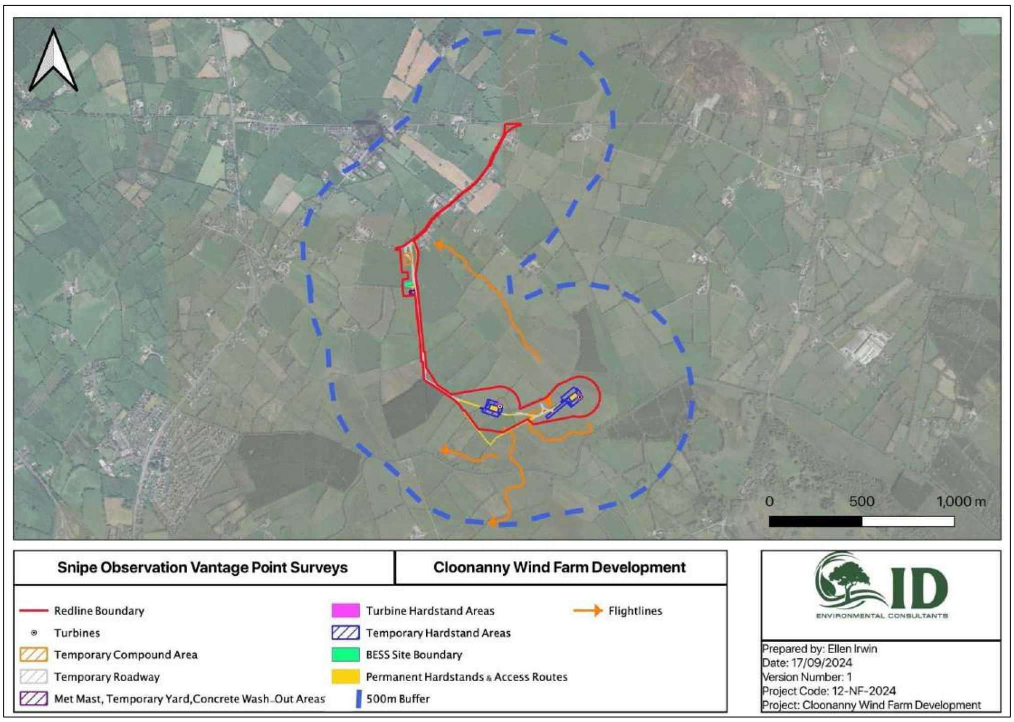

Figure 28: Snipe Vantage Point Survey Flightlines

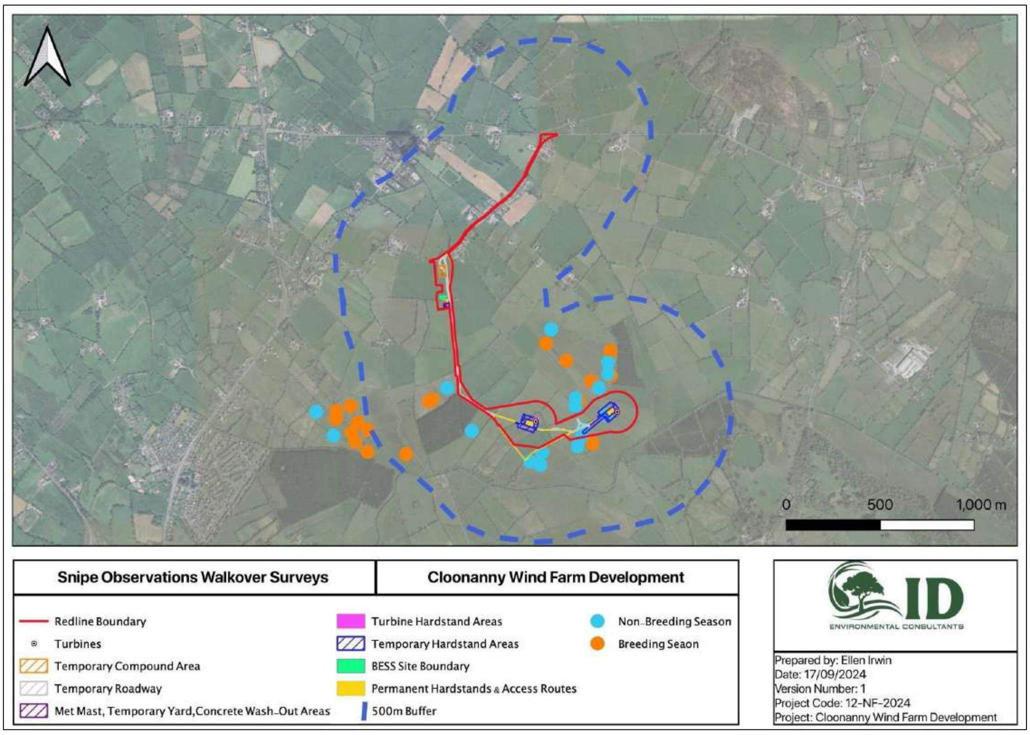

Figure 29: Snipe Walkover Survey Observations

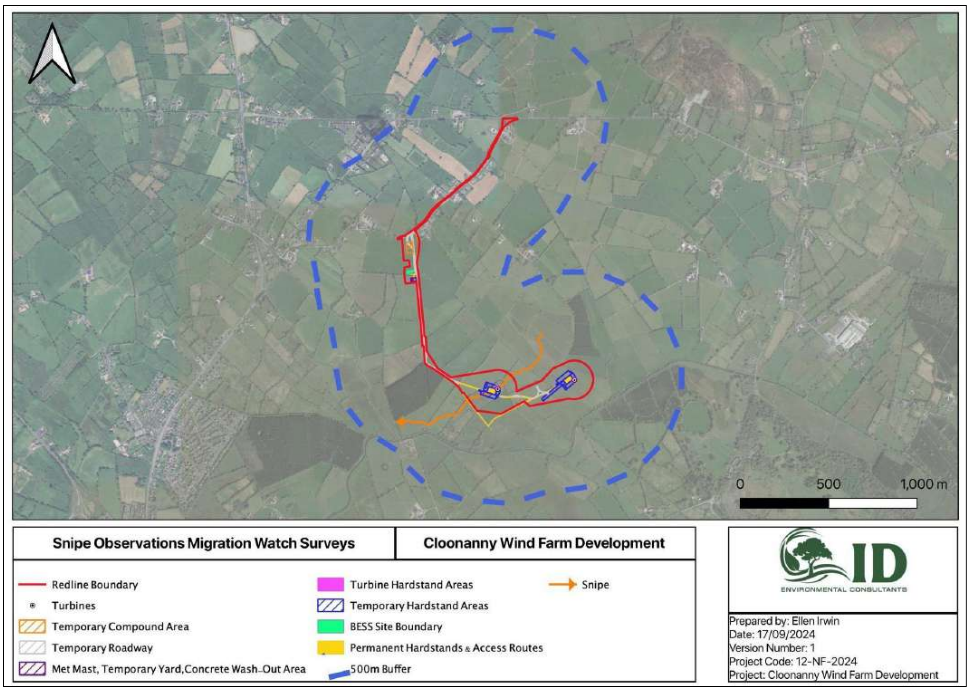

Figure 30: Snipe Migration Watch Observations

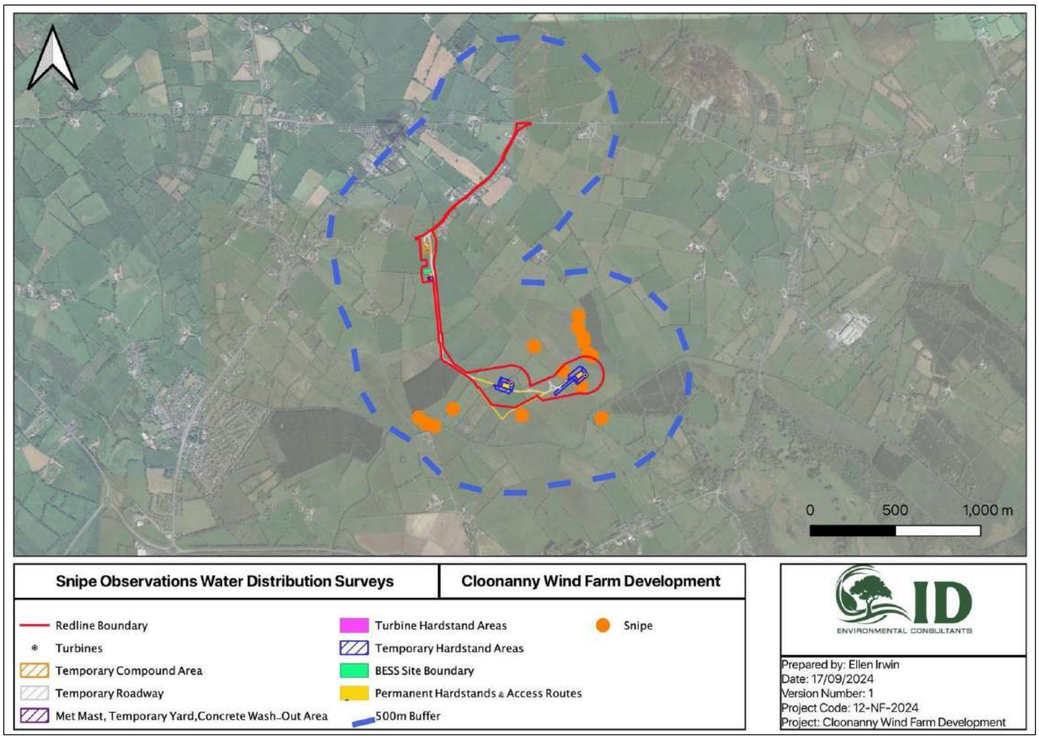

Figure 31: Snipe WDS Observations

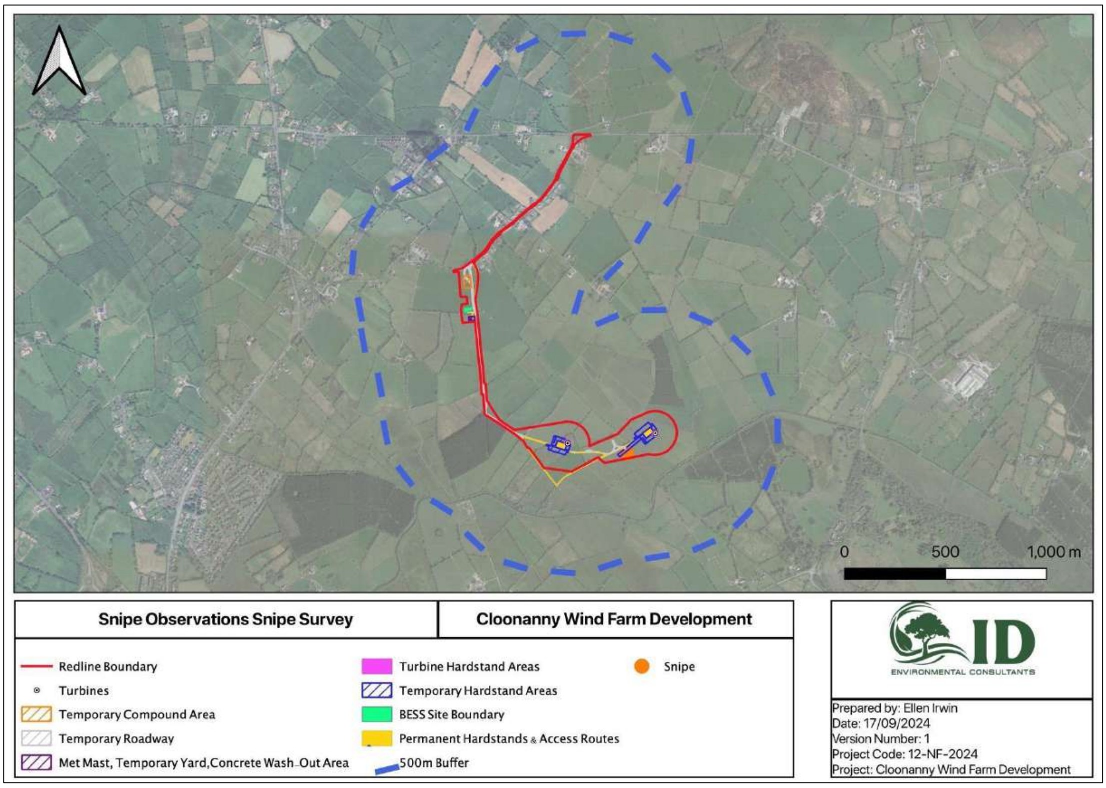

Figure 32: Snipe Survey Observations

Teal

Table 33: Teal Vantage Point Survey Data

Vantage Point Survey Data												
Date	VP No	Observation No	Species	BTO code	Number	Time	Flight Duration	Band 1 (025m)	Band 2 (25180m)	Band 3 (>180m)	Activity	Comments
11/12/2023	2	3	Teal	T	1	14:20	25	0	25	0	Travelling	
03/01/2024	1	1	Teal	T	2	11:21	28	0	28	0	Travelling	

Table 34: Teal Migration Watch Survey Data

Migration Watch Survey Data												
Date	VP No	Observation No	Species	BTO code	Number	Time	Flight Duration	Band 1 (0-25m)	Band 2 (25180m)	Band 3 (>180m)	Activity	Comments
29/09/2022	1	2	Teal	T	6	10:24	66	24	42	0	Flying	Dropped into flooded field

Table 35: Teal WDS Data

VDS Data						
Survey Date	Time	Species	BTO code	Number	Activity/Behaviour	Comments
29/01/2023	09:31	Teal	T	7	Foraging	GA1
30/11/2023	09:30	Teal	T	2	Travelling	Male and Female

