Planning and Environmental Consultants

Revised Natura Impact Statement

Coole Wind Farm, Co. Westmeath

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1. INTRODUCTION

1.1 Background

McCarthy Keville O'Sullivan Ltd. (MKO) has been appointed to prepare a Natura Impact Statement to allow the competent authority to conduct an Appropriate Assessment under Part XAB of the Planning and Development Acts 2000-2019 of the proposed construction of a 15 No. turbine wind energy development including the grid connection, near Coole, in north Co. Westmeath. This Natura Impact Statement (NIS) has been revised to take account of the request for further information issued by An Bord Pleanála in relation to the project on the 21st April 2022 and the submissions raised by the Development Applications Unit of the Department of the Department of Housing, Local Government and Heritage on the 17th May 2021. This document supersedes the NIS that was submitted with the Planning Application.

An Appropriate Assessment Screening Report has been prepared and is provided in Appendix 1. This Appropriate Assessment Screening Report identified the European Sites upon which the Proposed Development has the potential to result in significant effects and the pathways by which those effects may occur. The Screening Report identifies the European Sites upon which significant effects could not be excluded. Those sites will be assessed in this Natura Impact Statement.

This report has been prepared in compliance with Part XAB of the Planning and Development Acts 2000-2019, the Planning and Development Regulations 2001-2019 and relevant jurisprudence of the European and Irish courts. It has also been prepared in accordance with the European Commission's Assessment of Plans and Projects Significantly affecting Natura 2000 Sites: Methodological Guidance on the provisions of Article 6(3) and 6(4) of the Habitats Directive 92/43/EEC (EC, 2021) and Managing Natura 2000 Sites: the provisions of Article 6 of the 'Habitats' Directive 92/43/EEC (EC, 2018) as well as the Department of the Environment's Appropriate Assessment of Plans and Projects in Ireland - Guidance for Planning Authorities (DoEHLG, 2010) and the Appropriate Assessment Screening for Development Management. Office of the Planning Regulator, Dublin 7, Ireland OPR (2021).

In addition to the guidelines referenced above, the following relevant documents were also considered in the preparation of this report:

1. *Council of the European Commission (1992) Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora. Official Journal of the European Communities. Series L 20, pp. 7-49.*
2. *EC (2007) Guidance document on Article 6(4) of the 'Habitats Directive' 92/43/EEC – Clarification of the concepts of: alternative solutions, imperative reasons of overriding public interest, compensatory measures, overall coherence. Opinion of the commission.*
3. *EC (2013) Interpretation Manual of European Union Habitats. Version EUR 28. European Commission.*
4. *EC (2020) Guidance document on wind energy developments and nature legislation*

1.1.1 Statement of Authority

This report has been prepared by John Hynes (BSc., MSc., MCIEEM) and Laoise Kelly (BSc., MCIEEM) and reviewed by Pat Roberts (B.Sc. Environmental Science, MCIEEM). Pat has over 17 years' experience in ecological management and assessment. John Hynes has over 10 years' professional ecological consultancy experience Laoise Kelly has over 6 years' professional ecological consultancy experience and both are full members of the Chartered Institute of Ecology and Environmental Management. The baseline ecological surveys were undertaken by John Hynes B.Sc. (Env.) M.Sc MCIEEM, Pamela Boyle (PhD), Una Nealon (PhD), Laoise Kelly B.Sc. (Env.), MCIEEM, Aran Von der Geest Moroney (BSc.), Kevin McElduff (BSc. Env.) and Susan Doyle B.Sc. (Env.) M.Sc (Eco). All surveyors have relevant

academic qualifications and are competent experts in undertaking habitat and ecological assessments to this level. The bird surveys are undertaken by Patrick Manley (B.Sc.) Project Ornithologist with MKO, Andrew O'Donoghue, Conor Rowland, Niall McHugh, Niamh Scanlon, Patrick Manley, Tom Rae, Zak O'Conor and Zuzana Erosova, all of whom are experienced, competent bird surveyors.

2. CONSIDERATION OF THE HABITATS AND SPECIES WITH THE POTENTIAL TO BE AFFECTED

The Article 6(3) Appropriate Assessment Screening report, that is provided as **Appendix 1** to this NIS, concluded that there was potential for the Proposed Development to result in significant effects on the following European Sites:

- Lough Owel SAC (000688)
- Lough Ennell SAC (000685)
- Lough Owel SPA (004047)
- Lough Ennell SPA (004044)
- Lough Derravaragh SPA (004043)
- Lough Iron SPA (004046)
- Garriskil Bog SPA (004102)

This section of the NIS identifies the individual Qualifying Interests/Special Conservation Interests with the potential to be affected in each European Site and the pathways by which any such effects may occur. The location of the Proposed Development and connectivity with these EU designated sites is provided as Figure 2-1.

2.1 Lough Owel SAC

The SAC is located 12.5km south of the proposed wind farm site and the proposed grid connection route is located within the N4 road corridor along the boundary of the SAC. A watercourse flows under the N4 where the cable is to be laid and provides hydrological connectivity with this SAC. The proposed works have the potential to cause deterioration in surface water quality through the run-off of silt, hydrocarbons, cementitious material and other pollutants during the construction phase of the development potentially affecting the following habitats and species:

- Hard oligo-mesotrophic waters with benthic vegetation of *Chara spp.* [3140]
- Alkaline fens [7230]
- *Austropotamobius pallipes* (White-clawed Crayfish) [1092]
- Transition mires and quaking bogs [7140]

2.2 Lough Ennell SAC

The SAC is located 24km south of the proposed wind farm site and 4.2km south of the proposed grid connection route. There is hydrological connectivity between the proposed grid connection route and the SAC approximately 8.8km (hydrological distance) downstream. Taking a precautionary approach, the proposed works have the potential to cause deterioration in surface water quality through the run-off of silt, hydrocarbons, cementitious material and other pollutants during the construction phase of the Proposed Development potentially resulting in a significant effect on the following habitat for which the site is designated:

- Alkaline fens [7230]

Newry, Fane, Glyde and Dee
Erne
Upper Shannon
Boyne
Lower Shannon
Cooneen Bog SAC
Ballykenny-Fisherstown Bog SPA
Lough Forbes Complex SAC
Brown Bog SAC
Mount Jessop Bog SAC
Fortwilliam Turlough SAC
Lough Ree SAC
Carn Park Bog SAC
Crosswood Bog SAC
River Shannon Callows SAC
Middle Shannon Callows SPA
Ardagullion Bog SAC
Lough Sheelin SPA
Lough Kinale and Derragh Lough SPA
Derragh Bog SAC
Moneybeg And Clareisland Bogs SAC
Garriskil Bog SAC
Garriskil Bog SPA
Glen Lough SPA
Lough Iron SPA
Lough Derravaragh SPA
Scragh Bog SAC
Lough Owel SAC
Lough Owel SPA
Ballymore Fen SAC
Lough Ennell SPA
Lough Ennell SAC
Split Hills And Long Hill Esker SAC
White Lough, Ben Loughs And Lough Doo SAC
Lough Bane And Lough Glass SAC
Lough Lene SAC
Wooddown Bog SAC
Killyconny Bog (Cloghbally) SAC
River Boyne and River Blackwater SPA
River Boyne And River Blackwater SAC
Girley (Drewstown) Bog SAC
Mount Hevey Bog SAC

Map Legend
- EIAR Site Boundary
- 15km Buffer from Site
- Special Area of Conservation (SAC)
- Special Protection Area (SPA)
- WFD Catchments
- EPA Mapped Watercourses

15km Buffer to EU Designated Sites

Coole Wind Farm, Co. Westmeath

Drawn By	Checked By
HW	LK
Project No.	Drawing No.
200445	Figure 2-1
Scale	Date
1:200000	2021.01.27

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2.3 Lough Owel SPA

The SPA is located 12.5km south of the proposed wind farm site and the proposed grid connection route is located within the N4 road corridor along the boundary of the SPA. A watercourse flows under the N4 where the cable is to be laid and provides hydrological connectivity with this SPA. Taking a precautionary approach, a potential pathway for indirect effects in the form of deterioration of water quality resulting from pollution, associated with the construction phase of the development was identified. Consequently, there is potential for deterioration of the wetland habitat of all SCI species. In addition, taking a precautionary approach, given that the proposed grid connection route is located adjacent to the SPA boundary, a potential pathway for significant effect was identified in the form of bird disturbance and deterioration of habitat.