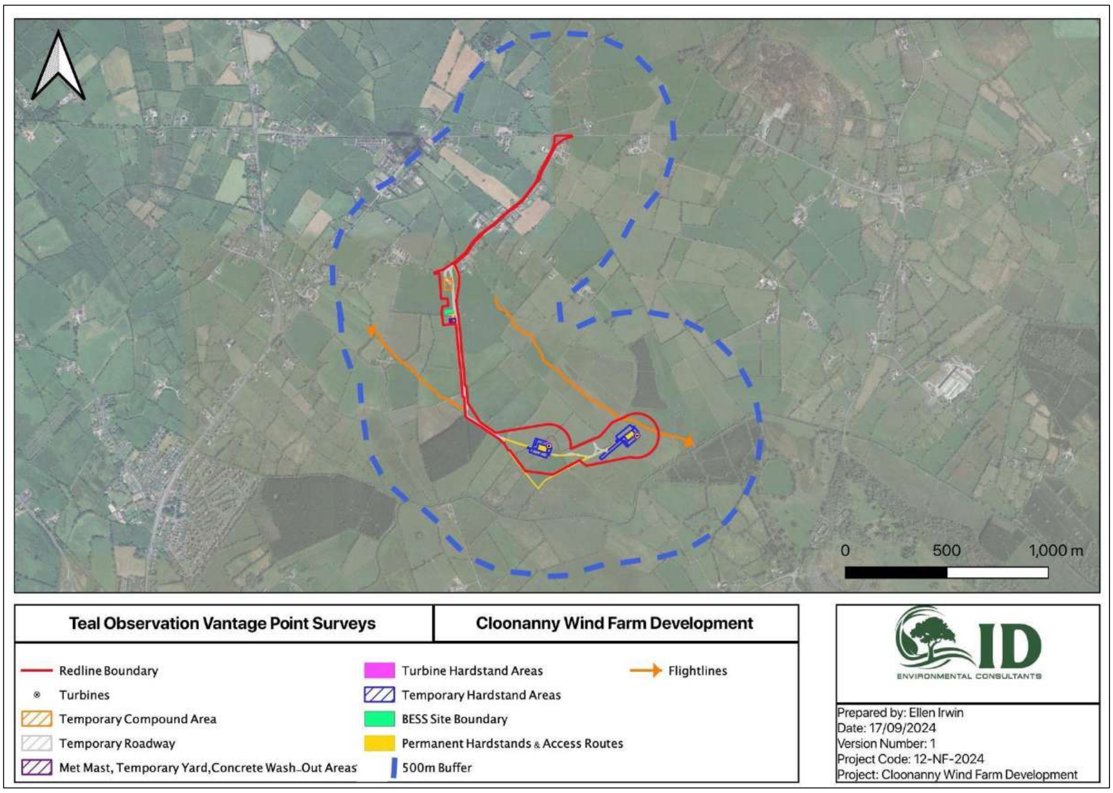

Figure 33: Teal Vantage Point Flightlines

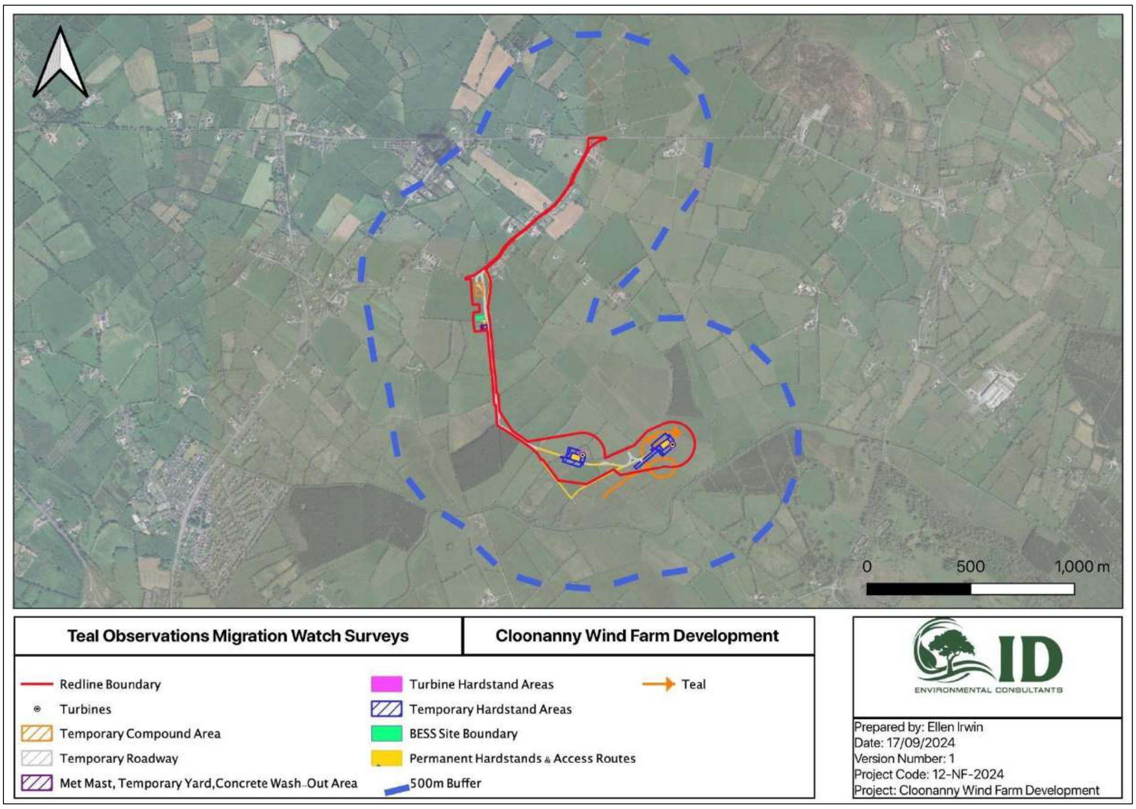

Figure 34: Teal Migration Watch Observations

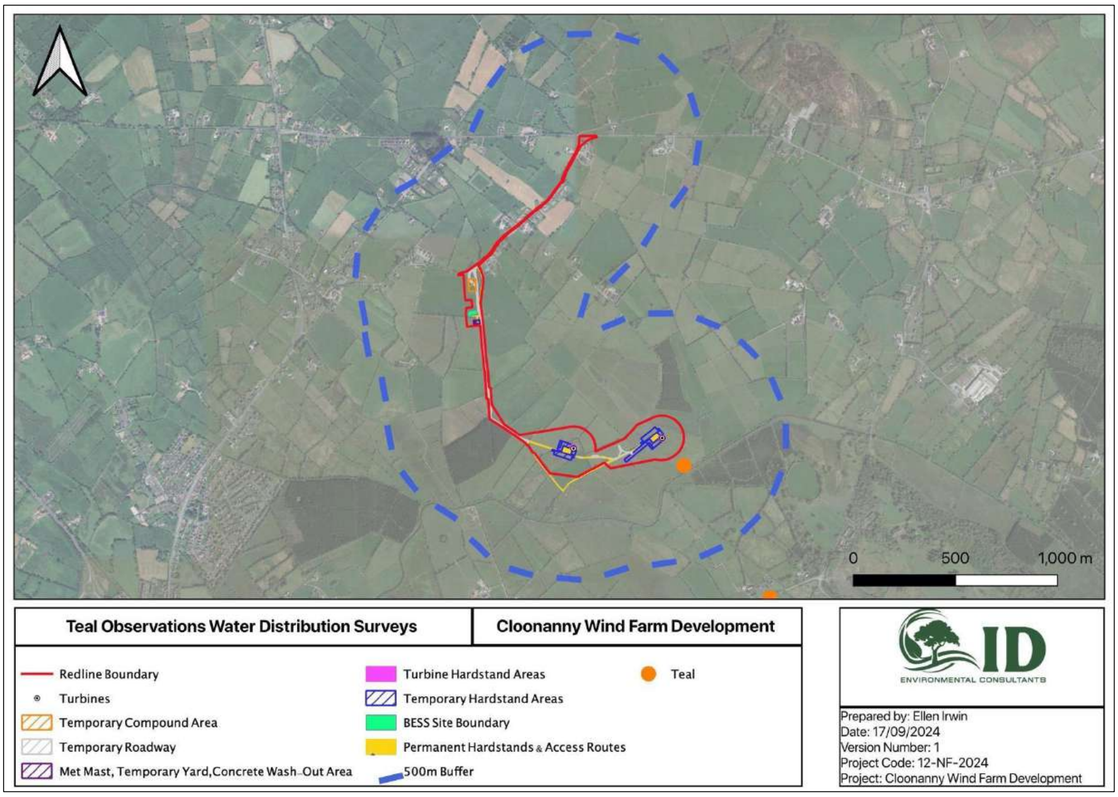

Figure 35: Teal WDS Observations

Meadow Pipit

Table 36: Meadow Pipit Survey Data

Walkover Survey Data						
Survey Date	**Transect No**	**Species**	**BTO code**	**Number**	**Habitat**	**Breeding/Non-breeding**
26/10/2021	T1	Meadow Pipit	MP	1	GA1	Non-breeding
26/10 /2021	T1	Meadow Pipit	MP	1	GA1	Non-breeding
26/10 /2021	T1	Meadow Pipit	MP	1	GA1	Non-breeding
26/10/2021	T1	Meadow Pipit	MP	1	GA1	Non-breeding
07/11/2021	T1	Meadow Pipit	MP	4	GA1	Non-breeding
04/12/2021	T1	Meadow Pipit	MP	1	GA1	Non-breeding
04/12/2021	T1	Meadow Pipit	MP	1	GA1	Non-breeding
04/12/2021	T1	Meadow Pipit	MP	1	GA1	Non-breeding
04/12/2021	T1	Meadow Pipit	MP	1	GA1	Non-breeding
06/01/2022	T1	Meadow Pipit	MP	1	GA1	Non-breeding
06/01/2022	T1	Meadow Pipit	MP	1	GA1	Non-breeding
06/01/2022	T1	Meadow Pipit	MP	1	GA1	Non-breeding
20/02/2022	T1	Meadow Pipit	MP	1	GA1	Non-breeding
20/02/2022	T1	Meadow Pipit	MP	1	GA1	Non-breeding
12/03/2022	T1	Meadow Pipit	MP	1	GA1	Non-breeding
12/03/2022	T1	Meadow Pipit	MP	1	GA1	Non-breeding
17/04/2022	T1	Meadow Pipit	MP	1	GA1	Non-breeding
17/04/2022	T1	Meadow Pipit	MP	2	GA1	Non-breeding
09/05/2022	T1	Meadow Pipit	MP	1	GA1	Breeding
09/05/2022	T1	Meadow Pipit	MP	1	GA1	Breeding
09/05/2022	T1	Meadow Pipit	MP	1	GA1	Breeding
09/05/2022	T1	Meadow Pipit	MP	1	GA1	Breeding
09/05/2022	T1	Meadow Pipit	MP	1	GA1	Breeding
29/06/2022	T1	Meadow Pipit	MP	1	GA1	Breeding

29/06/2022	T1	Meadow Pipit	MP	1	GA1	Breeding
29/06/2022	T1	Meadow Pipit	MP	2	GA1	Breeding

29/06/2022	T1	Meadow Pipit	MP	1	GA1	Breeding
29/06/2022	T1	Meadow Pipit	MP	1	GA1	Breeding
29/06/2022	T1	Meadow Pipit	MP	1	GA1	Breeding
29/06/2022	T1	Meadow Pipit	MP	1	GA1	Breeding
29/07/2022	T1	Meadow Pipit	MP	1	GA1	Breeding
29/07/2022	T1	Meadow Pipit	MP	1	GA1	Breeding
30/03/2023	T1	Meadow Pipit	MP	1	GA1	Breeding
30/03/2023	T1	Meadow Pipit	MP	1	GA1	Breeding
30/03/2023	T1	Meadow Pipit	MP	4	GA1	Breeding
16/04/2023	T1	Meadow Pipit	MP	2	GA1	Breeding
16/04/2023	T1	Meadow Pipit	MP	4	GA1	Breeding
16/04/2023	T1	Meadow Pipit	MP	2	GS	Breeding
18/05/2023	T1	Meadow Pipit	MP	1	GA1	Breeding
18/05/2023	T1	Meadow Pipit	MP	2	GA1	Breeding
18/05/2023	T1	Meadow Pipit	MP	1	GA1	Breeding
18/05/2023	T1	Meadow Pipit	MP	2	GA1	Breeding
25/06/2023	T1	Meadow Pipit	MP	1	GA1	Breeding
25/06/2023	T1	Meadow Pipit	MP	1	GA1	Breeding
25/06/2023	T1	Meadow Pipit	MP	2	GA1	Breeding
25/06/2023	T1	Meadow Pipit	MP	1	GA1	Breeding
07/07/2023	T1	Meadow Pipit	MP	3	GA1	Breeding
07/07/2023	T1	Meadow Pipit	MP	1	GA1	Breeding
07/07/2023	T1	Meadow Pipit	MP	6	GA1	Breeding
07/07/2023	T1	Meadow Pipit	MP	2	GA1	Breeding
28/09/2023	T1	Meadow Pipit	MP	1	FW4	Breeding
28/09/2023	T1	Meadow Pipit	MP	1	FW4	Breeding

28/09/2023	T1	Meadow Pipit	MP	2	GA1	Breeding
28/09/2023	T1	Meadow Pipit	MP	4	GA1	Breeding
28/09/2023	T1	Meadow Pipit	MP	6	GA1	Breeding
28/09/2023	T1	Meadow Pipit	MP	2	GA1	Breeding
20/10/2023	T1	Meadow Pipit	MP	2	GA1	Non-breeding
20/10/2023	T1	Meadow Pipit	MP	3	FW4	Non-breeding
20/10/2023	T1	Meadow Pipit	MP	3	BL3	Non-breeding
20/10/2023	T1	Meadow Pipit	MP	4	GA1	Non-breeding
20/10/2023	T1	Meadow Pipit	MP	4	GA1	Non-breeding
20/10/2023	T1	Meadow Pipit	MP	6	GA1	Non-breeding
18/11/2023	T1	Meadow Pipit	MP	2	GA1	Non-breeding
18/11/2023	T1	Meadow Pipit	MP	1	WL2	Non-breeding
18/11/2023	T1	Meadow Pipit	MP	5	GA1	Non-breeding
18/11/2023	T1	Meadow Pipit	MP	7	GA1	Non-breeding
12/12/2023	T1	Meadow Pipit	MP	2	GA1	Non-breeding
12/12/2023	T1	Meadow Pipit	MP	4	GA1	Non-breeding
12/12/2023	T1	Meadow Pipit	MP	2	BL3	Non-breeding
12/12/2023	T1	Meadow Pipit	MP	3	GA1	Non-breeding
12/12/2023	T1	Meadow Pipit	MP	7	GA1	Non-breeding

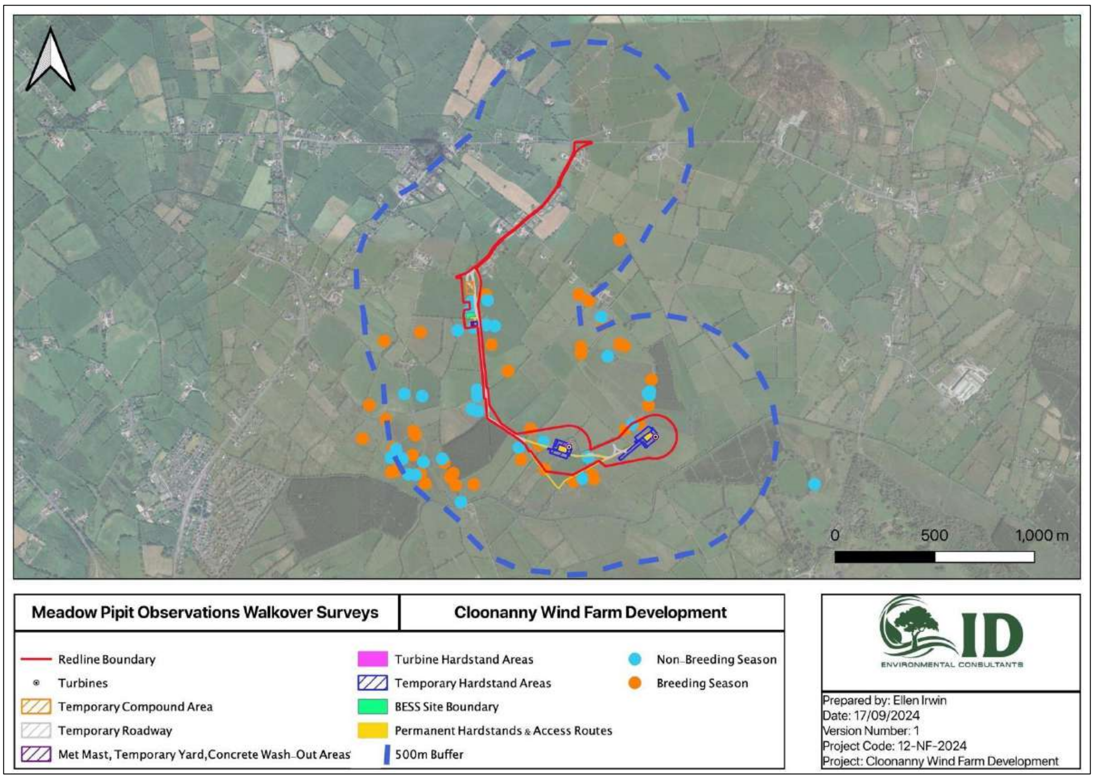

Figure 36: Meadow Pipit Walkover Survey Observations

Redwing

Table 37: Redwing Vantage Point Survey Data

Walkover Survey Data						
Survey Date	**Transect No**	**Species**	**BTO code**	**Number**	**Habitat**	**Breeding/Non-breeding**
07/11/2021	T1	Redwing	RE	1	GA1	Non-breeding
04/12/2021	T1	Redwing	RE	26	GA1	Non-breeding
13/01/2023	T1	Redwing	RE	26	GA1	Non-Breeding
20/10/2023	T1	Redwing	RE	4	GA1	Non-breeding
20/10/2023	T1	Redwing	RE	5	GA1	Non-breeding
20/10/2023	T1	Redwing	RE	8	GA1	Non-breeding
20/10/2023	T1	Redwing	RE	3	WL1	Non-breeding
20/10/2023	T1	Redwing	RE	4	WL1	Non-breeding
18/11/2023	T1	Redwing	RE	4	WL1	Non-breeding
18/11/2023	T1	Redwing	RE	7	WD4	Non-breeding
18/11/2023	T1	Redwing	RE	3	GA1	Non-breeding
18/11/2023	T1	Redwing	RE	4	GA1	Non-breeding
18/11/2023	T1	Redwing	RE	8	GA1	Non-breeding
18/11/2023	T1	Redwing	RE	13	WL2	Non-breeding
18/11/2023	T1	Redwing	RE	2	GA1	Non-breeding
12/12/2023	T1	Redwing	RE	7	WL1	Non-breeding
12/12/2023	T1	Redwing	RE	17	GA1	Non-breeding
12/12/2023	T1	Redwing	RE	4	GA1	Non-breeding
12/12/2023	T1	Redwing	RE	8	GA1	Non-breeding
12/12/2023	T1	Redwing	RE	5	WL2	Non-breeding