The following SCI species have the potential to be significantly affected as a result of potential deterioration of water quality as well as disturbance and displacement associated with construction activity:

- *Shoveler Anas clypeata [A056]*
- *Coot Fulica atra [A125]*
- *Wetland and Waterbirds [A999]*

2.4 Lough Ennell SPA

The SPA is located 24.3km south of the proposed wind farm site and 4.5km south of the proposed grid connection route. Due to this distance, there is no potential for significant indirect effects as a result of disturbance. There is hydrological connectivity between the proposed grid connection route and the SPA approximately 9.2km (hydrological distance) downstream. Taking a precautionary approach, a potential pathway for indirect effects in the form of deterioration of water quality resulting from pollution, associated with the construction phase of the Proposed Development was identified. Consequently, there is potential for deterioration of the wetland habitat of the following SCI species.

- Pochard *Aythya ferina* [A059]
- Tufted duck *Aythya fuligula* [A061]
- Coot *Fulica atra* [A125]
- Wetland and Waterbirds [A999]

2.5 Lough Derravarragh SPA

The SPA is located 4.8km south of the proposed wind farm site and 70m east of the proposed grid connection route. The Proposed Development is located within the potential core foraging range of Whooper Swan which is an SCI species associated with the SPA (SNH Guidelines (2016). The proposed grid connection route is located approximately 70m west of the SPA. Therefore, potential for disturbance to the remaining bird species associated with the SPA have also been considered. Given that the SPA is located hydrologically downstream of the Proposed Development site there is potential for indirect effects on surface water quality through the run off of silt, hydrocarbons, cementitious material and other pollutants during the construction phase of the Proposed Development. The following SCIs were identified as having potential to be impacted by the Proposed Development and will be assessed further:

- Whooper swan *Cygnus cygnus* [A038]
- Pochard *Aythya ferina* [A059]
- Tufted duck *Aythya fuligula* [A061]
- Coot *Fulica atra* [A125]
- Wetland and Waterbirds [A999]

2.6 Lough Iron SPA

The SPA is located 11.4km south west of the proposed wind farm site, 3km from the proposed junction works in Joanstown and 4.3km west of the proposed grid connection route. The windfarm site is located outside the potential core foraging range of SCI species associated with the SPA (SNH Guidelines (2016). It is also located outside the zone of sensitivity of any species that is listed as particularly sensitive to wind energy development in Mc Guinness et.al (2015). However, on a highly precautionary basis the potential for effects on the SCI species is considered in this NIS.

There will be no direct effects on the supporting wetland habitat of waterbirds within the SPA. However, taking a precautionary approach, a potential pathway for indirect effects in the form of deterioration of water quality resulting from pollution, associated with the construction phase of the Proposed Development was identified. Consequently, there is potential for deterioration of the wetland habitat of all SCI species as listed below:

- Whooper Swan *Cygnus cygnus* [A038]
- Wigeon *Anas penelope* [A050]
- Teal *Anas creca* [A052]
- Shoveler *Anas clypeata* [A056]
- Coot *Fulica atra* [A125]
- Golden Plover *Pluvialis apricaria* [A140]
- Greenland White-fronted Goose *Anser albifrons flavirostris* [A395]

2.7 Garriskil Bog SPA

The SPA is located 1.8km from the wind farm site and 4.4km from the proposed grid connection route.In accordance with SNH Guidelines (2016), the wind farm site is located within the potential core foraging range of SCI species associated with the SPA. However, as per the NPWS site synopsis, the last record of Greenland White-fronted Goose at the site was from *1986/87 (43 individuals).*

The following is an extract from the NPWS site synopsis for the SPA "

At the time this site was designated as a Special Protection Area (SPA) it was known to be utilised by part of an internationally important population of Greenland White-fronted Goose centered around the midland lakes. The geese appear to have abandoned these peatland sites in favour of grassland sites elsewhere.

Given that lack of evidence to suggest that the SCI species utilise the SPA, and the lack of potential for the proposed development to result in significant effects thereon (following detailed bird surveys at the site and as presented in the bird survey report prepared in response to the request for further information), potential impacts on the populations of the SCI species for which the SPA was designated are considered highly unlikely. However, following an extremely precautionary principle and due to the fact that the wind farm site is within the core foraging range of the SCI species of the site:

- Greenland white-fronted goose *Anser albifrons flavirostris* [A395]

3. DESCRIPTION OF PROPOSED DEVELOPMENT

3.1 Site Location

The proposed wind farm site is located approximately 2.4 kilometres north of Coole village (i.e. distance from Coole village centre to the main wind farm site boundary).The town of Castlepollard is located approximately 6.7 kilometres southeast of the wind farm site boundary, at its nearest point. The townlands in which the proposed wind farm site, ancillary works, grid connection route and junction accommodation works are located, are listed in Table 3-1.

Table 3-1 Townlands within which the Project is located

Development Works	Townland
Wind Farm, including Turbines and Access Roads, Substation, Construction Compound	Coole, Monktown, Camagh, Doon, Clonsura, Clonrobert, Mullagh, Newcastle and Carlanstown
Proposed Borrow Pit	Mullagh
Junction Accommodation Works	Boherquill, Coole, Corralanna, Culvin,Joanstown and Mayne
Grid Connection Route	Camagh, Monktown, Coole, Fearmore (Fore by), Newtown (Fore by), Mayne, Simonstown (fore by), Ballinealoe, Shrubbywood, Clonava, Lackan (Corkaree by), Soho, Ballynaclonagh, Abbeyland, Rathganny, Ballindurrow, Cullendarragh, Culleenabohoge, Ballynafid, Knightswood, Portnashangan, Culleen More, Farranistick, and Irishtown (Moyashel by)

A previous application for a wind farm development at this location was submitted by Coole Wind Farm Ltd. to Westmeath County Council on the 19th October 2017 and was considered under Pl. Ref. 17/6292. This application comprised of a wind farm consisting of up to 13 No. wind turbines with a tip-height of up to 175 metres, upgrade of existing internal access roads and provision of new internal access roads, an on-site substation, underground cabling, temporary construction compound and all ancillary infrastructure. Westmeath County Council issued their decision to refuse to grant permission on 12th December 2017 based on 1 no. refusal reason. This decision was appealed to An Bord Pleanála on 14th January 2018 and was considered under ABP-300686-18. An Bord Pleanála issued the decision to grant permission for the wind farm on 27th March 2019.

In preparing the NIS, the applicant and design team have considered in full the previous applications for the project, along with Further Information Requests received in relation to the project.

3.2 Characteristics of the Proposed Development

3.2.1 Description of the project

The Proposed Development comprises the provision of the following:

Coole Wind Farm Ltd. intends to apply for planning permission to construct a wind energy development at Coole in north Co. Westmeath. The Proposed Development will comprise of:

i. Up to 15 No. wind turbines with a tip height of up to 175 metres and all associated foundations and hardstanding areas;
ii. 1 no. onsite electrical substation including a control building, associated electrical plant and equipment, welfare facilities and a wastewater holding tank;
iii. 1 no. temporary construction compound;
iv. Provision of new site access roads, upgrading of existing access roads and hardstand areas;
v. Excavation of 1 no. borrow pit;
vi. All associated underground electrical and communications cabling connecting the turbines to the proposed onsite substation;
vii. Laying of approximately 26 km of underground electricity cabling to facilitate the connection to the national grid from the proposed onsite substation located in the townland of Camagh to the existing 110kV Mullingar substation located in the townland of Irishtown;
viii. Upgrade works to the existing 110kV Mullingar substation consisting of the construction of an additional dedicated bay to facilitate connection of the cable;
ix. Construction of a link road between the R395 and R396 Regional Roads in the townland of Coole to facilitate turbine delivery;
x. Junction improvement works to facilitate turbine delivery, at the N4 junction with the L1927 in the townland of Joanstown, on land to the South East of railway line level crossing on the L1927 in the townland of Culvin, the L1927 and L5828 junction in the townland of Boherquill and the L5828 and R395 junction in the townland of Corralanna;
xi. Site Drainage;
xii. Forestry Felling;
xiii. Signage, and;
xiv. All associated site development works.