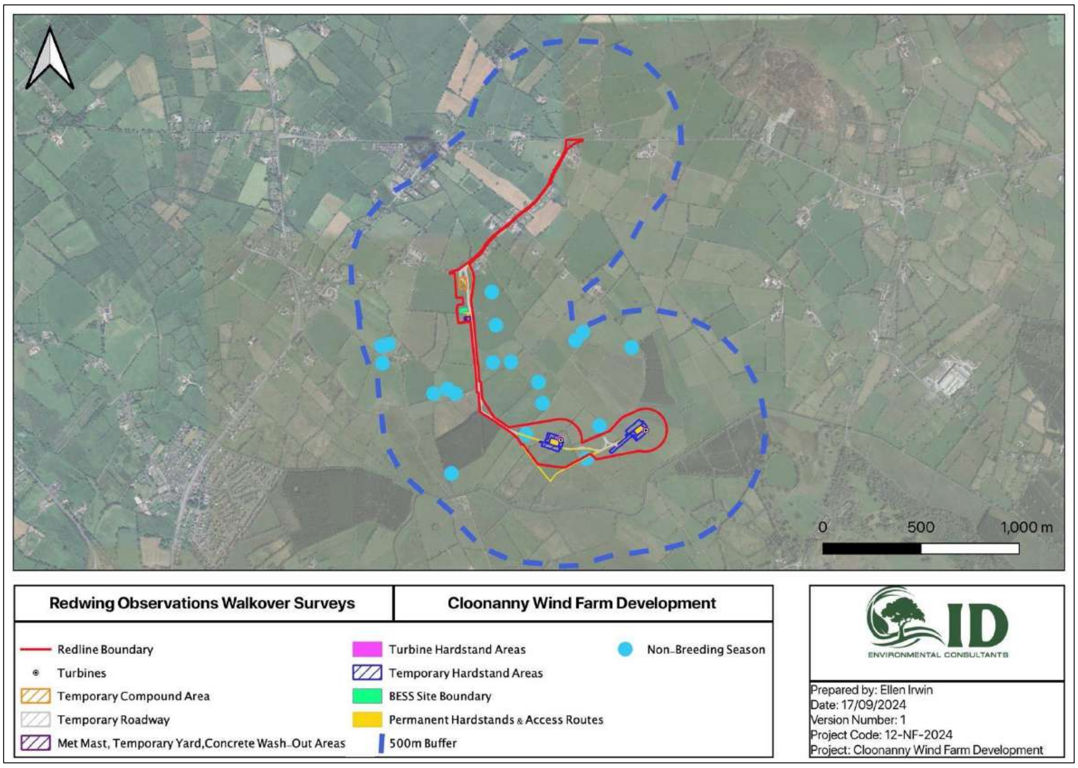

Figure 37: Redwing Walkover Survey Observations

Fieldfare

Table 38: Fieldfare Walkover Survey Data

Walkover Survey Data						
Survey Date	**Transect No**	**Species**	**BTO code**	**Number**	**Habitat**	**Breeding/Non-breeding**
04/12/2021	T1	Fieldfare	FF	19	GA1	Non-breeding

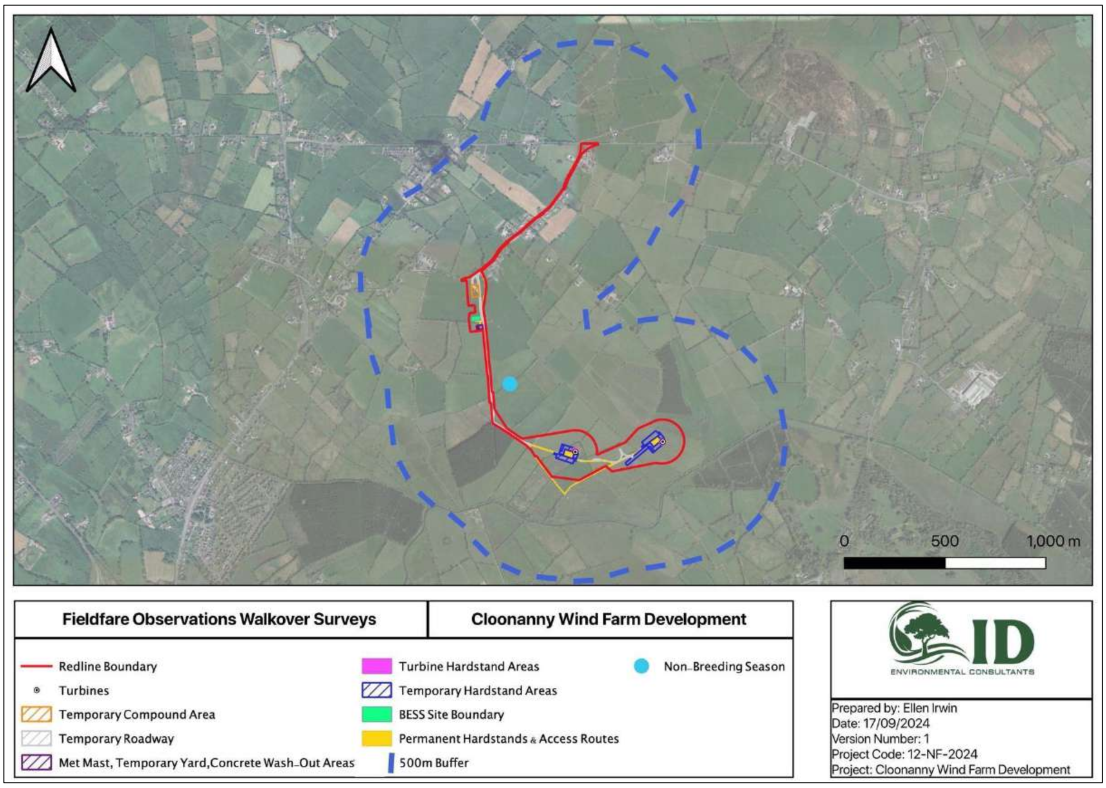

Figure 38: Fieldfare Walkover Survey Observations

Greenfinch

Table 39: Greenfinch Walkover Survey Data

Walkover Survey Data						
Survey Date	**Transect No**	**Species**	**BTO code**	**Number**	**Habitat**	**Breeding/Non-breeding**
20/02/2022	T1	Greenfinch	GR	2	GA1	Non-breeding

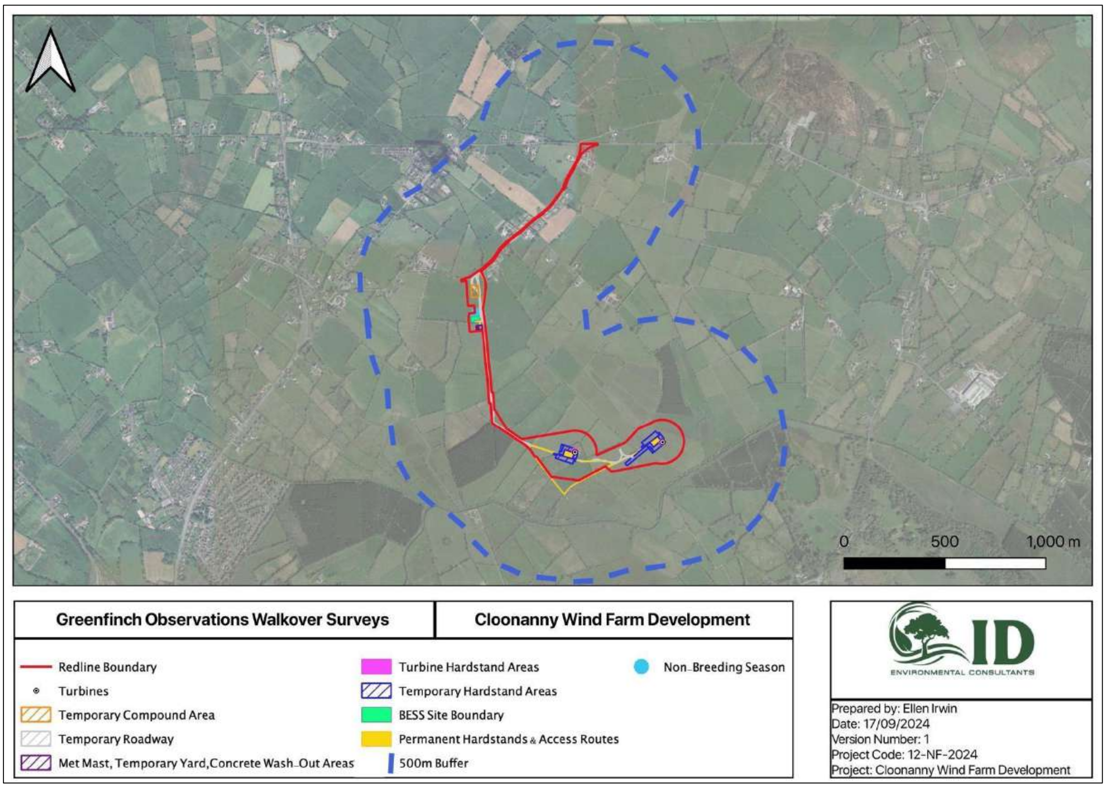

Figure 39: Greenfinch Walkover Survey Observations

Tufted Duck

Table 40: Tufted Duck Survey Data

Walkover Survey Data						
Survey Date	**Transect No**	**Species**	**BTO code**	**Number**	**Habitat**	**Breeding/Non-breeding**
20/02/2022	T1	Tufted Duck	TU	6	GA1	Non-breeding

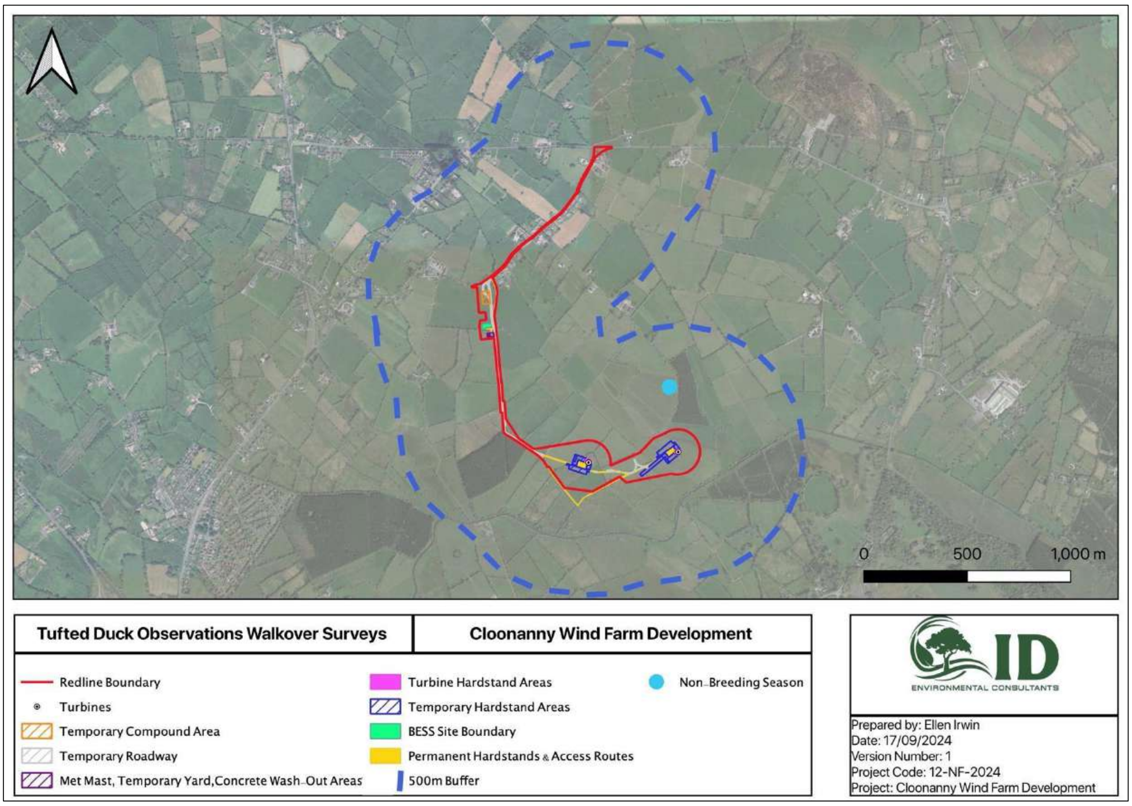

Figure 40: Tufted Duck Walkover Survey Observations

Grey Wagtail

Table 41: Grey Wagtail Survey Data

Walkover Survey Data						
Survey Date	**Transect No**	**Species**	**BTO code**	**Number**	**Habitat**	**Breeding/Non-breeding**
20/02/2022	T1	Grey Wagtail	GL	1	GA1	Non-breeding
17/04/2022	T1	Grey Wagtail	GL	1	GA1	Breeding
30/03/2023	T1	Grey Wagtail	GL	1	GA1	Non-breeding
28/09/2023	T1	Grey Wagtail	GL	1	GA1	Breeding

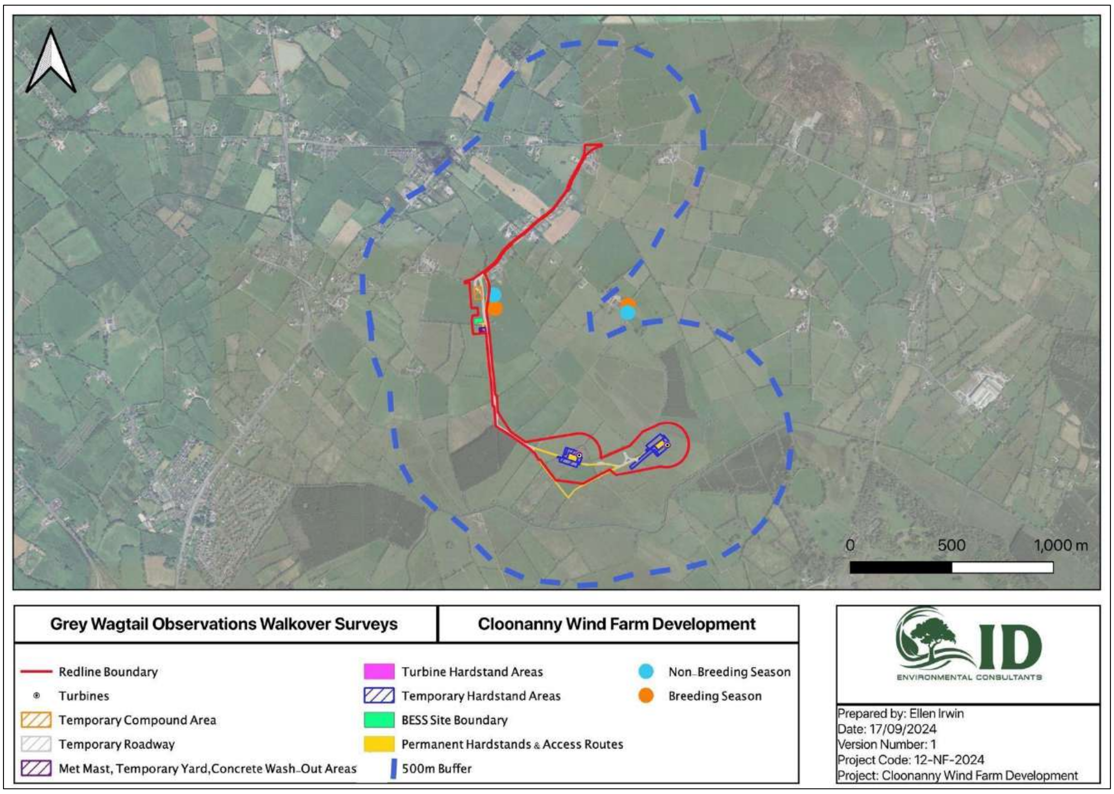

Figure 41: Grey Wagtail Walkover Survey Observations

Linnet

Table 42: Linnet Survey Data

Walkover Survey Data						
Survey Date	**Transect No**	**Species**	**BTO code**	**Number**	**Habitat**	**Breeding/Non-breeding**
20/02/2022	T1	Linnet	LI	6	GA1	Non-breeding
12/03/2022	T1	Linnet	LI	4	GA1	Non-breeding