The application is seeking a 10-year planning permission, that is that the planning consent would remain valid for 10 years following a final grant of planning permission.

An Environmental Impact Assessment Report (EIAR) and Natura Impact Statement (NIS) were prepared for the project to accompany the planning application.

Project Location & Access

The Proposed Development site measures approximately 498 hectares and is located in north Co. Westmeath, approximately 2.4 kilometres north of Coole village. The town of Castlepollard is located approximately 6.7 kilometres southeast of the site, at its nearest point. The Grid Reference co-ordinates for the approximate centre of the site are E641172, N776072.

Access to the site is via regional and local roads. The site is accessed via the R396 Regional Road, which travels in a southeast-northwest direction between Coole and Granard. From the R396, the L5755 local road traverses the site, linking to the R394 Regional Road, east of the Proposed Development site.

Grid Connection

The planning application includes for the construction of underground electricity cabling from the proposed onsite substation located in the townland of Camagh. This connection is carried out via an underground cable which is almost entirely contained within the public road corridor to the existing

110kV Mullingar substation located in the townland of Irishtown. Proposed upgrade works at the existing Mullingar substation will consist of the construction of an additional dedicated bay to facilitate connection of the cable. The total length of the proposed cable route is approximately 26 kilometres.

3.2.2 Development Layout

The layout of the Proposed Development has been designed to minimise the potential environmental effects of the wind farm, while at the same time maximising the energy yield of the wind resource passing over the site. A constraints study, as described in Section 3.3.5, in Chapter 3 of the EIAR, has been carried out to ensure that turbines and ancillary infrastructure are located in the most appropriate areas of the site.

The overall layout of the Proposed Development is shown on Figure 3-1. This figure shows the Proposed Development infrastructure as outlined above. Detailed site layout drawings of the Proposed Development are included in Appendix 4-1 to the EIAR.

Map Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- Proposed Hardstand
- Proposed Borrow Pit
- Construction Compound
- Internal Roads (new)
- Internal Roads (Upgrades to existing)
- Proposed Junction Works
- External Roads (Upgrades to Existing)
- Proposed Onsite Substation
- Proposed Grid Connection Route
- Proposed Upgrade Works to Existing Mullingar Substation
- Turbine Delivery Route
- Temporary Hardcore Surfacing Areas

Site Layout

Project Title: Coole Wind Farm, Co. Westmeath	
Drawn By: HW	Checked By: LK
Project No: 200445	Drawing No: Figure 3-1
Scale: 1:30000	Date: 2021.01.27

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3.3 Mitigation Measures and Best practice

The design of the Proposed Development, as described in Chapter 4 of the EIAR sets out very clearly how the wind farm including the grid connection has been designed and will be operated in accordance with best industry practice to avoid any significant effects outside the site including the prevention of impacts on watercourses.

A Construction and Environmental Management Plan (CEMP) has been prepared and is included as **Appendix 2** of this report. The CEMP will be in place prior to the start of the construction phase. Best practice measures which form part of the design of the project are included in Chapter 4 (Description of the Proposed Development) and in the relevant chapters of the EIAR.

The CEMP also outlines that a Site Supervisor/Construction Manager and/or Environmental Manager will be appointed to maintain responsibility for monitoring the works and Contractors/Sub-contractors from an environmental perspective. In addition, an Environmental Clerk of Works or Project Ecologist, Project Hydrologist, Project Geotechnical engineer will visit the site regularly and report to the Site Environmental Office. This structure will provide a "triple lock" review/interaction by external specialists during the construction phase. Some of the key features of the environmental management strategy are provided below.

3.3.1 Water quality

The Proposed Development has been designed so that all large-scale infrastructure such as turbine and site compounds are located as far from watercourses as possible. These best practice construction measures are designed to avoid impacts on areas that are outside the site including downstream watercourses. The development has been designed to maintain a drainage neutral situation to avoid drainage related impacts (See Chapter 9: Hydrology and Hydrogeology).

The Proposed Development includes a detailed drainage plan that is included in full in Chapter 9 (Hydrology and Hydrogeology) of the EIAR. This plan and all the associated measures have been taken into account in this assessment but are not included in full (to avoid repetition). The drainage philosophy overall is to minimise waters arising on site, to adequately treat any water that may arise and to ensure that the hydrological function of the watercourses on the site and in the wider catchment are not affected by the proposed works. This philosophy including all associated mitigation measures to protect local surface water quality are fully described in the Construction and Environmental Management Plan (CEMP) and Chapter 9 (Hydrology and Hydrogeology Chapter) of the EIAR.

The Inland Fisheries Ireland (2016): *Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters*; and the Scottish Natural Heritage (SNH) *Good Practice During Wind Farm Construction* (SNH, 2019, 4th Edition) will also be adhered to.

Section 9.4 of the Hydrology and Hydrogeology Chapter (Chapter 9) of the EIAR accompanying this application sets out in full the mitigation measures that will be implemented to protect water quality.

The key mitigation measure during the construction phase is the avoidance of sensitive aquatic areas where possible, by application of suitable buffer zones (i.e. 50m to main watercourses, and 10m to main drains). All major infrastructure such as turbines, substations and site compounds will be over 50m from any main watercourse (identified on EPA watercourse mapper) and 10m from any large drainage channels on the site. The only works that will be inside these buffer zones will be where access roads cross drains throughout the site and where there is a proposed upgrade to an existing watercourse crossing. There will be 2 no. crossings over the River Glore as part of the Proposed Development. The first crossing comprises the replacement of an existing timber bridge with a 5m clear span bridge connecting Turbines T5-T12 to Turbines T1-T4. The second crossing will comprise a new 5m clear-span bridge to provide access to T15. A third crossing will be required to provide access to Turbine T1

located to the north of an OPW drain. This will require a 3-metre clear span bridge. Figure 4-24 in Chapter 4 of the EIAR shows the typical clear span bridge design. There will be no in-stream works required as part of the Proposed Development. Additional control measures, which are outlined further on in this section, will be undertaken at the proposed watercourse and drain crossing locations.

There are a total of 16 no. watercourse crossings along the Grid Connection Route, as shown in Figure 3-2. There are 7 no. river/stream crossings (Locations No. 2, 3, 4, 10, 14, 15 & 16), with the remaining crossings being classified as culverts. All the crossings are existing bridges and culverts along the public road.

No in-stream works are required at any of these crossings, however due to the proximity of the streams to the construction work at the crossing locations, there is a potential for surface water quality impacts during trench excavation work. Mitigation measures are outlined below.

A constraint/buffer zone will be maintained for all crossing locations where possible, whereby all watercourses will be fenced off. In addition, measures which are outlined below will be implemented to ensure that silt laden or contaminated surface water runoff from the excavation work does not discharge directly to the watercourse.