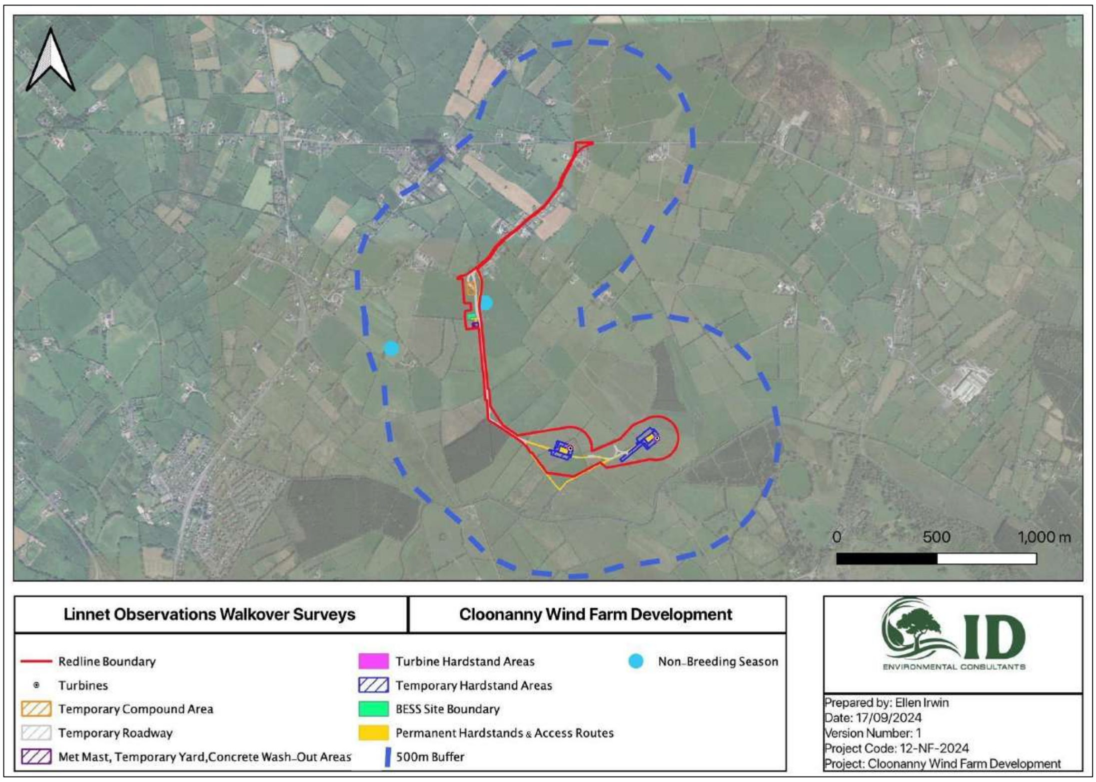

Figure 42: Linnet Walkover Survey Observations

Starling

Table 43: Starling Walkover Survey Data

Walkover Survey Data						
Survey Date	**Transect No**	**Species**	**BTO code**	**Number**	**Habitat**	**Breeding/Non-breeding**
20/02/2022	T1	Starling	SG	6	GA1	Non-breeding
12/03 /2022	T1	Starling	SG	12	GA1	Non-breeding
17/04 /2022	T1	Starling	SG	10	GA1	Breeding
09/05/2022	T1	Starling	SG	14	GA1	Breeding
09/05/2022	T1	Starling	SG	6	GA1	Breeding
09/05/2022	T1	Starling	SG	2	GA1	Breeding
29/06/2022	T1	Starling	SG	19	GA1	Breeding
29/06/2022	T1	Starling	SG	11	GA1	Breeding
30/03/2023	T1	Starling	SG	10	GA1	Non-breeding

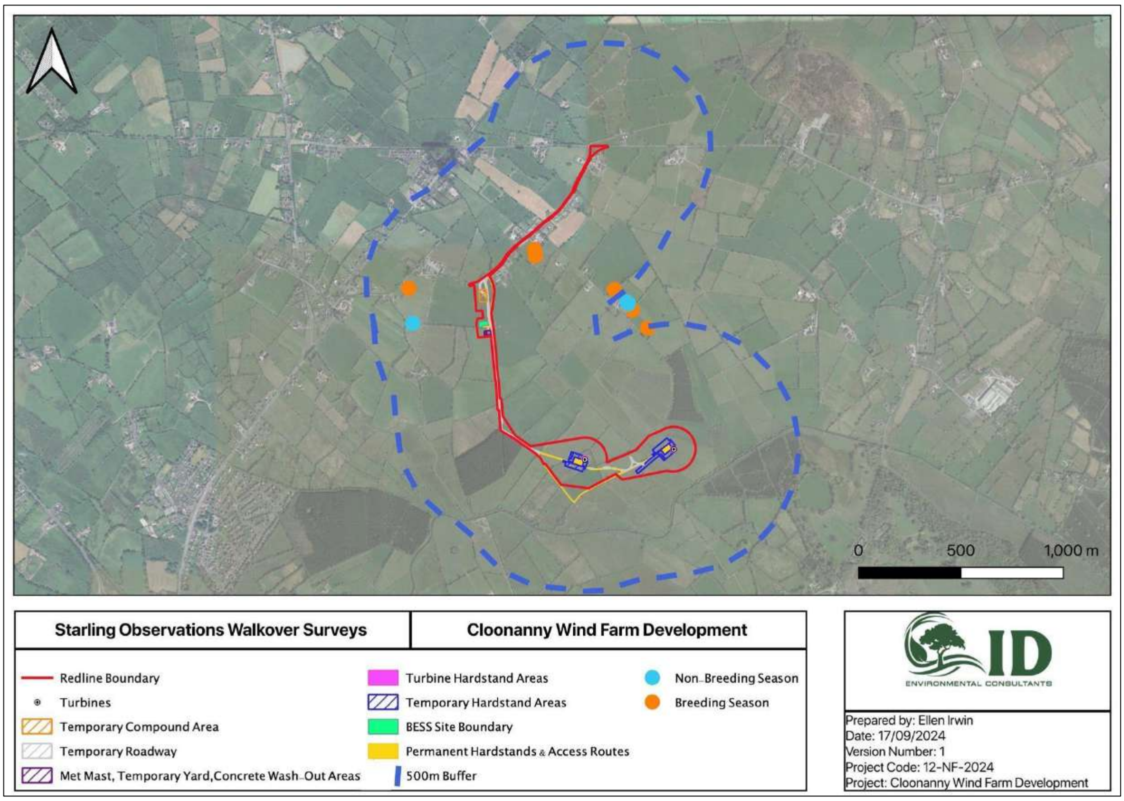

Figure 43: Starling Walkover Survey Observations

Skylark

Table 44: Skylark Walkover Survey Data

Walkover Survey Data						
Survey Date	**Transect No**	**Species**	**BTO code**	**Number**	**Habitat**	**Breeding/Non-breeding**
12/03/2022	T1	Skylark	S.	1	GA1	Non-breeding
17/04/2022	T1	Skylark	S.	1	GA1	Breeding
17/04/2022	T1	Skylark	S.	1	GA1	Breeding
17/04/2022	T1	Skylark	S.	1	GA1	Breeding
17/04/2022	T1	Skylark	S.	1	GA1	Breeding
17/04/2022	T1	Skylark	S.	1	GA1	Breeding
09/05/2022	T1	Skylark	S.	1	WL1	Breeding
09/05/2022	T1	Skylark	S.	1	WL1	Breeding
09/05/2022	T1	Skylark	S.	1	WL1	Breeding
09/05/2022	T1	Skylark	S.	1	WD4	Breeding
09/05/2022	T1	Skylark	S.	1	GA1	Breeding
29/06/2022	T1	Skylark	S.	1	GA1	Breeding
29/06/2022	T1	Skylark	S.	1	GA1	Breeding
29/06/2022	T1	Skylark	S.	2	WL2	Breeding
29/06/2022	T1	Skylark	S.	1	GA1	Breeding
29/06/2022	T1	Skylark	S.	2	WL1	Breeding
29/06/2022	T1	Skylark	S.	1	GA1	Breeding
29/06/2022	T1	Skylark	S.	1	GA1	Breeding

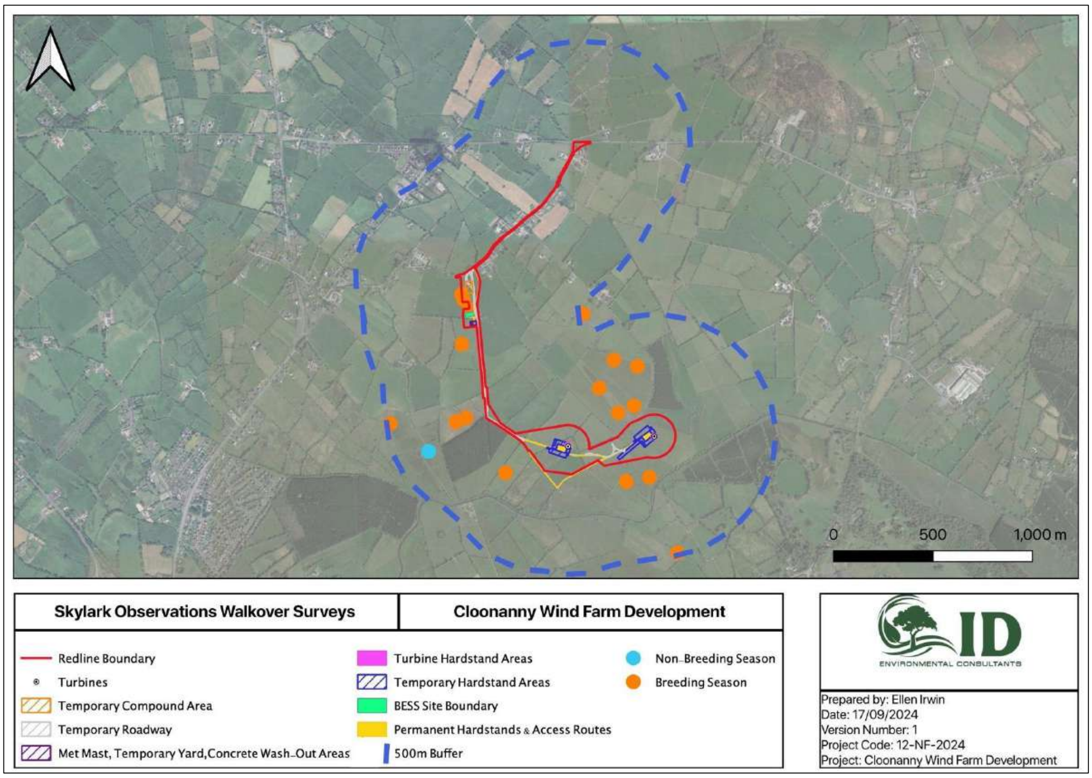

Figure 44: Skylark Walkover Survey Observations

Great Black Backed Gull

Table 45: Great Black Backed Gull Walkover Survey Data

Walkover Survey Data						
Survey Date	**Transect No**	**Species**	**BTO code**	**Number**	**Habitat**	**Breeding/Non-breeding**
17/04/2022	T1	Great Black Backed Gull	GB	12	GA1	Breeding
09/05/2022	T1	Great Black Backed Gull	GB	9	GA1	Breeding

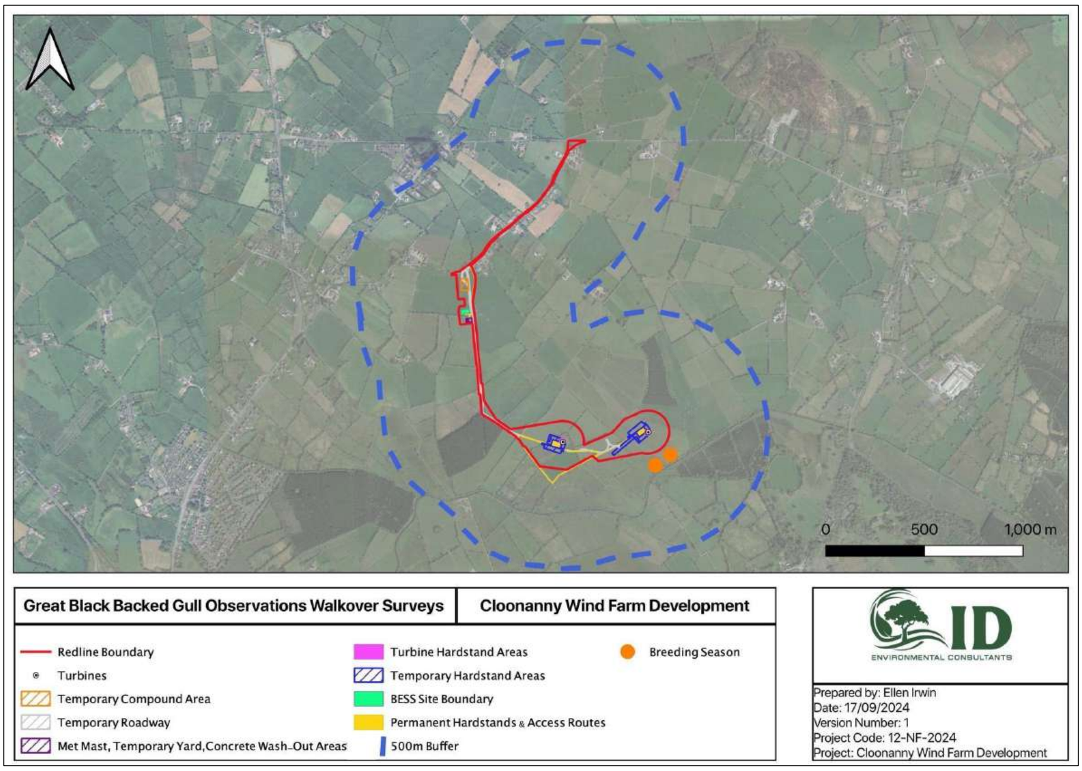

Figure 45: Great Black Backed Gull Walkover Survey Observations

Herring Gull

Table 46: Herring Gull Walkover Survey Data

Walkover Survey Data						
Survey Date	**Transect No**	**Species**	**BTO code**	**Number**	**Habitat**	**Breeding/Non-breeding**
17/04 /2022	T1	Herring Gull	HG	16	GA1	Breeding
09/05/2022	T1	Herring Gull	HG	16	GA1	Breeding
29/06/2022	T1	Herring Gull	HG	6	GA1	Breeding
20/10/2023	T1	Herring Gull	HG	2	GA1	Non-breeding
20/10/2023	T1	Herring Gull	HG	1	GA1	Non-breeding
18/11/2023	T1	Herring Gull	HG	1	GA1	Non-breeding
12/12/2023	T1	Herring Gull	HG	1	GA1	Non-breeding