The large setback distance from sensitive hydrological features means that adequate room is maintained for the proposed drainage mitigation measures (discussed below) to be properly installed and operate effectively. The proposed buffer zone will:

- Avoid physical damage to watercourses, and associated release of sediment;
- Avoid excavations within close proximity to surface watercourses;
- Avoid the entry of suspended sediment from earthworks into watercourses; and,
- Avoid the entry of suspended sediment from the construction phase drainage system into watercourses, achieved in part by ending drain discharge outside the buffer zone and allowing percolation across the vegetation of the buffer zone;

Grid Connection Route Watercourse Crossing Locations

Coole Wind Farm, Co. Westmeath

EC	MW
200445	Figure 3-2
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Increased surface water runoff during the operational phase of the Proposed Development was considered, due to the replacement of vegetated surfaces with impermeable surfaces including hardstand areas, amenity links and substation.

The operational phase drainage system will be installed and constructed in conjunction with the road and hardstanding construction work as described below:

- Runoff from individual turbine hardstanding areas will not be discharged into the existing drain network, but discharged locally at each turbine location through settlement ponds and buffered outfalls onto vegetated surfaces;
- Interceptor drains will be installed up-gradient of all proposed infrastructure to collect clean surface runoff, in order to minimise the amount of runoff reaching areas where suspended sediment could become entrained. It will then be directed to areas where it can be re-distributed over the ground by means of a level spreader;
- Swales/road side drains will be used to collect runoff from access roads and turbine hardstanding areas of the site, likely to have entrained suspended sediment, and channel it to settlement ponds for sediment settling;
- On steep sections of access road transverse drains ('grips') will be constructed where appropriate in the surface layer of the road to divert any runoff off the road into swales/road side drains;
- Check dams will be used along sections of access road drains to intercept silts at source. Check dams will be constructed from a 4/40mm non-friable crushed rock;
- Settlement ponds, emplaced downstream of road swale sections and at turbine locations, will buffer volumes of runoff discharging from the drainage system during periods of high rainfall, by retaining water until the storm hydrograph has receded, thus reducing the hydraulic loading to watercourses; and,
- Settlement ponds will be designed in consideration of the greenfield runoff rate.

Decommissioning phase impacts will be similar to construction phase but the potential for impacts will be significantly less given that much of the infrastructure will remain in-situ. Temporary drainage measures as outlined in the Hydrology and Hydrogeology Chapter of the EIAR and best practice fuel/hydrocarbon cement management will be employed as required.

3.3.2 Hydrocarbons and Waste Material

The use of hydrocarbons during the construction process leads to the potential for pollution to enter the wider environment, including drainage ditches and watercourses. Leaks in poorly maintained plant and machinery could lead to hydrocarbon dispersal over works areas. Leaks in fuel storage tanks and spillages during refuelling operations could lead to larger releases of hydrocarbons into the environment.

The Construction and Environmental Management Plan (CEMP) provides measures to avoid impacts on the wider environment as a result of pollution and are summarised below.

3.3.2.1 Refuelling, Fuel and Hazardous Materials Storage

The following mitigation measures are proposed to avoid release of hydrocarbons at the site:

- Onsite re-fuelling of machinery will be carried out using a mobile double skinned fuel bowser. The fuel bowser, a double-axel custom-built refuelling trailer will be re-filled off site (Wind Farm Site and Grid Connection Route) and will be towed around the site by a 4x4 jeep to where machinery is located. The 4x4 jeep will also carry fuel

absorbent material and pads in the event of any accidental spillages. The fuel bowser will be parked on a level area in the construction compound when not in use and only designated trained and competent operatives will be authorised to refuel plant on site. Mobile measures such as drip trays and fuel absorbent mats will be used during all refuelling operations;
- Refuelling or maintenance of machinery will not occur within 100m of a watercourse;
- Fuels stored on site will be minimised;
- Any diesel or fuel oils stored at the temporary site compound will be bunded. The bund capacity will be sufficient to contain 110% of the storage tank's maximum capacity;
- The electrical control building at the Wind Farm Site will be bunded appropriately to the volume of oils likely to be stored, and to prevent leakage of any associated chemicals and to groundwater or surface water. The bunded area will be fitted with a storm drainage system and an appropriate oil interceptor;
- The plant used will be regularly inspected for leaks and fitness for purpose; and,
- An emergency plan for the construction phase to deal with accidental spillages will be contained within Environmental Management Plan. Spill kits will be available to deal with accidental spillages.

3.3.2.2 Cement Based Products Control Measures

The following mitigation measures are proposed to avoid release of cement leachate from the site:

- No batching of wet-cement products will occur on site/along the grid route works or near other ancillary construction activities. Ready-mixed supply of wet concrete products and where possible, emplacement of pre-cast elements, will take place;
- Where possible pre-cast elements for culverts and concrete works will be used;
- No washing out of any plant used in concrete transport or concreting operations will be allowed on-site;
- Where concrete is delivered on site, only the chute will need to be cleaned, using the smallest volume of water possible. No discharge of cement contaminated waters to the construction phase drainage system or directly to any artificial drain or watercourse will be allowed. Chute cleaning water is to be directed into a dedicated concrete wash out pit. Decommissioning of this pit will occur at the end of the construction phase and water and solids will be tanked and removed from the site to a suitable, non-polluting, discharge location;
- All concrete will be paced in shuttering and will not be in contact with soils or groundwater until after it has set;
- Use weather forecasting to plan dry days for pouring concrete; and,
- Ensure pour site is free of standing water and plastic covers will be ready in case of sudden rainfall event.

4. CHARACTERISTICS OF THE RECEIVING ENVIRONMENT

The ecological surveys that were undertaken to inform this NIS are fully described in this section. The specific surveys that were undertaken to assess the potential effects on the identified European Sites are described below.

4.1 Ecological Survey Methodologies

4.1.1 Desk Study methodology

The desk study undertaken for this assessment included a thorough review of the available ecological data associated with the study area of the Proposed Development. Sources of data included the following:

- Review of existing information obtained during the application made in 2017 as part of the permitted Coole Wind Farm.
- Review of NPWS Conservation Objectives supporting documents, site synopsis, standard data forms and supporting documents for EU Designated Sites,
- Review of online web-mappers: National Parks and Wildlife Service (NPWS), Environmental Protection Agency (EPA), EPA (Envision), Water Framework Directive (WFD), Geological Survey of Ireland (GSI) and Inland Fisheries Ireland (IFI)
- Review of the publicly available National Biodiversity Data Centre (NBDC) web-mapper,
- Inland Fisheries Ireland (IFI) reports, where relevant/available,
- Review of NPWS Article 17 metadata and GIS database.
- Review of NPWS Article 12 metadata and GIS database.
- Records from the NPWS web-mapper and review of specially requested records from the NPWS Rare and Protected Species Database for the hectads in which the Proposed Project is located.
- Review of OS maps and aerial photographs of the site of the Proposed Development.
- Review of other plans and projects within the area.
- MKO field assessments and bird surveys carried out between 2015 and 2022 and as provided in full in the EIAR, NIS and associated appendices and within the response to further information documentation associated with the application.

4.1.2 Scoping and Consultation

A detailed Scoping Document, providing details of the application site, the Proposed Development and the proposed scope of the EIAR, and inviting the comments and input of consultees, was prepared by MKO and circulated on the 31st August 2020. Copies of the scoping responses are included in Appendix 2-2 of the EIAR. Table 4.1 provides a list of the organisations consulted with regard to biodiversity during the scoping process, and notes where scoping responses were received.

The recommendations of the consultees have been taken into consideration in the preparation of this NIS.

Table 4-1 Scoping Response Summary

Consultee	Response
An Taisce	No response received to date
Bat Conservation Ireland	No response received to date
BirdWatch Ireland	No response received to date
Department of Agriculture, Food and the Marine	Response Received on 5th November 2020
Department of Communications, Climate Action & Environment	No response received to date
Development Applications Unit of the Department of the Department of Housing, Local Government and Heritage	Submission received on 17th May 2021.
Forest Service	No response received to date
Irish Wildlife Trust	No response received to date
Geological Survey of Ireland	Response received on 2nd October 2020
Inland Fisheries Ireland	No response received to date
Irish Peatland Conservation Council	No response received to date
Irish Wildlife Trust	No response received to date
Waterways Ireland	No response received to date

4.2 Ecological Survey Methodologies

A comprehensive survey of the biodiversity of the entire site was undertaken by MKO on various dates throughout 2016, 2017, 2019, 2020, 2021and 2022. The following sections fully describe the ecological surveys that have been undertaken and provide details of the methodologies, dates of survey and guidance followed.

4.2.1 Ecological Multidisciplinary Walkover Surveys

As part of the original Coole Wind Farm application that was granted in 2019, multidisciplinary walkover surveys associated with the windfarm site were undertaken by MKO in March, April, July, August and September 2016. The survey timing falls within the recognised optimum period for vegetation surveys/habitat mapping, i.e. April to September (Smith et al., 2011). Additional visits were also conducted outside the optimum survey period in March and October 2016 and in March 2017.

Surveys of the windfarm site including the proposed new turbine locations, 14 and 15, and the proposed new grid connection route were carried out on the 21st of November and 16th of December 2019 and the 31st of July and 23rd October 2020 which covered the optimal survey period. Bat surveys for the Wind Farm Site were carried out by Woodrow Sustainable Solutions over the spring, summer and autumn period in 2020. A visual inspection and driven transect of the grid connection route was

carried out by MKO on 15th September 2020. These surveys provided up to date baseline data for the windfarm site as well as for the footprint of the new works proposed.

Additional Ecological Multi- Disciplinary Walkover Surveys of site of proposed development including the cable route undertaken in November 2021 and August 2022 to ensure the ecological information on the site baseline is up to date and remains accurate. The surveys were undertaken by Laoise Kelly (B. Sc. Env, MCIEEM) and Aran Von der Geest Moroney (BSc.) on the 17th and 25th of November 2021and on the 3rd , 23rd and 24th of August 2022 by Kevin McElduff (BSc. Env.).

The walkover surveys were designed to detect the presence, or likely presence, of a range of protected species. The survey included a search for badger setts and areas of suitable habitat, potential features likely to be of significance to bats and additional habitat features for the full range of other protected species that are likely to occur in the vicinity of the Proposed Development (e.g. otter etc.). In addition, an inventory of other species of local biodiversity interest was compiled including invertebrates (butterflies, dragonflies, damselflies, beetles), plants, fungi etc.

The multi-disciplinary walkover surveys comprehensively covered the entire study area and based on the survey findings, further detailed targeted surveys were carried out for features and locations of ecological significance. These surveys were carried out in accordance with NRA *Guidelines on Ecological Surveying Techniques for Protected Flora and Fauna* on National Road Schemes (NRA, 2009).

During the multidisciplinary surveys, a search for Invasive Alien Species (IAS) listed under the Third Schedule of the European Communities Regulations 2011 (S.I. 477 of 2015) was conducted.

Other targeted survey methodologies undertaken at the site are described in the following subsections.

4.2.1.1 Turbine Base and Infrastructure Locations

The locations of turbine bases, hard standing areas, the substation, the site compound, internal roads, haul road, borrow pit and grid connection route were visited during the multidisciplinary walkover surveys.

Botanical surveys for all turbines, road infrastructure, susbstation and all other infrastructure were undertaken. These surveys provided an understanding of the baseline and informed further survey work following finalisation of the proposed infrastructure layout. The habitat assessment surveys described in this report have been undertaken with reference to the following guidelines and interpretation documents:

- Perrin, P.M, Martin, J.R., Barron, J.R., Roche & O'Hanrahan, B. (2014) *Guidelines for a national survey and conservation assessment of upland vegetation and habitats in Ireland.* Version 2.0. Irish Wildlife Manuals, No. 79. National Parks and Wildlife Service.
- Cross, J. & Lynn, D. (2013) *Results of a monitoring survey of bog woodland.* Irish Wildlife Manuals, No. 69. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.
- Fernandez, F., Connolly K., Crowley W., Denyer J., Duff K. & Smith G. (2014) Raised Bog Monitoring and Assessment Survey 2013. Irish Wildlife Manuals, No. 81. National Parks and Wildlife Service, Department of Arts, Heritage and Gaeltacht, Dublin, Ireland.
- Commission of the European Communities (2007) Interpretation manual of European Union habitats. Eur 27. European Commission DG Environment.
- Foss, P.J. & Crushell, P. 2008, *Guidelines for a National Fen Survey of Ireland, Survey Manual.* Report for the National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Ireland.

- NPWS (2013) The Status of EU Protected Habitats and Species in Ireland. Habitat Assessments Volume 2. Version 1.1. Unpublished Report, National Parks and Wildlife Services. Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.
- NPWS (2019). The Status of EU Protected Habitats and Species in Ireland. Volume 2: *Habitat Assessments*. Unpublished NPWS report. Edited by: Deirdre Lynn and Fionnuala O'Neill

Plant nomenclature for vascular plants follows '*New Flora of the British Isles*' (Stace, 2010), while mosses and liverworts nomenclature follows '*Mosses and Liverworts of Britain and Ireland - a field guide'* (British Bryological Society, 2010).

4.2.1.2 Faunal Surveys

4.2.1.2.1 *Aquatic surveys*

In 2016, Ecofact Environmental Consultants were commissioned to undertake aquatic surveys of watercourses within and in proximity to the proposed wind farm site. The Aquatic Survey Report provides an overview of the habitats and plants, fish, aquatic macroinvertebrates and biological and chemical water quality at each of the 8 sampling locations. A description of site location, physical characteristics, habitats, vegetation community, macroinvertebrate community, biological water quality, chemical water quality and species specific survey results are detailed on a site by site basis. Surveys were undertaken in June 2016. The relevant extracts from the Aquatic Survey Report are provided as **Appendix 3**.

Of the eight sampling locations, seven (Sites 1, 2, 3, 5, 6, 7 & 8) are pertinent to the Proposed Development. Sampling location 4 was located on the Mayne river and has no hydrological connectivity with the Proposed Development. Sample locations 1-3 are located on the River Inny downstream of the Proposed Development.

In addition to the above assessment, watercourse crossings associated with the proposed grid connection route and locations of Turbine 14 and 15 were assessed by MKO in 2019 and 2020. This comprised a visual assessment of the character of the watercourse, associated vegetation and connectivity with other watercourses and/or sites of interest downstream.

Aquatic surveys were undertaken in 2022 and provide up to date information on the baseline aquatic environment. Details of these surveys are provided in **Appendix 3.**

4.2.1.2.2 *Invasive species survey*

During the multi-disciplinary walkover surveys, a search for non-native invasive species was undertaken. The survey focused on the identification of invasive species listed under the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations 2011 (As Amended) (S.I. 477 of 2015).

4.2.1.2.3 *Survey limitations*

Seasonal factors that affect distribution patterns and habits of species were taken into account when conducting the surveys. The potential of the site to support certain populations (in particular those of conservation importance that may not have been recorded during the field survey due to their seasonal absence or nocturnal/cryptic habits) was assessed.

4.2.2 Bird Surveys

Field surveys were undertaken during two survey periods: April 2015 – March 2017 and April 2018 - March 2020. The data provided in this report is robust and allows clear, precise and definitive conclusions to be made on the avian receptors identified within the subject site. Field survey methodologies have been devised to survey for the bird species composition and assemblages that occur within the study area. The study area varied with the target species and type of survey.

Further bird surveys were undertaken between March 2021 and March 2022 to verify the results and conclusions of the previous surveys. A bird survey report is provided in **Appendix 4.** These surveys were undertaken to update and verify the previous surveys that informed the original NIS and where appropriate, to corroborate the previous findings. The surveys described below relate to the 2015 – 2018 surveys. Details of the more recent surveys are provided in **Appendix 4.**

4.2.2.1 Initial Site Assessment

Based on the results of the desk study, consultation and reconnaissance site visits, the likely importance of the study area for bird species was ascertained. Based on the collated information available from the above preliminary assessment and adopting a precautionary approach, a site-specific scope for the ornithological survey was developed.