Table 47: Herring Gull WDS Data

VDS Data						
Survey Date	**Time**	**Species**	**BTO code**	**Number**	**Activity/Behaviour**	**Comments**
12/01/2023	10:14	Herring Gull	HG	14	Loafing/Circling	Loafing in GA1
29/03/2023	12:39	Herring Gull	HG	9	Flying	
01/11/2023	12:15	Herring Gull	HG	2	Travelling	
08/12/2023	12:05	Herring Gull	HG	1	Travelling	Adult
22/12/2023	13:20	Herring Gull	HG	1	Travelling	Adult
22/12/2023	14:07	Herring Gull	HG	2	Travelling	Adults

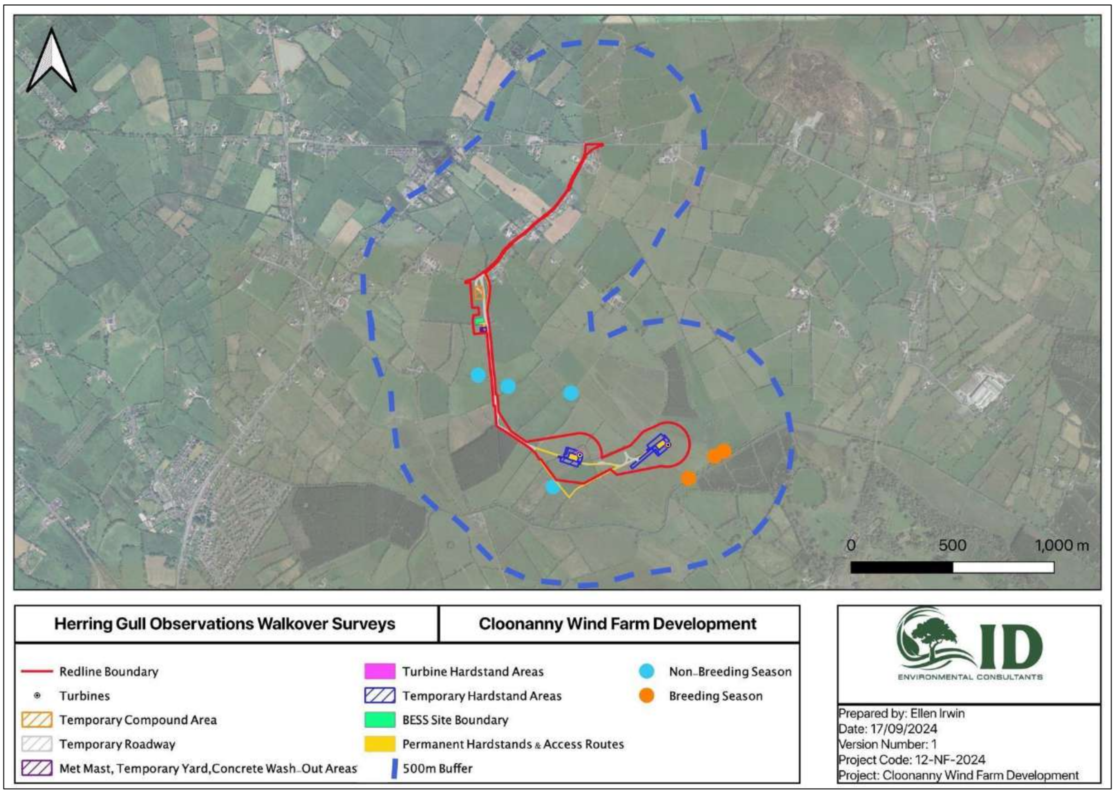

Figure 46: Herring Gull Walkover Survey Observations

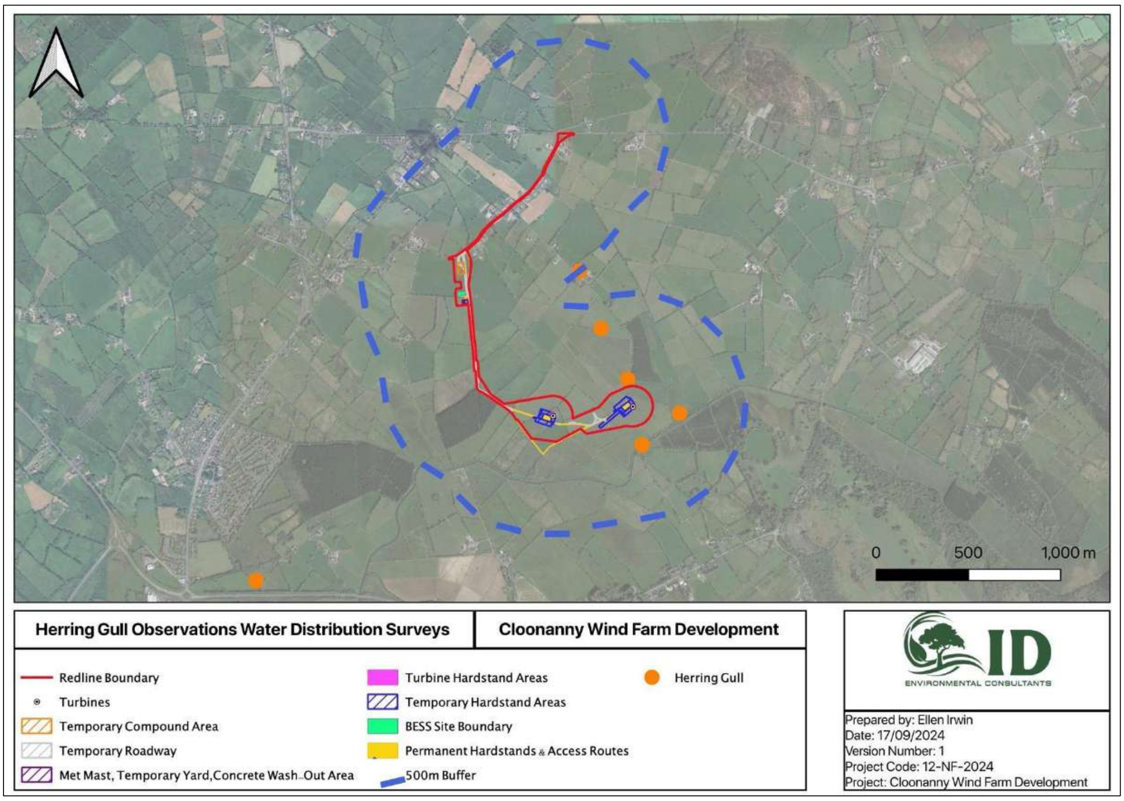

Figure 47: Herring Gull WDS Observations

Lesser Black Backed Gull

Table 48: Lesser Black Backed Gull Walkover Survey Data

Walkover Survey Data						
Survey Date	Transect No	Species	BTO code	Number	Habitat	Breeding/Non-breeding
16/04 /2023	T1	Lesser Black Backed Gull	LB	3	GA1	Breeding
16/04/2023	T1	Lesser Black Backed Gull	LB	4	GA1	Breeding
18/05/2023	T1	Lesser Black Backed Gull	LB	1	GA1	Breeding
25/06/2023	T1	Lesser Black Backed Gull	LB	1	GA1	Breeding
25/06/2023	T1	Lesser Black Backed Gull	LB	1	GA1	Breeding
07/07/2023	T1	Lesser Black Backed Gull	LB	1	GA1	Breeding
28/09/2023	T1	Lesser Black Backed Gull	LB	2	GA1	Breeding
28/09/2023	T1	Lesser Black Backed Gull	LB	1	GA1	Breeding

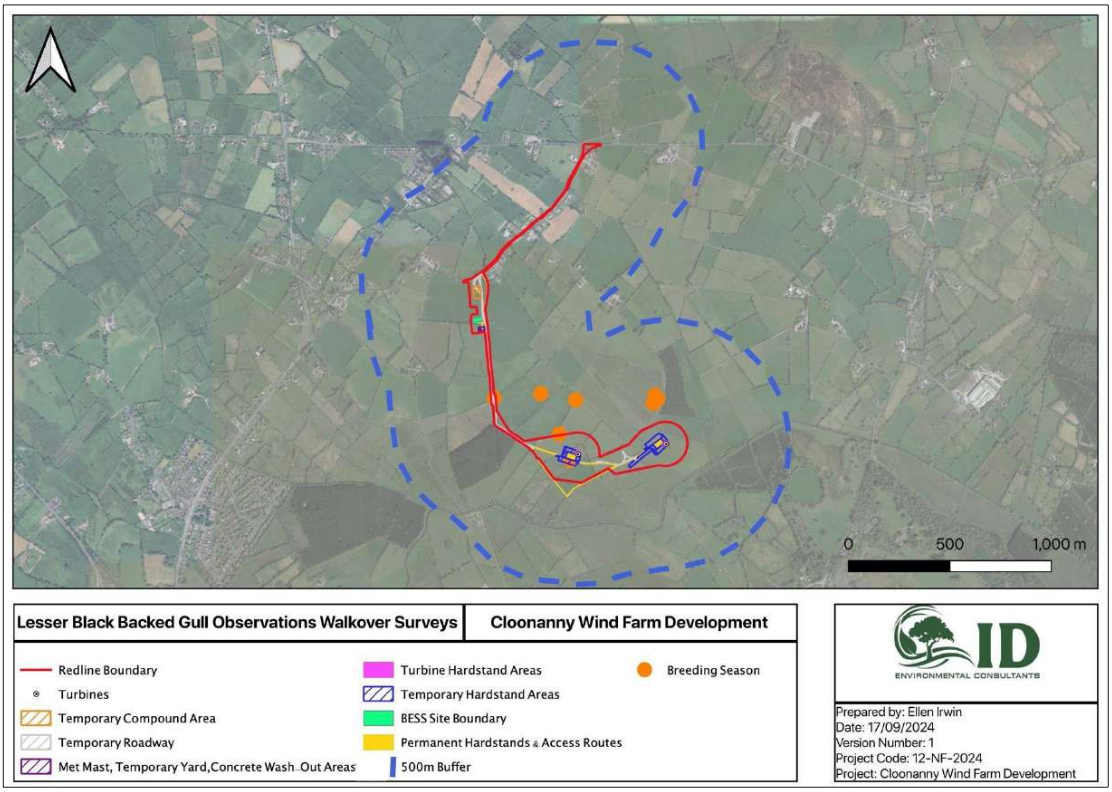

Figure 48: Lesser Black Backed Gull Walkover Observations

Black Headed Gull

Table 49: Black Headed Gull Walkover Survey Data

Walkover Survey Data						
Survey Date	**Transect No**	**Species**	**BTO code**	**Number**	**Habitat**	**Breeding/Non-breeding**
16/04/2023	T1	Black Headed Gull	BH	6	GA1	Breeding
18/11/2023	T1	Black Headed Gull	BH	3	GA1	Non-breeding
18/11/2023	T1	Black Headed Gull	BH	2	GA1	Non-breeding

Table 50: Black Headed Gull WDS Data

VDS Data						
Survey Date	**Time**	**Species**	**BTO code**	**Number**	**Activity/Behaviour**	**Comments**
01/11/2023	14:17	Black Headed Gull	BH	4	Foraging	
01/11/2023	14:53	Black Headed Gull	BH	2	Foraging	
08/12/2023	10:54	Black Headed Gull	BH	3	Foraging	Flooded Field

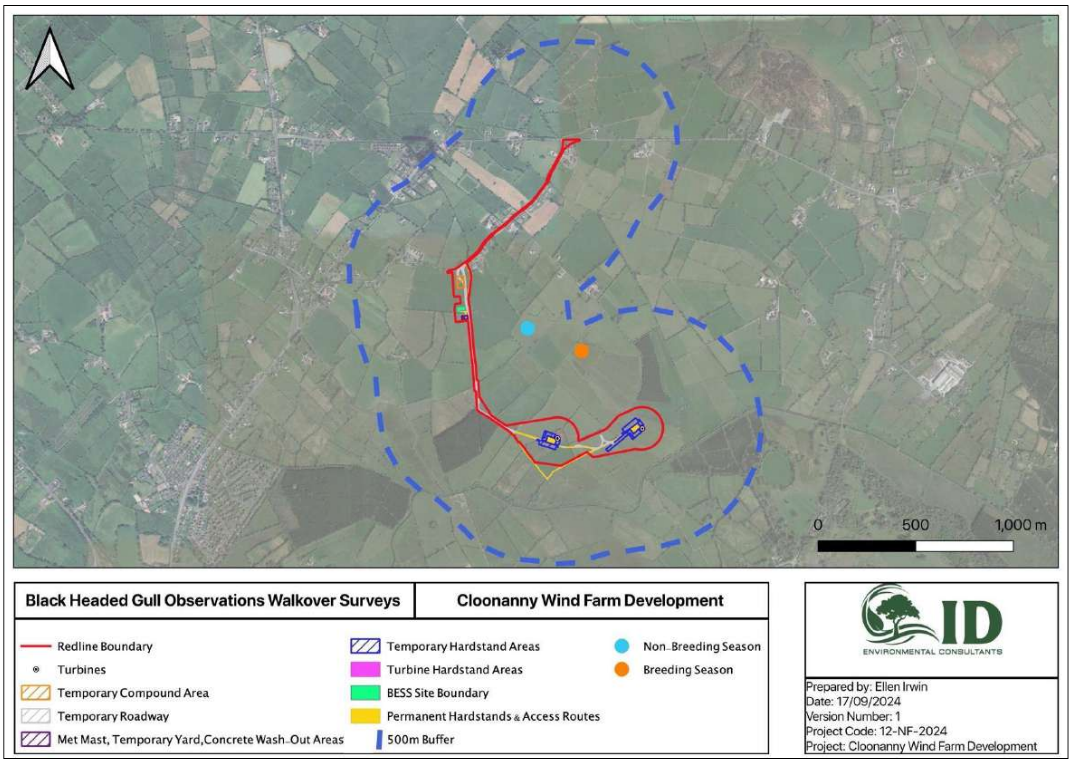

Figure 49: Black Headed Gull Walkover Observations

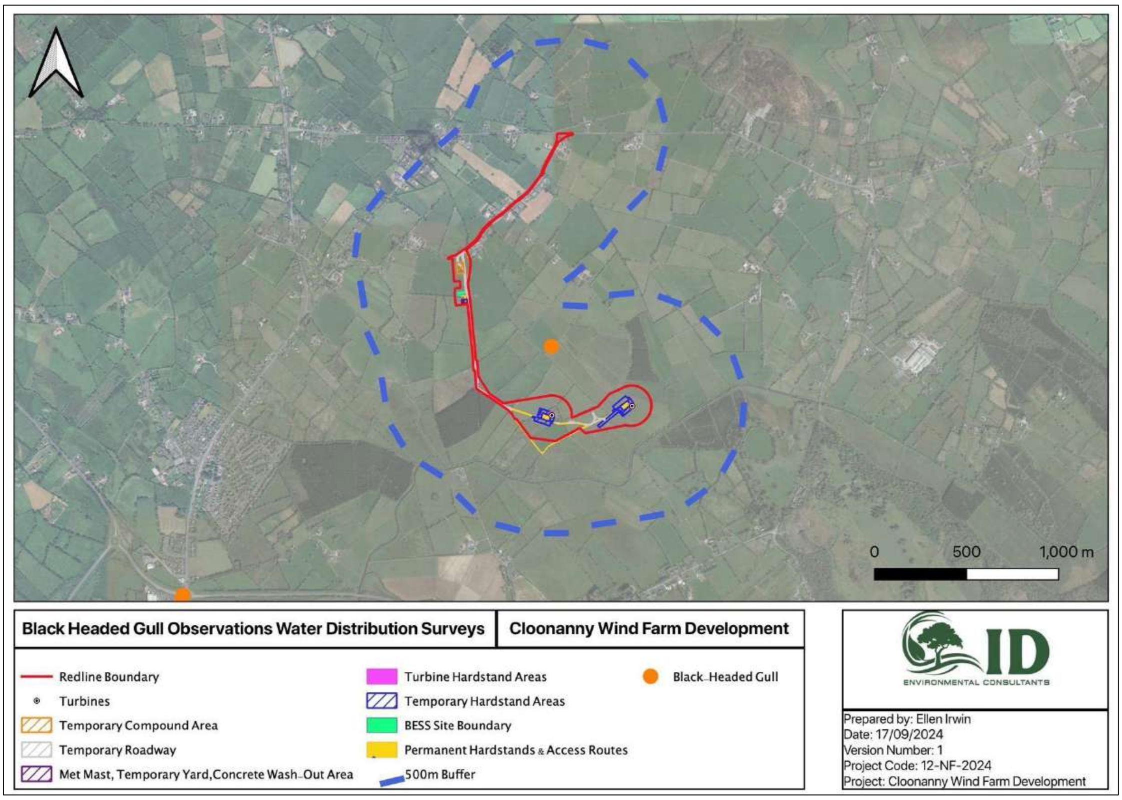

Figure 50: Black Headed Gull WDS Observations

Grey Heron

Table 51: Grey Heron Walkover Survey Data

Walkover Survey Data						
Survey Date	**Transect No**	**Species**	**BTO code**	**Number**	**Habitat**	**Breeding/Non-breeding**
29/07/2022	T1	Grey Heron	H.	1	GA1	Breeding
18/11/2023	T1	Grey Heron	H.	1	GA1	Non-breeding