4.2.2.2 Survey Methodologies

The survey work undertaken between October 2015 and September 2017 and April 2018 and March 2020 forms the core dataset for the assessment of effects on ornithology. Separate sections to distinguish the two sets of surveys are clearly distinguished in this assessment.

In the absence of specific national bird survey guidelines, the ornithological surveys were designed and undertaken in full accordance with '*Recommended bird survey methods to inform impact assessment of onshore wind farms'* (SNH, 2017).

The various survey types undertaken are described below.

4.2.2.2.1 *Vantage Point Surveys*

Flight activity data was collected from three vantage point locations (VPs 3, 4 and 5) (see Figure 7-1 in Chapter 7 of the EIAR) to inform a collision risk analysis and identify areas of ornithological importance within the wind farm site. The southern and eastern sections of the Site were surveyed between 2018 and 2020. While the northern section of the Site was surveyed before this, between 2015 and 2017. In total three fixed vantage points (VP3, VP5 in 2018-2020 and VP3, VP4 in 2015-2017) were required to provide adequate coverage of the proposed turbine layout. Further details are provided below.

Survey work 2018-2020

Vantage point surveys were undertaken in accordance with SNH guidance from April 2018 to March 2020. Surveys were conducted monthly throughout this survey period from four fixed vantage points (VP1, VP2, VP3 and VP5) to allow comprehensive coverage of a larger study area. The vantage point locations were selected by undertaking a viewshed analysis, as described below, and confirmed by a recce visit and initial field surveys in April 2018. Following a contraction of the proposed development area and turbine layout, only two of these four VPs have view sheds that overlap with the proposed turbine layout: VP3 and VP5.

Survey work 2015-2017

Vantage point surveys were previously undertaken to SNH guidance between October 2015 and September 2017. Surveys were conducted monthly throughout this survey period from two fixed vantage points (VP3 and VP4). Vantage point 4 provides coverage of the northern section of the wind farm site.

Figure 7-1 in Chapter 7 of the EIAR shows the locations of all vantage points relative to the development Site.

Viewshed Analysis

Viewshed analysis was carried out to show the coverage of the study area from three fixed vantage point locations (i.e. VPs 3, 4 and 5). Viewsheds were calculated using Resoft Wind Farm ZTV (Zone of Theoretical Visibility) software in combination with Mapinfo Professional (Version 10.0) using a notional layer suspended at 20 metres, which is representative of the minimum height considered for the Potential Collision Risk Area based on a worst-case scenario turbine model. While the relevance of being able to view as much of the site to ground level is acknowledged, the SNH guidance emphasizes the importance of visibility of the 'collision risk volume' when the data is to be used to estimate the risk of collisions with turbines by birds.

The viewshed analysis involved testing each VP location for its visibility coverage by creating a viewshed point 1.5 meters in height (to represent the height of observer) on a map using 10 metre contours terrain data. The relative height of forestry and its effects on visibility is also accounted for in the analysis. Using the ZTV software, a viewshed of 360 degrees was produced calculating an area 20 metres from ground level up to a 2km radius. The resulting viewshed image was then cropped to 180 degrees to give the viewshed from each VP location in line with SNH (2017). A 500m buffer was applied to the outer most turbines of the proposed development in line with SNH (2017). The aim of the viewshed analysis is to establish whether the selected vantage points offer adequate coverage of the proposed turbine layout. The visible area within the view sheds at 20m are provided in Figures 7-2, 7-2-1, 7-2-2 and 7-2-3 in Chapter 7 of the EIAR.

Vantage points should provide the best views of potential turbine locations. Although there is a small gap in the view shed, as detailed in Figure 7-2 in Chapter 7 of the EIAR, the coverage of the site in general is considered adequate to inform the collision risk analysis, i.e. the Band Model (2007) presumes random movement of target species within the view shed, therefore given sufficient coverage of the site, the Band Model can account for gaps in the view shed.

Data Recording and Digitisation

Data on bird observations and flight activity was collected from a scanning arc of 180° and a 2km radius by an observer at each fixed location for six hours per month. Surveys were scheduled to provide a spread over the full daylight period including dawn and dusk watches to coincide with the highest peaks of bird activity. Target species were as listed in Appendix 7-1, Table 1-1 in Chapter 7 of the EIAR.

Survey effort for vantage point watches is presented in Appendix 7-2, Table 1-1 in Chapter 7 of the EIAR. This includes full details of dates, times, survey locations, survey duration and weather conditions for each survey. Table 4-2 below shows a summary of the VP survey work undertaken.

Table 4-2 Vantage Point Survey Effort

Survey Season	Months	Minimum Effort per VP
2015/2016 Non-Breeding Season (VP3, VP4)	Oct - Mar	36 hours/VP

Survey Season	Months	Minimum Effort per VP
2016 Breeding Season (VP3, VP4)	Apr - Sep	36 hours/VP
2016/2017 Non-Breeding Season (VP3, VP4)	Oct - Mar	36 hours/VP
2017 Breeding Season (VP3, VP4)	Apr - Sep	36 hours/VP
2018 Breeding Season (VP3, VP5)	Apr - Sep	36 hours/VP
2018/2019 Non-Breeding Season (VP3, VP5)	Oct - Mar	36 hours/VP
2019 Breeding Season (VP3, VP5)	Apr - Sep	36 hours/VP
2019/2020 Non-Breeding Season (VP3, VP5)	Oct - Mar	36 hours/VP

Observed flight activity was recorded as per defined flight bands which were chosen in relation to the dimensions of potential turbine models for the Site. Bands were split into 0-10m, 10-25m, 25m-175m and >175m. All recorded flight activity within the height bands 10-25m and 25-175m is considered to be within the Potential Collision Height (PCH) with regard to the rotor swept area, based on a worst-case scenario rotor swept area.

Each flight observation was assigned a unique identifier when mapped in the field and subsequently digitised using GIS software.

4.2.2.2.2 *Breeding Bird Surveys (Adapted Brown & Shepherd Survey)*

Breeding walkover surveys were undertaken to determine the presence of bird species of high conservation concern and identify areas of possible, probable or confirmed breeding territories within the study area. The survey methodology followed the adapted Brown and Shepherd method as outlined in Gilbert et al. (1998) and SNH (2017) ('adapted Brown and Shepherd surveys').

Transect routes were devised to ensure coverage of different habitat complexes within the study area. Transects were selected in order to survey every area of suitable breeding/foraging habitat to within 100m, where access allowed. Target species were waders, raptors, waterbirds, gulls and other birds of conservation concern. Along with target species, all additional species observed were recorded to inform the evaluation of supporting habitat.

Walkover surveys were carried out between daylight hours during the core breeding season months between April and June/July (in 2016, 2017, 2018 and 2019). The timing of visits followed the recommendations of Calladine et al. (2009). Following all survey visits, the field maps were analysed to determine the number and location of breeding territories. All non-breeding individuals and species encountered were also recorded.

Survey effort is presented in Appendix 7-2, Table 1-2 in Chapter 7 of this EIAR. This includes full details of dates, times, survey locations, survey duration and weather conditions for each survey. Figure 7-3 in chapter 7 shows the area surveyed.

4.2.2.2.3 *Breeding Raptor Surveys*

Breeding raptor surveys (i.e. birds of prey and owls) were undertaken within the study area and its immediate surrounds. Survey methodology was as outlined in Hardey et al. (2013), as per SNH (2017) recommendations. The aim of these surveys was to identify occupied territories and monitor their breeding success within the study area. Raptor surveys were undertaken onsite and to a 2km radius

from the planning/development boundary, in the form of short VP watches and walked transects. These surveys were undertaken on a monthly basis during the core breeding season period (April to July, in 2016, 2017, 2018 & 2019). All areas of suitable habitat within 2km of the Site boundary were surveyed for the presence of raptor species.

Survey effort details are provided in Appendix 7-2, Table 1-3 in Chapter 7 of the EIAR. Figure 7-4 in Chapter 7 shows the areas surveyed.

4.2.2.2.4 *Winter Transect Surveys*

Winter transect surveys were undertaken to record the presence of bird species of high conservation concern within areas of potential suitable habitat in the study area and within 500m of same.

Transect routes, devised to ensure coverage of different habitat complexes, were visited within the study area during winter months. Methodology was broadly based on adapted Brown and Shepherd methods. Target species included raptors, waterbirds, gulls and ground birds of conservation interest. Along with target species, all additional species observed were recorded to inform the evaluation of supporting habitat.

Survey effort, including details of survey duration and weather condition, is presented in Appendix 7-2, Table 1-4 in Chapter 7 of the EIAR. Figure 7-5 in Chapter 7 shows the surveyed area.

4.2.2.2.5 Waterfowl Surveys

Significant wetland sites and waterbodies within five kilometres of the study area were surveyed for waterbird populations during the 2018/19 and 2019/20 migratory/winter seasons. The area surveyed exceeded the requirements of SNH (SNH, 2017), i.e., 500m for foraging wildfowl and one kilometre for roosting wildfowl. In addition, the Lough Iron waterbird population situated approximately 12.8km to the south-west of the proposed development Site was monitored one day per month during the same period, with a particular focus on Greenland white-fronted goose. The count methodology was in line with survey guidelines issued by SNH (2017) and BirdWatch Ireland (2015). Counts were undertaken during daylight hours from suitable vantage points at the wetland sites.

Survey effort, including details of survey duration and weather condition, is presented in Appendix 7-2, Table 1-5 in Chapter 7 of the EIAR. Figure 7-5 in Chapter 7 shows the surveyed area.

4.2.2.2.6 Breeding Woodcock Surveys

Breeding woodcock surveys were undertaken in accordance with Gilbert et al. (1998). Survey visits were undertaken in June 2016 and June 2017. The survey area extended 500m beyond the Site boundary and was focused in areas of suitable habitat. Surveys commenced one hour before sunset and continued for one hour after sunset or until it was too dark to see. Transects were slowly walked through areas of suitable woodland habitat onsite and to a 500m radius of the development area. All observations of woodcock (as well as the areas covered) are recorded on to a map. The aim of the survey was to record the presence of roding (displaying) male woodcock and thereby establish the distribution and abundance of the species in the study area. This survey method also allowed the observer to survey for owls, i.e. barn owls and long-eared owls.

Survey effort is presented in Appendix 7-2, Table 1-6 in Chapter 7 of the EIAR. This includes full details of dates, times, survey locations, survey duration and weather conditions for each survey. Figure 7-6 in Chapter 7 shows the transect routes surveyed.

4.2.2.2.7 Grid Connection Route

Ornithological surveys were conducted as part of the multidisciplinary surveys along the proposed grid connection route carried out by MKO in 2017, 2019 and 2020. These surveys were undertaken in addition to the dedicated bird surveys carried out between 2015 and 2017 as part of the permitted Coole Wind Farm. The grid connection works will be confined to the existing road corridor, conifer plantation and Mullingar substation.

4.3 Desk Study Results

4.3.1 Lough Owel SAC

The SAC is located 12.5km south of the proposed wind farm site and the proposed grid connection route is located within the N4 road corridor along the boundary of the SAC. A watercourse flows under the N4 where the cable is to be laid and provides hydrological connectivity with this SAC. The proposed works have the potential to cause deterioration in surface water quality through the run-off of silt, hydrocarbons, cementitious material and other pollutants during the construction phase of the development potentially affecting the following habitats and species:

- Hard oligo-mesotrophic waters with benthic vegetation of *Chara spp.* [3140]
- Alkaline fens [7230]
- *Austropotamobius pallipes* (White-clawed Crayfish) [1092]

- Transition mires and quaking bogs [7140]

The site specific conservation objective document is available at the following link https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO000688.pdf.

The relevant QIs and the associated conservation objectives are presented in Table 4-3.

Table 4-3 Qualifying Interest and Conservation Objectives

Qualifying Interest	Conservation Objective
Hard oligo-mesotrophic waters with benthic vegetation of *Chara spp.* [3140]	To maintain the favourable conservation condition of Hard oligo-mesotrophic waters with benthic vegetation of Chara spp. in Lough Owel SAC
Alkaline fens [7230]	To maintain the favourable conservation condition of Alkaline fens. in Lough Owel SAC
Transition mires and quaking bogs [7140]	To maintain the favourable conservation condition of Transition mires and quaking bogs in Lough Owel SAC
Austropotamobius pallipes (White-clawed Crayfish) [1092]	To maintain the favourable conservation condition of White-clawed Crayfish. in Lough Owel SAC

4.3.1.1 Review of site-specific pressures and threats

As per the Natura 2000 Data Form, the site-specific threats, pressures and activities with potential to impact on the SAC were reviewed and considered in relation to the Proposed Development. These are provided in Table 4-4.

Table 4-4 Site-specific threats, pressures and activities

Negative Impacts			
Rank	Threats and Pressures		Inside/Outside
Low	F03.01	Hunting	Inside
Medium	D04	Airports, flightpaths	Inside
Medium	D03.01.02	Piers / tourist harbours or recreational piers	Inside
Low	J02.06.02	Surface water abstractions for public water supply	Inside
Medium	D03.01.02	Piers / tourist harbours or recreational piers	Inside
Low	J02.01	Landfill, land reclamation and drying out, general	Inside
Medium	G02.10	Other sport / leisure complexes	Inside
Medium	G01	Outdoor sports and leisure activities, recreational activities	Inside
Medium	H01.05	Diffuse pollution to surface waters due to agricultural and forestry activities	Outside

A pathway for impact with regard to 'Diffuse pollution to surface waters due to agriculture and forestry activities' was identified as there will be some tree felling required as part of the Proposed Development.

4.3.1.2 Qualifying Interests

4.3.1.2.1 *Hard oligo-mesotrophic waters with benthic vegetation of Chara spp. [3140]*

According to the detailed conservation objectives for this site, Lough Owel is one of the most important and best studied hard water lakes (3140) in Ireland. (Groves and Groves, 1893, 1895; John et al., 1982; Heuff, 1984; Pentecost, 2009; Roden and Murphy, 2013). It was in favourable conservation condition in 2011 (Roden and Murphy, 2013). Information relating to all attributes of the lake is provided in the lake habitats supporting document for the purposes of site-specific conservation objectives and Article 17 reporting (O Connor, 2015). Owel is groundwater fed, has no surface water inlet and no functioning outflow. Fluctuations in lake water level are amplified at Owel by abstractions to provide 66% of Westmeath's drinking water and feed the Royal Canal (Quinlan, 2010). There is potential for deterioration in surface water quality of this aquatic habitat to occur as a result of the proposed works.

4.3.1.2.2 *Alkaline fens [7230]*

Alkaline fen has not been mapped in detail for Lough Owel SAC and thus the total area of the qualifying habitat in the SAC is unknown. However, it is known that the areas of alkaline fens (7240) in the SAC are small and occur in close association with transition mire and quaking bogs (7140) in two main areas at the north-west (Bunbrosna) and the south-west (Tullaghan) ends of Lough Owel. Though small in area, the habitat in the SAC is considered a representative example of fen associated with an alkaline lake and possibly springs (NPWS internal files). Fen habitats require high groundwater levels (i.e. water levels at or above the ground surface) for a large proportion of the calendar year (i.e. duration of mean groundwater level). There is potential for deterioration in surface water quality of this aquatic habitat to occur as a result of the proposed works.