Table 52: Grey Heron WDS Data

WDS Data						
Survey Date	**Time**	**Species**	**BTO code**	**Number**	**Activity/Behaviour**	**Comments**
05/10/2023	13:08	Grey Heron	H.	1	Travelling	
01/11/2023	14:53	Black Headed Gull	BH	2	Foraging	
08/12/2023	10:54	Black Headed Gull	BH	3	Foraging	Flooded Field

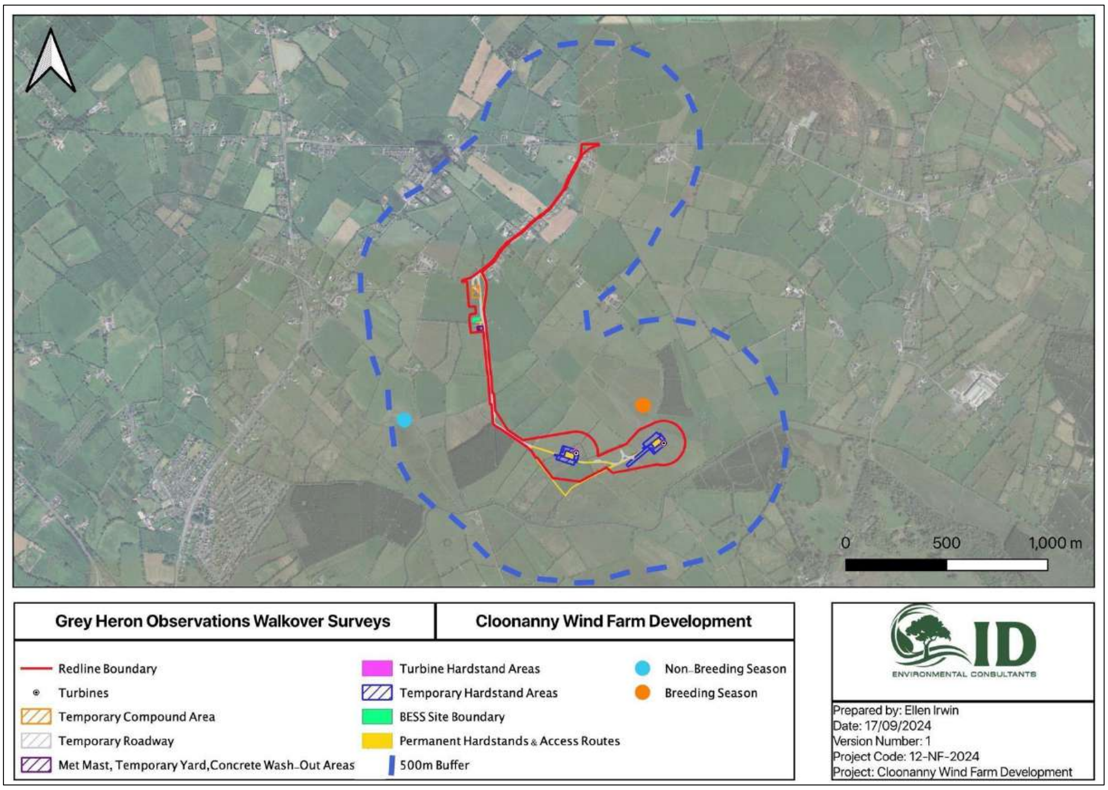

Figure 51: Grey Heron Walkover Survey Observations

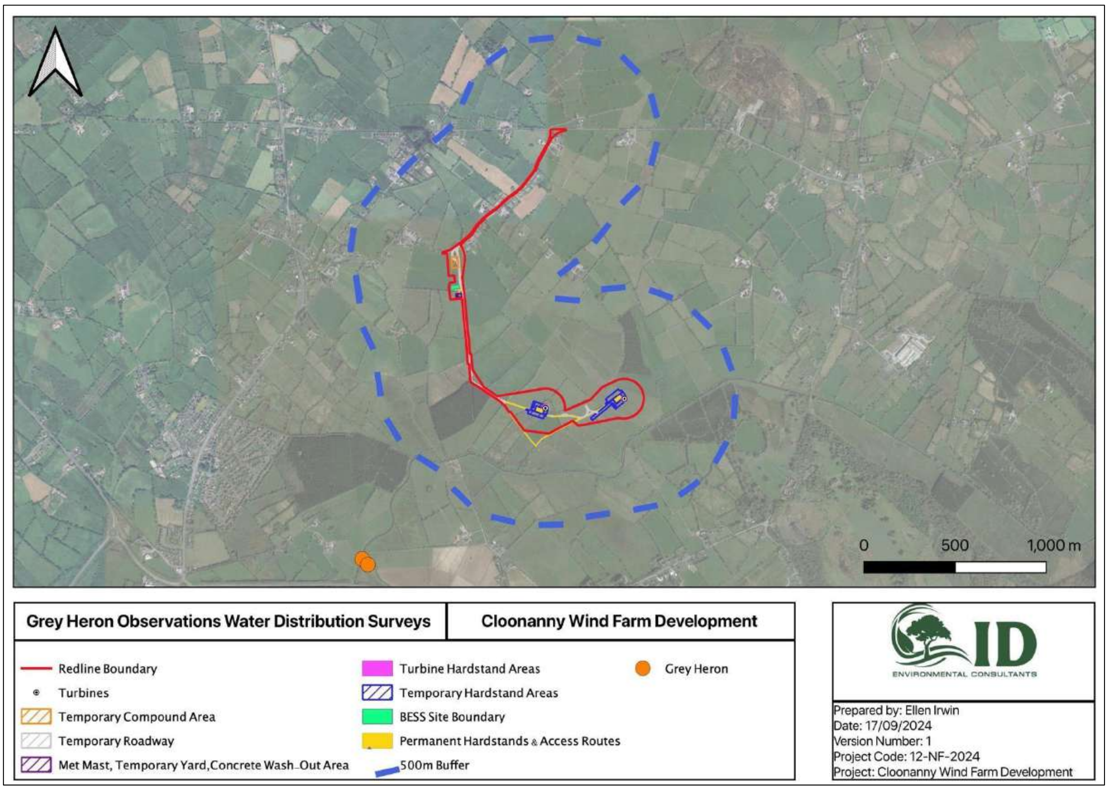

Figure 52: Grey Heron WDS Observations

Lapwing

Table 53: Lapwing Vantage Point Survey Data

Date	VP No	Observation No	Species	BTO code	Number	Time	Flight Duration	Band 1 (025m)	Band 2 (25180m)	Band 3 (>180m)	Activity	Comments
13/02/2023	3	1	Lapwing	L.	7	10:24	35	0	35	0	Travelling	

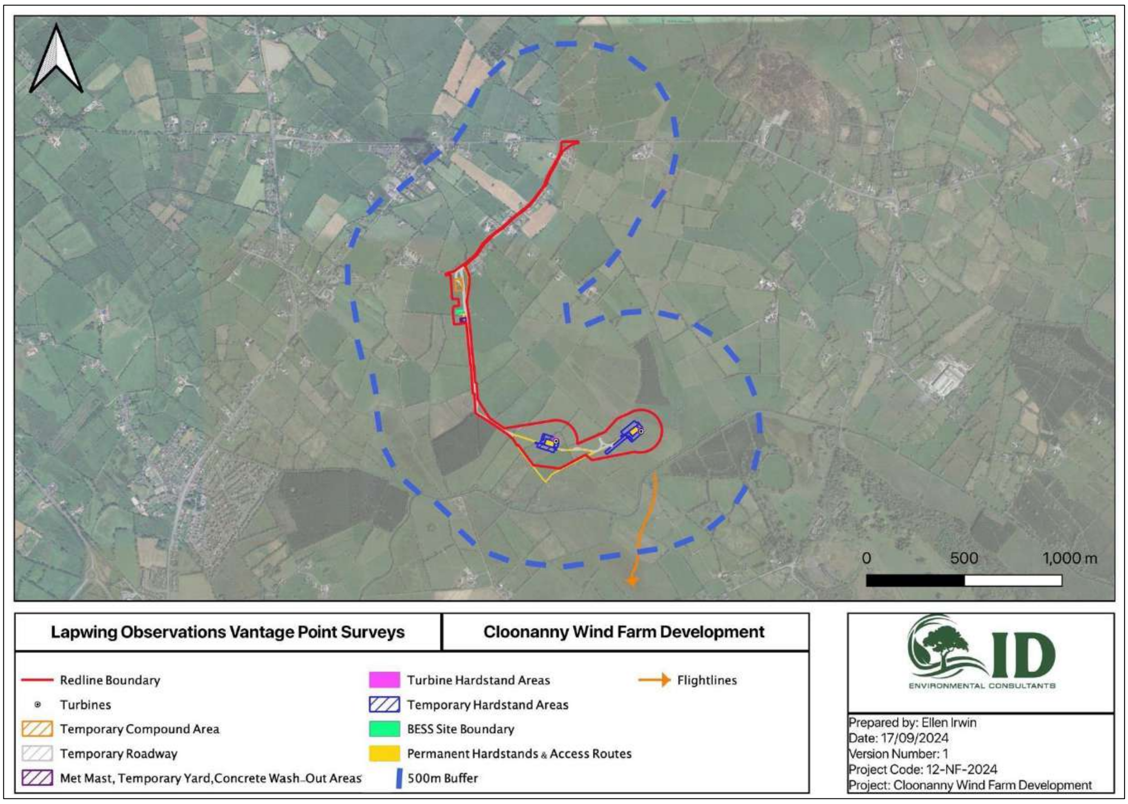

Figure 53: Lapwing Vantage Point Survey Flightlines

Cormorant

Table 54: Cormorant Vantage Point Survey Data

Vantage Point Survey Data												
Date	VP No	Observation No	Species	BTO code	Number	Time	Flight Duration	Band 1 (025m)	Band 2 (25180m)	Band 3 (>180m)	Activity	Comments
03/01/2024	1	1	Cormorant	CA	2	14:40	57	0	57	0	Travelling	
16/01/2024	2	1	Cormorant	CA	1	14:41	55	0	55	0	Travelling	

Table 55: Cormorant WDS Data

WDS Data						
Survey Date	Time	Species	BTO code	Number	Activity/Behaviour	Comments
08/12/2023	12:55	Cormorant	CA	1	Travelling	

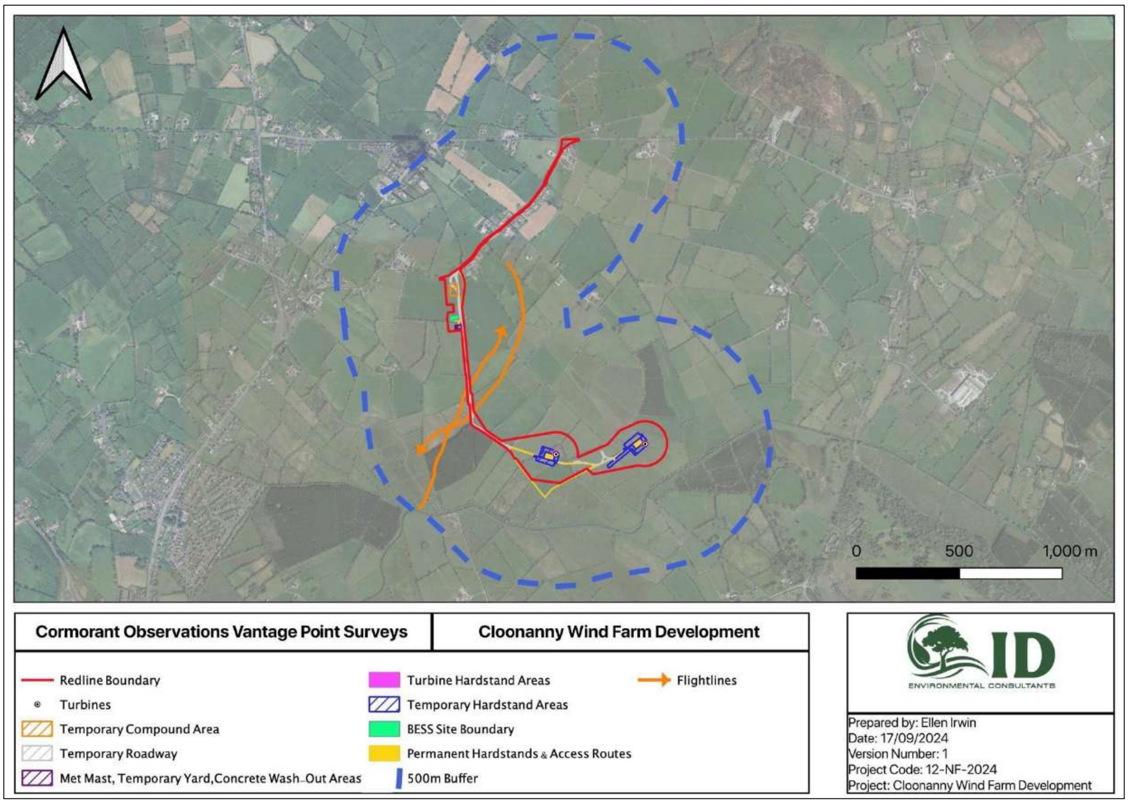

Figure 54: Cormorant Vantage Point Survey Flightline

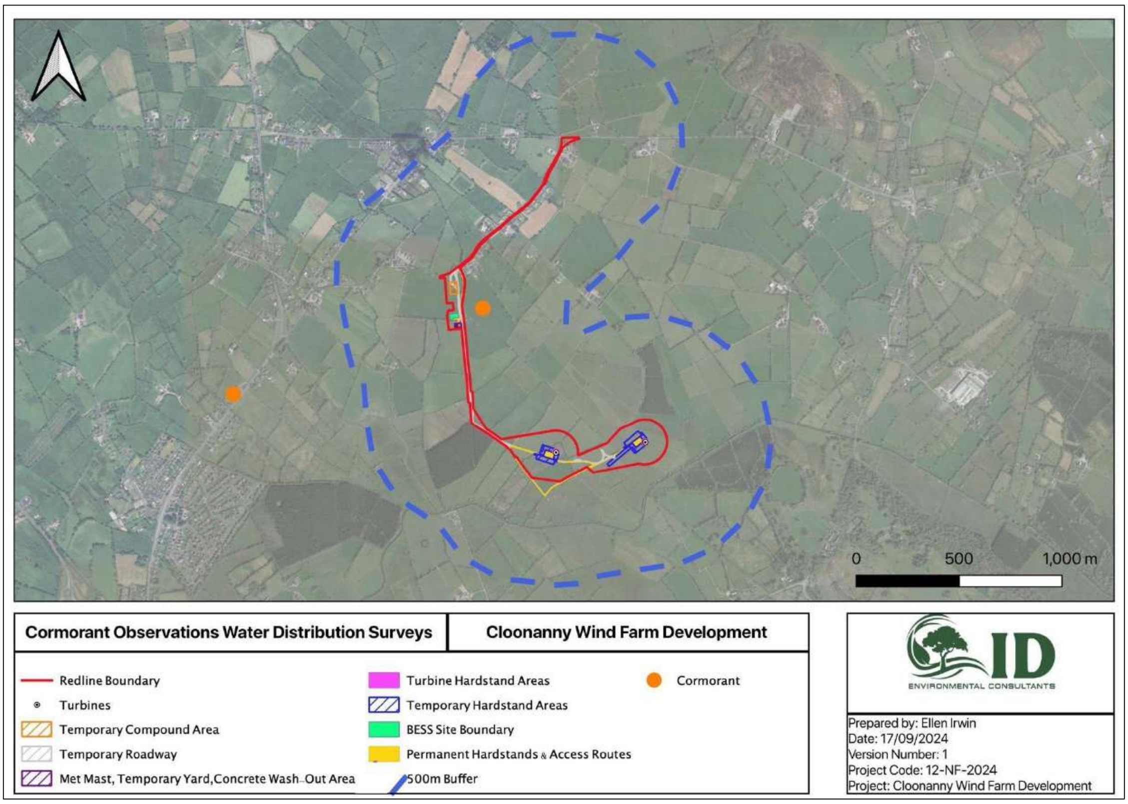

Figure 55: Cormorant WDS Observations

APPENDIX 11.3
COLLISION RISK ASSESSMENT

VOLUME III
APPENDICES TO ENVIRONMENTAL IMPACT ASSESSMENT REPORT

RFI Response July 2025

Planning and Environmental Consultants

Collision Risk Assessment

Cloonanny Wind Farm

DOCUMENT DETAILS

Client:	**Natural Forces**
Project Title:	**Cloonanny Wind Farm**
Project Number:	**230534**
Document Title:	**Collision Risk Assessment**
Document File Name:	**Cloonanny CRA - F - 2024.04.03 - 230534**
Prepared By:	**MKO** **Tuam Road** **Galway** **Ireland** **H91 VW84**

MKO Planning and Environmental Consultants

Rev	Status	Date	Author	Approved By
01	Draft	28/03/2024	PM	SD
02	Final	03/04/2024	PM	SD

Table of Contents

1. INTRODUCTION

This document outlines the methodology used and the results of an assessment of the predicted rate of collisions for birds at Cloonanny Wind Farm. The assessment is based on vantage point surveys that were undertaken at the wind farm study area between October 2021 and March 2024. Surveys were undertaken from three fixed vantage points in both the bird winter season (i.e. October-March) and breeding season (i.e. April-September). Surveys were conducted from October 2021 to September 2022, and from January 2023 to March 2024, providing data for two winter seasons (winter 2021-22 and winter 2023-24) and two breeding seasons (summer 2022 and summer 2023), in line with NatureScot (formerly Scottish Natural Heritage) guidelines (SNH, 2017) for collision risk modelling. The additional data collected between January and March 2023 is also included in the assessment.

Collision risk is calculated using a mathematical model to predict the number of birds that may be killed by collision with moving wind turbine rotor blades. The modelling method used in this collision risk calculation is known as the Band Model (Band *et al.,* 2007) and has been used in a number of studies on bird collision with wind turbines (e.g., Chamberlain *et al.,* 2006; Drewitt and Langston, 2006; Fernley *et al.,* 2006; Madders and Whitfield, 2006). Note that these are theoretical predictions, therefore results must be interpreted with a degree of caution.

Two stages are involved in the Band Model. First, the number of bird transits through the air space swept by the rotor blades of the wind turbines per year is estimated. Then the collision risk for a bird passing through the rotor blades is calculated using a mathematical formula. The product of these provides a theoretical annual collision mortality rate. Finally, a bird avoidance rate is applied to the collision mortality rate to account for birds attempting to avoid collision. This final collision mortality rate informs the assessment of impacts of the wind turbine on birds.

2. METHODOLOGY

2.1 The Band Model

The Band Model is used to predict the number of bird collisions that might be caused by a wind turbine. It uses species-specific information on bird biometrics, flight characteristics and the expected amount of flight activity, along with turbine-specific information on hub height, rotor diameter, pitch and rotational speed. The turbine will be 112 m at hub height, with 3 blades of a diameter of 175m, giving a maximum rotor height of 199.5m and a minimum rotor height of 24.5m. The model makes a number of assumptions on the turbine design and on biometrics of birds:

- Birds are assumed to be of a simple cruciform shape.
- Turbine blades are assumed to have length, depth and pitch angle, but no thickness.
- Birds fly through turbines in straight lines.
- Bird flight is not affected by the slipstream of the turbine blade.
- Because the model assumes that no action is taken by a bird to avoid collision, it is recognised that the collision risk figures derived are purely theoretical and represent worst case estimates

Two forms of collision risk modelling are outlined by Band *et al.* (2007): a **"Regular Flight Model"** and the **"Random Flight Model"**. A Regular Flight Model is generally applied to situations where flightlines form a regular pattern. This may occur, for example, when birds are using a wind farm site as a commuting corridor between roosting and feeding grounds or migratory routes, as is often observed in geese and swans. The Random Flight Model generally applied to situations where flightlines form no discernible patterns or routes. This is often observed, for example when raptors are in foraging or hunting flights.

The Regular Flight Model predicts the number of transits through a cross-sectional area of a wind farm which represents the width of the commuting corridor. A "risk window" is identified: a 2-dimensional line the width of a wind farm to a 500m buffer of the turbines, multiplied by the rotor diameter. All commuting flights which pass through this risk window within the rotor swept height (potential collision height; PCH) are included in collision risk modelling. Any regular flights more than 500m from the turbine layout can be excluded from analysis. There are a number of key assumptions and limitations:

- The turbine rotor swept area is 2-dimensional, i.e., there is a single row of turbines in the windfarm. This represents all turbines within the commuting corridor accounted for by a single straight-line.
- Bird activity is spatially explicit.
- Birds in an observed flight only cross the turbine area once and do not pass through the cross-section a second time (or multiple times).
- Habitat and bird activity will remain the same over time and be unchanged during the operational stage of the windfarm.
- All flight activity used in the model occurred within the viewshed area calculated at the lowest swept rotor height.

The Random Flight Model predicts the number of transits through a wind farm while assuming that all flights within the vantage point viewshed are randomly occurring, i.e., any observed flight could just as easily occur within a wind farm site as outside it. All flights within PCH inside the viewshed are included in the model. There are a number of key assumptions and limitations:

- Bird activity is not spatially explicit, i.e., activity is equal throughout the viewshed area and this is equal to activity in the wind farm area.
- Habitat and bird activity will remain the same over time and be unchanged during the operational stage of the wind farm.
- All flight activity used in the model occurred within the viewshed area calculated at the lowest swept rotor height.

More detail on both the Random and Regular Flight Model calculations are available from SNH: https://www.nature.scot/wind-farm-impacts-birds-calculating-theoretical-collision-risk-assuming-no-avoiding-action. In the case of Cloonanny Wind Farm, 13 species recorded in flight in the study area were randomly distributed. Therefore, a Random Flight Model was conducted for these species. A Regular Flight Model was not conducted for any species because no regular flight paths were recorded.

2.2 Modelling Process

The steps used in the Band Model to derive the collision mortality rate for each species observed at a wind farm site are outlined below.

- Stage 1: Estimate the number of bird transits through the air space swept by the rotor blades of the wind turbines. Transits are calculated using either the "Regular" or "Random" flight model (Band *et al.,* 2007), depending on flight distribution and behaviour.
- Stage 2: Calculate the collision risk for an individual bird flying through a rotating turbine blade. Collision risk is calculated using a formula which incorporates the number of bird transits (Stage 1), individual species' biometrics, individual species' flight speed and style, and the proposed turbine parameters. This formula is publicly available on the SNH website: https://www.nature.scot/wind-farm-impacts-birds-calculating-probability-collision. Biometrics are available from the British Trust of Ornithology (BTO, 2021) and flight speeds are available from Alerstam *et al.* (2007). For species that can both flap and glide, the mean of the collision risk for flapping and for gliding flight is taken.
- The product of the number of birds transits per year multiplied by the collision risk provides an annual collision mortality rate. There is an assumption that birds flying towards the turbines make no attempt to avoid them.
- To account for birds attempting to avoid collision, an avoidance factor is applied to the annual collision mortality rate. This corrects for the ability of the birds to detect and manoeuvre around the turbines. Avoidance rates are available from SNH (2018). Bird avoidance rates are generally 98-99% or higher for most species, based on empirical evidence, targeted studies and literature reviews, and continue to be updated following further studies of bird behaviour and mortality rates at wind farm sites.

The final annual collision risk corrected for avoidance is a "real-world" estimation of the number of collisions that may occur at a wind farm, based on observed bird activity during the vantage point survey period.

2.3 Turbine specifications

Birds in flight within the viewshed at heights from 25m above ground level have been included in the collision risk model. The turbine specifications used in the model are available in Table 1.

Table 1 Turbine specifications[1]

Wind Farm Component	Scenario Modelled
Turbine model	Enercon E175 EP5
Number of turbines	2
Blades per turbine rotor	3
Rotor diameter (m)	175
Rotor radius (m)	87.5
Hub height (m)	112
Swept height (m)	24.5-199.5
Pitch of blade (degrees)	6
Maximum chord (m) (i.e., depth of blade)	4.01
Rotational period (s)	7.75
Turbine operational time[2]	85%

2.4 Ornithological Receptors

The species of conservation concern recorded in during vantage point surveys at Cloonanny were:

- Buzzard;
- Cormorant;
- Golden Plover;
- Kestrel;
- Lapwing;
- Mallard;
- Mute Swan;
- Peregrine Falcon;
- Snipe;
- Sparrowhawk;
- Teal;
- Wigeon;
- Whooper Swan.

Mallard and wigeon were each recorded on one occasion during the surveys, and were not flying at PCH, therefore are not included in the collision risk assessment. An assessment was conducted for the remaining species. It is assumed that waterbirds (cormorant, golden plover, lapwing, mute swan, snipe, teal and whooper swan) are active for 25% of the night along with daylight hours (as per SNH guidance) and this is accounted for in the model. Buzzard and sparrowhawk were recorded breeding in the vicinity, so a separate collision risk estimation was made for the breeding season and winter season to provide more resolution.

[1] Specifications as provided by the developer at the time of analysis.
[2] This operational period of 85% is referenced from a report by the British Wind Energy Association (2007) which identifies the standard operational period of the wind turbines in the UK to be roughly 85%.

2.5 Calculation Parameters

The calculation parameters for the vantage point are outlined in Table 2. Note that VP1 and VP2 commenced in October 2021, and VP3 was added at the beginning of the breeding season 2022. Bird biometrics are presented in Table 3. Table 4 presents the model input values for the random model: bird seconds in flight at PCH observed from the vantage points during the relevant survey period. Bird seconds in flight at PCH is calculated by multiplying the number of birds observed per flight by the duration of the flight spent within PCH.

Table 2 Survey effort and viewshed coverage

Vantage Point	Visible Area at 25m (ha)	Risk Area (ha)	Turbines visible	Total Survey Effort (hours)
VP1	498.751	89.404	2	162
VP2	333.808	72.433	2	162
VP3	298.181	57.531	2	126

Table 3 Bird biometrics

Species	Body Length (m)	Wingspan (m)	Flight Speed (m/s)
Buzzard	0.540	1.205	11.6
Cormorant	0.900	1.450	15.2
Golden Plover	0.275	0.715	17.9
Kestrel	0.335	0.755	10.1
Lapwing	0.295	0.845	12.8
Mute Swan	1.500	2.230	16.2
Peregrine Falcon	0.445	1.050	12.1
Snipe	0.255	0.420	17.1
Sparrowhawk	0.330	0.625	10.0
Teal	0.360	0.610	19.7
Whooper Swan	1.500	2.200	17.3

Table 4 Model input values

Species	Model	Period	Input value
Buzzard	Random	Winter	2,154s (VP1), 1,006s (VP2), 92s (VP3)
	Random	Breeding	15,036s (VP1), 1,948s (VP2), 2,133s (VP3)
	Random	All	17,190s (VP1), 2,954s (VP2), 2,225s (VP3)
Cormorant	Random	Winter	114s (VP1), 55s (VP2), 0s (VP3)
Golden Plover	Random	September to April	3,525s (VP1), 555s (VP2), 1,680s (VP3)
Kestrel	Random	All	225s (VP1), 224s (VP2), 496s (VP3)
Lapwing	Random	Winter	0s (VP1), 0s (VP2), 245s (VP3)
Peregrine Falcon	Random	All	76s (VP1), 44s (VP2), 0s (VP3)
Snipe	Random	Winter	63s (VP1), 0s (VP2), 92s (VP3)

Species	Model	Period	Input value
Sparrowhawk	Random	Winter	258s (VP1), 817s (VP2)., 0 (VP3)
	Random	Breeding	363s (VP1), 496s (VP2), 82s (VP3)
	Random	All	621s (VP1), 1,313s (VP2), 82s (VP3)
Teal	Random	Winter	56s (VP1), 25s (VP2), 0s (VP3)
Whooper Swan	Random	Winter	264s (VP1), 208s (VP2), 165s (VP3)

The avoidance rates applied to the collision risk were: 95% for kestrel; 98% for buzzard, cormorant, golden plover, lapwing, peregrine falcon snipe, sparrowhawk and teal; and 99.5% for mute swan and whooper swan.

3. RESULTS AND DISCUSSION

A "Random" collision risk model has been conducted for birds observed during vantage points surveys at Cloonanny Wind Farm using the Band Model. Collision risk models provide theoretical predictions of the probability of bird collision with wind turbine rotor blades. The results are affected by sources of uncertainty including the representativeness of the survey data, natural variability in bird populations, model assumptions and estimates on bird attraction and avoidance rates. As such, the results are considered to be a best estimate of collision risk, rather than a precise figure. The predicted number of transits per year and the estimated collision risk is presented in Table 5, along with the final predicted number of collisions per year. Note that for birds that both flap and glide, the average collision risk percentage between flapping and gliding is taken.

Table 5 Collision rate predictions. For each species, the survey period and model type are specified, along with the predicted number of transits through the risk area and the collision risk (for flapping flight, gliding flight and the overall average of both). Two values for collision rate are presented: the initial collision rate without avoidance and a final estimated collision rate (with an avoidance factor). Finally, the estimated number of collisions over the lifetime of the turbines in presented, along with the corresponding estimated number of years of operation for one collision to occur.

Species	Survey Period	Model	Transits	Collision Risk			Collision Rate			Estimated Collisions Over Lifetime of Wind Farm	One Bird Collision
				flapping	gliding	overall	without avoidance	avoidance factor	with avoidance		
Buzzard	Winter	random	38.7	4.75%	4.6%	4.68%	1.81	98%	**0.036**	1.27 birds	28 years
	Breeding	random	327.7	4.75%	4.6%	4.68%	15.32	98%	**0.306**	10.73 birds	3 years
	All	random	316.5	4.75%	4.6%	4.68%	14.8	98%	**0.296**	10.36 birds	3 years
Golden Plover	September to April	random	150	3.58%	no gliding flight	3.58%	5.36	98%	**0.107**	3.75 birds	9 years
Kestrel	All	random	15.1	4.14%	4.06%	4.1%	0.62	95%	**0.031**	1.09 birds	32 years
Peregrine Falcon	All	random	1.8	4.37%	4.21%	4.29%	0.08	98%	**0.002**	0.06 birds	631 years
Sparrowhawk	Winter	random	12.9	4.1%	4.04%	4.07%	0.53	98%	**0.011**	0.37 birds	95 years
	Breeding	random	16.4	4.1%	4.04%	4.07%	0.67	98%	**0.013**	0.47 birds	75 years
	All	random	29.3	4.1%	4.04%	4.07%	1.19	98%	**0.024**	0.83 birds	42 years
Whooper Swan	Winter	random	16.5	6.47%	no gliding flight	6.47%	1.07	99.5%	**0.005**	0.19 birds	187 years

Species	Survey Period	Model	Transits	Collision Risk			Collision Rate			Estimated Collisions Over Lifetime of Wind Farm	One Bird Collision
				flapping	gliding	overall	without avoidance	avoidance factor	with avoidance		
Cormorant	Winter	random	3.3	5.27%	no gliding flight	5.27%	0.18	98%	**0.004**	0.12 birds	284 years
Lapwing	Winter	random	5.9	3.85%	no gliding flight	3.85%	0.23	98%	**0.005**	0.16 birds	220 years
Mute Swan	Winter	random	2.6	6.68%	no gliding flight	6.68%	0.18	99.5%	**0.001**	0.03 birds	1138 years
Snipe	Winter	random	4.2	3.4%	no gliding flight	3.4%	0.14	98%	**0.003**	0.1 birds	353 years
Teal	Winter	random	2.1	3.59%	no gliding flight	3.59%	0.07	98%	**0.001**	0.05 birds	675 years

Taking into account the uncertainties associated with the model, the predicted collision risk is negligible for the species peregrine falcon, sparrowhawk, whooper swan, cormorant, lapwing, mute swan, snipe and teal. Sparrowhawk were recorded breeding in the vicinity of the study area. In summer 2022, a male and female were regularly observed, including carrying prey, and a juvenile was seen in September. Additionally juveniles were observed in August 2023. To account for possible variation in activity levels, a separate collision risk was estimated for the winter season and breeding season. The collision risk for sparrowhawk in the wintering and breeding seasons were similar (0.011 and 0.013 birds per year).

At least one collision over the lifetime of the wind farm is predicted for the species buzzard, golden plover and kestrel. The collision risk for kestrel is estimated at 0.03 birds per year (or 1 bird over the lifetime of the wind farm). The collision risk for golden plover is estimated at 0.107 birds per year (or 4 birds over the lifetime of the wind farm).

Buzzard were recorded breeding in the vicinity of the study area. In summer 2022, a male and female were regularly observed in an area of woodland, including carrying nesting material and prey, and a juvenile was seen in September. A pair were observed again in breeding season, though no nest was located. To account for variable activity levels, a separate collision risk was estimated for the winter season and breeding season. The collision risk for wintering buzzard (when activity was lower at the study area) is estimated at 0.036 birds per winter (or 1 buzzard over the lifetime of the wind farm). However, the collision risk for breeding buzzard (when activity increases at the study area) is estimated at 0.306 birds per breeding season (or 11 buzzard over the lifetime of the wind farm).

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APPENDIX 11.4
ORNITHOLOGICAL MONITORING PROGRAMME

VOLUME III
APPENDICES TO ENVIRONMENTAL IMPACT ASSESSMENT REPORT

RFI Response July 2025

ENVIRONMENTAL CONSULTANTS

Ornithological Monitoring Programme

Cloonanny Windfarm Development

Cloonanny Glebe, Co. Longford

Document Details

Client:	Natural Forces
Project Title:	Cloonanny Windfarm Development
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Prepared By:	Ian Douglas

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01	Final	29/11/2024

Contents

1 Ornithological Monitoring Programme

1.1 Introduction

This Ornithological Monitoring Programme has been prepared by ID Environmental Consultants Ltd for the Proposed Development, Co. Longford. This document provides a timeframe and monitoring schedule for bird surveys at the Proposed Development during the construction and post-construction phase of the project. The survey work undertaken between November 2021 and March 2024 forms the core dataset for assessing effects on ornithology. These field surveys complied with SNH guidance (SNH, 2017). Field survey methodologies were devised to survey the composition and assemblages of bird species within the Proposed Development and its surroundings.

1.2 Avian Key Ecological Receptors (KERs)

This evaluation for Avian KERs followed the guidance for the assessment of birds outlined in Percival (2003). The sensitivity of avian KERs, as per Percival, are listed below and have been abstracted from the EIAR and are listed below:

Species of High Sensitivity

- Whooper Swan (A flock of county importance was recorded, Annex I; EU Birds Directive Species),

Species of Medium Sensitivity

- Peregrine (Annex I; EU Birds Directive),
- Herring Gull,

Species of Low Sensitivity

- Mute Swan,
- Buzzard,
- Sparrowhawk,
- Kestrel,
- Mallard,
- Snipe,
- Golden Plover,
- Great Black-Back Gull,
- Black-headed Gull,
- Lesser Black-backed gull, and
- Passerines, including meadow pipit and grey wagtail.

1.2.1 Objectives

This document has been prepared with regard to the following objectives:

- To ensure any required pre-commencement/pre-construction phase monitoring is scheduled to avoid any impacts.

- To record bird usage of the site and interaction with operating turbines during the post-construction phase of the development.
- To monitor short-term and long-term effects on bird populations with a particular emphasis on wintering and breeding birds deemed to be of high conservation concern (Annex I; EU Birds Directive and BoCCI red list species).
- To undertake collision monitoring and corpse searches for potential bird fatalities from collision with turbine blades.
- Report on findings of post-construction monitoring at the end of each monitoring year (Years 1, 2, 3, 5, 10 and 15 of the wind farm lifetime).

1.3 Three-Phase Bird Monitoring Programme

This bird monitoring programme is designed to assess potential impacts on bird populations throughout the lifecycle of the Proposed Development. It encompasses three distinct phases: construction, operation, and decommissioning.

- **Pre-construction Monitoring:** Monitoring will commence one month before construction or decommissioning activities begin. This pre-construction phase helps establish baseline data on bird activity in the area.
- **Operational Monitoring:** During the Proposed Development's operational phase, surveys will be conducted at designated intervals throughout the project's lifespan. These surveys will target all Avian KERs listed above, along with other waterbirds, raptors, ground-nesting birds, protected near-passerines, and protected passerines.
- **Decommissioning Monitoring:** Similar to the pre-construction phase, monitoring will resume one month prior to decommissioning activities to assess potential impacts on birds during this phase.

1.3.1 Pre-Construction Monitoring

To minimise disturbance during the avian breeding season, construction activities will commence outside this period, which falls between 1st March and 31st August (inclusive).

Before commencing any work at the study area, a qualified ornithologist will undertake confirmatory bird surveys within one month of the start date. These surveys aim to identify any sensitive sites, such as roosting locations, within a 500-meter radius of the Proposed Development's footprint and all work areas where access permits.

If construction works extend into subsequent breeding or winter seasons following commencement, pre-construction surveys will be repeated to identify any new sensitive sites (e.g., nests). Additionally, breeding season surveys (where applicable) will be conducted once per month from April to July.

The ornithologist will conduct a thorough walkover survey of the development area. If winter roosts or nests of high conservation concern bird species are identified, the location will be earmarked for continued monitoring throughout the construction works.
Should an active roost or nest be identified during construction, all work within a species-specific buffer zone around the location will be suspended. This adheres to best practice guidance outlined by Forestry Commission Scotland (2006), Goodship & Furness (2022), and Ruddock & Whitfield (2007) to minimize disturbance. No works will be permitted within the buffer zone until it can be confirmed that

the roost or nest is no longer occupied.

Toolbox talks will inform all site personnel and subcontractors of any restrictions. A clear map demarcating the "no-work zone" will be provided to construction staff. The restricted area will also be physically marked on-site to alert personnel to the work suspension within that specific area.

1.3.2 Operational Phase

Operational monitoring will be undertaken in prescribed monitoring years during the operational lifetime of the Proposed Development. The SNH guidance document 'Monitoring the impact of onshore wind farms on birds' (SNH, 2009) requires that bird monitoring in wind farms should occur in years 1, 2, 3, 5, 10 and 15 after the turbines become operational. At the end of the first 5-year period, the results will be reviewed in consultation with the National Parks and Wildlife Service and future monitoring needs, and gaps will be identified to determine the frequency of monitoring in subsequent years. The requirements for monitoring in subsequent years, including any decision to reduce the frequency of surveys, will be agreed with the National Parks and Wildlife Service, allowing an adaptive approach to monitoring at the Proposed Development.

Surveys will take note of any changes in bird behaviour indicative of avoidance or change of activity from baseline studies. If there are detectable changes in bird behaviour or if collisions are found to be greater than those predicted, then additional mitigation, such as curtailing operation times, may be proposed. The monitoring programme, at a minimum, will include:

- Breeding bird surveys,
- Winter bird surveys; and
- Targeted bird collision surveys (corpse searches).

1.3.3 Vantage Point Surveys

Vantage point surveys will be undertaken to monitor flight activity within a 500m radius of the turbine positions. The vantage point survey methodology will be the same as used during pre-planning surveys to provide comparable data before and after the construction of the Proposed Development. The survey methodology should follow SNH (2017) and any revisions to the same. The surveyor should collect data from fixed vantage point locations for two 3-hour watches separated by a minimum 30-minute break (i.e. 6 hours total) per month. Surveys should be conducted monthly and provide a minimum of 36 hours per winter or breeding season and spread over the full daylight period, including dawn and dusk watches, to coincide with the highest periods of bird activity.

1.3.4 Walkover Surveys

The walkover survey methodology will be the same as used during pre-planning surveys to provide comparable data before and after the construction of the Proposed Development. Walkover surveys should be undertaken following the same transects used during the initial surveys. The presence of bird species of high conservation concern within areas of potentially suitable habitat in the study area will be recorded. The methodology was broadly based on methods described in Bibby *et al*.,(2000) and adapted by Brown and Shepherd (SNH, 2017).

1.3.5 Collision Monitoring Surveys

Bird collision mortality will be monitored throughout the wind's operational lifespan, considering the implementation of collision risk mitigation measures detailed in Chapter 11 of the EIAR. Survey frequency will be in line with the recommendations outlined in Scottish Natural Heritage (SNH, 2009). Carcass search methodology will adhere to the protocols outlined by SNH (2009) and Duffy & Steward (2008). Trained personnel, ideally accompanied by a search dog and handler, will conduct systematic carcass searches throughout the study area. The search frequency will vary seasonally:

- Breeding Season (April-September): Surveys will be conducted once per month.
- Winter Season (October-March): Surveys will be conducted twice per month.

The search area for each turbine will be determined based on its size and the surrounding habitat characteristics. For each bird carcass, the following data will be collected:

- **GPS location**: The precise location of each carcass will be recorded using a GPS device.
- **High-resolution digital photographs**: Detailed digital photographs will be captured to document the carcass condition.
- **Carcass condition**: Each carcass will be categorised according to established criteria: as intact (completely whole or not severely decomposed), scavenged (evidence of feeding by scavengers/predators), or feather spot (presence of ten or more feathers, or at least two primary feathers, indicating potential predation or scavenging).
- **Distance from the nearest turbine**: The distance between the discovered carcass and the closest wind turbine will be measured.
- **Date and time of discovery**: The date and time of carcass discovery will be recorded for further analysis.

1.3.6 Decommissioning Phase

To minimise disturbance to avian species potentially using the site, decommissioning activities will be scheduled to commence outside the breeding season, typically between 1st March and 31st August (inclusive).

Prior to initiating decommissioning works, confirmatory bird surveys will be conducted by a suitably qualified ornithologist within a one-month window before works begin. These surveys aim to identify any sensitive sites within a 500m radius of the Proposed Development and accessible work areas, focusing on roosting locations.

If decommissioning extends into subsequent breeding or winter seasons, pre-commencement surveys will be repeated to identify any new sensitive sites (e.g., nests). Additionally, breeding season surveys may be conducted once per month from April to July (inclusive), where applicable.

The ornithologist will conduct a thorough walkover survey of the development area. If winter roosts or nests of bird species with high conservation value are identified, their locations will be earmarked for continued monitoring throughout decommissioning works.

Should an active roost or nest be identified during decommissioning activities, works within a species-specific buffer zone around the location will be suspended. This adheres to best practice principles for minimising disturbance, as outlined by relevant guidance documents (e.g., Forestry Commission Scotland, 2006; Goodship & Furness, 2022; Ruddock & Whitfield, 2007). No works will be permitted within the buffer zone until it can be confirmed that the roost or nest is no longer occupied.

Toolbox talks will inform all site personnel and subcontractors of any restrictions. A clear map demarcating the "no-work zone" will be provided to construction staff, and the restricted area will be physically marked on-site to alert personnel to the work suspension within that specific area.

1.4 Reporting

At the conclusion of each designated monitoring period, a report summarising the findings of bird and collision monitoring surveys will be submitted to the Planning Authority and the National Parks and Wildlife Service. This report will present the survey results, evaluate potential impacts on birds (with a particular focus on Avian KERs and offer recommendations that may guide additional mitigation measures during the operational phase of the Proposed Development.

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APPENDIX 12.1
GLOSSARY OF ACOUSTIC TERMINOLOGY

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APPENDIX 12.1 - GLOSSARY OF ACOUSTIC TERMINOLOGY

A – Weighting	The “A” suffix denotes the fact that the sound levels have been “A-weighted” in order to account for the non-linear nature of human hearing.
Background Noise	The noise level rarely fallen below in any given location over any given time period, often classed according to day time, evening or night time periods. The $L_{A90,10min}$ is the parameter that is used to define the background noise level in this instance. L_{A90} is the sound level that is exceeded for 90% of the sample period. It is typically used as a descriptor for background noise.
dB (decibel)	The unit normally employed to measure the magnitude of sound. It is defined as 20 times the logarithm of the ratio between the RMS pressure of the sound field and the reference pressure of 20 micro-pascals (20 μPa).
dB(A)	An ‘A-weighted decibel’ – a measure of the overall noise level of sound across the audible frequency range (20 Hz – 20 kHz) with A-frequency weighting (i.e. A – Weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.
Hub Height Wind Speed	The wind speed at the centre of the turbine rotor.
Hertz (Hz)	The unit of sound frequency in cycles per second.
$L_{Aeq,T}$	This is the equivalent continuous sound level. It is a type of average and is used to describe a fluctuating noise in terms of a single noise level over the sample period (T).The closer the L_{Aeq} value is to either the L_{AF10} or L_{AF90} value indicates the relative impact of the intermittent sources and their contribution. The relative spread between the values determines the impact of intermittent sources such as traffic on the background.
L_{AF90}	Refers to those A-weighted noise levels in the lower 90 percentile of the sampling interval; it is the level which is exceeded for 90% of the measurement period. It will therefore exclude the intermittent features of traffic and is used to estimate a background level. Measured using the “Fast” time weighting.
L_{den}	Refers to the L_{Aeq} noise levels over a whole day, but with a penalty of 10 dB(A) for night-time noise (23:00-07:00) and 5 dB(A) for evening noise (19:00-23:00), also known as the day evening night noise indicator.
Low Frequency Noise	LFN - noise which is dominated by frequency components towards the lower end of the frequency spectrum.
Noise	Sound that evokes a feeling of displeasure in the environment in which it is heard, and is therefore unwelcomed by the receiver
Noise Sensitive Location (NSL)	Any dwelling house, hotel or hostel, health building, educational establishment, place of worship or entertainment, or any other facility or other area of high amenity which for its proper enjoyment requires the absence of noise at nuisance levels.

octave band	A frequency interval, the upper limit of which is twice that of the lower limit. For example, the 1,000Hz octave band contains acoustical energy between 707Hz and 1,414Hz. The centre frequencies used for the designation of octave bands are defined in ISO and ANSI standards.
Pascal (Pa)	Pascal is a unit of pressure and so sound pressures are measured in Pascals.
Sound Power Level (LW)	The sound power level radiated by a source is defined as: $L_W = 10\log_{10}\left(\frac{W}{W_0}\right)$ dB where W is the acoustic power of the source in Watts (W) and W_0 is a reference sound power chosen in air to be 10^{-12} W.
Sound Pressure Level (Lp)	The sound pressure level at a point is defined: $L_P = 20\log_{10}\left(\frac{P}{P_0}\right)$ dB where P is the sound pressure and P_0 is a reference pressure for propagation of sound in air and has a value of 2×10^{-5}Pa.
Tonal	Sounds which cover a range of only a few Hz which contains a clearly audible tone i.e. distinguishable, discrete or continuous noise (whine, hiss, screech, or hum etc.) are referred to as being 'tonal'.
10 Minute Average Wind Speed (m/s)	The wind speed measured by an anemometer at a specified height above ground level, averaged over a 10-minute period.
Wind Shear	The increase of wind speed with height above ground.