4.3.1.2.3 *Transition mires and quaking bogs [7140]*

This habitat dominates two main areas of wetland vegetation in the SAC, at the north-west (Bunbrosna) and the south-west (Tullaghan) ends of Lough Owel. These areas comprise a mosaic of different vegetation types of varying degrees of wetness with the transition mire and quaking bog vegetation grading into alkaline fen (7230), wet grassland and wet woodland (NPWS internal files). Maintenance of a permanently high water level, remaining close to the peat surface all year, with water level fluctuations within natural ranges, is required for this wetland habitat. There is potential for deterioration in surface water quality of this aquatic habitat to occur as a result of the proposed works.

4.3.1.2.4 *Austropotamobius pallipes (White-clawed Crayfish) [1092]*

There are few geo-referenced records of white-clawed crayfish (*Austropotamobius pallipes*) from Lough Owel, but the species is mentioned in reports as being widespread in the lake. It is likely that the species is present in all the 1km squares that contain shoreline habitat. See also Reynolds (1988) and O'Connor et al. (2009). There have been outbreaks of crayfish plague (*Aphanomyces astaci*) in Ireland since 2015 and it is thought that human activity, especially the transport of disease vectors on contaminated equipment, has introduced and spread the disease, strict biosecurity is required. There should be no decline in water quality as defined by the targets set for lake habitat 3140 in Lough Owel SAC (see the conservation objective for 3140 in this volume). White-clawed crayfish (*Austropotamobius pallipes*) is tolerant of a wide range of water conditions except for the poorest quality and most acid waters. The water quality targets for lake habitat 3140 are more stringent than white-clawed crayfish

require so no specific target is set for the species. There is potential for deterioration in surface water quality of the aquatic habitat associated with this species as a result of the proposed works.

4.3.2 Lough Ennell SAC

The SAC is located 24.2km south of the proposed wind farm site and 4.2km south of the proposed grid connection route. There is hydrological connectivity between the proposed grid connection route and the SAC approximately 8.8km (hydrological distance) downstream. Taking a precautionary approach, the proposed works have the potential to cause deterioration in surface water quality through the run-off of silt, hydrocarbons, cementitious material and other pollutants during the construction phase of the development potentially affecting the following habitat:

- Alkaline fens [7230]

The site specific conservation objective document is available at the following link https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO000685.pdf.
The relevant QIs and the associated conservation objectives are presented in Table 4.5. The targets and attributes for these habitats, as described in the Site-specific Conservation Objectives document, were reviewed and considered in this assessment.

Table 4-5 Qualifying Interest and Conservation Objectives

Qualifying Interest	Conservation Objective
Alkaline fens [7230]	To maintain the favourable conservation condition of Alkaline fens in Lough Ennell SAC

4.3.2.1 Review of site-specific pressures and threats

As per the Natura 2000 Data Form, the site-specific threats, pressures and activities with potential to effect on the SAC were reviewed and considered in relation to the Proposed Development. These are provided in Table 4-6.

Table 4-6 Site-specific threats, pressures and activities

Negative Impacts			
Rank	Threats and Pressures		Inside/Outside
Medium	H06.01.01 -	Point source or irregular noise pollution	Outside
Low	B02.02 -	Forestry clearance	Outside
Low	F03.01 -	Hunting	Inside
Low	H01.08 -	Diffuse pollution to surface waters due to household sewage and waste waters	Inside

Negative Impacts			
Rank	Threats and Pressures		Inside/Outside
Low	H01.05 -	Diffuse pollution to surface waters due to agricultural and forestry activities	Inside
Low	A04.03 -	Abandonment of pastoral systems, lack of grazing	Both
Low	A04.01.01 -	Intensive cattle grazing	Both
Low	J02.05.02 -	Modifying structures of inland water courses	Inside
Low	J02.01 -	Landfill, land reclamation and drying out, general	Inside
Low	F02.03.02 -	Pole fishing	Inside
Low	K03.01 -	Competition (fauna)	Inside
Low	H06.02 -	Light pollution	Inside
Low	D01.01 -	Paths, tracks, cycling tracks	Inside
Low	H06.01.01 -	Point source or irregular noise pollution	Inside
Low	B02.02 -	Forestry clearance	Inside

A pathway for impact with regard to 'Forestry clearance' were identified as there will be some tree felling required as part of the Proposed Development.

4.3.2.2 Qualifying Interests

4.3.2.2.1 *Alkaline fens [7230]*

According to the detailed conservation objectives for this site, alkaline fen has not been mapped in detail for Lough Ennell SAC and thus the total area of the qualifying habitat in the SAC is unknown. The habitat occurs in scattered areas around the shores of Lough Ennell and grades into reed swamp, freshwater marsh and wet woodland in places. It is best developed particularly at Robinstown, Derries, on the eastern side of the lake, and at the inlets and outlets of the River Brosna (NPWS internal files). Fen habitats require high groundwater levels (i.e. water levels at or above the ground surface) for a large proportion of the calendar year (i.e. duration of mean groundwater level). Regional abstraction of groundwater may affect fen groundwater levels. There is potential for deterioration in surface water quality of this aquatic habitat to occur as a result of the proposed works.

4.3.3 Lough Owel SPA

The SPA is located 12.5km south of the proposed wind farm site and the proposed grid connection route is located within the N4 road corridor along the boundary of the SPA. A watercourse flows under the N4 where the cable is to be laid and provides hydrological connectivity with this SPA. Taking a precautionary approach, a potential pathway for indirect effects in the form of deterioration of water quality resulting from pollution, associated with the construction phase of the development was identified. Consequently, there is potential for deterioration of the wetland habitat of all SCI species. In addition, taking a precautionary approach, given that the proposed grid connection route is located adjacent to the SPA boundary, a potential pathway for significant effect was identified in the form of bird disturbance and deterioration of habitat.

The following SCI species have the potential to be significantly affected as a result of potential deterioration of water quality as well as disturbance and displacement associated with construction activity:

- *Shoveler Anas clypeata [A056]*
- *Coot Fulica atra [A125]*
- *Wetland and Waterbirds [A999]*

The generic Conservation Objectives are available at the following link https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO004047.pdf. The relevant SCIs and their associated conservation objectives are presented in Table 4-7

Table 4-7 SCIs and Conservation Objectives

Special Conservation Interest (SCI)	Conservation Objective
Shoveler	Detailed conservation objectives are not available for this site. These SCI species have the generic conservation objective: '*To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA'.*
Coot	
Wetland and Waterbirds	*'To maintain or restore the favourable conservation condition of the wetland habitat at Lough Owel SPA as a resource for the regularly-occurring migratory waterbirds that utilise it.'*

4.3.3.1 Review of site-specific pressures and threats

As per the Natura 2000 Data Form, the site-specific threats, pressures and activities with potential to impact on the SPA were reviewed and considered in relation to the Proposed Development. These are provided in Table 4-8.

Table 4-8 Site-specific threats, pressures and activities

Negative Impacts			
Rank	Threats and Pressures		Inside/Outside
Low	F03.01	Hunting	Inside

Negative Impacts			
Rank	Threats and Pressures		Inside/Outside
Medium	F02.03	Leisure fishing	Inside
Medium	B	Sylviculture, forestry	Outside
Medium	A08	Fertilisation	Outside
Low	J02	Human induced changes in hydraulic conditions	Inside

A pathway for impact with regard to 'Sylviculture, forestry' was identified as there will be some tree felling required as part of the Proposed Development.

4.3.3.2 Special Conservation Interests

The following relevant information on the special conservation interests of Lough Owel SPA has been extracted from the site synopsis (NPWS, 2014).

> 'Lough Owel is one of the most important Midland lakes for wintering waterfowl, with nationally important populations of Shoveler (142) and Coot (1,825) -figures given are mean peaks for the five seasons 1995/96-1999/00. The populations for both of these species represent a significant proportion (c. 4.7% and 6.5%) of the respective All-Ireland totals. The lake is utilised by Pochard (291), Tufted Duck (227) and Goldeneye (75). The lake has been used as a roost by the internationally important Midland lakes Greenland White-fronted Goose population (200 recorded at the site in 2004/05). The lake also supports populations of Little Grebe (16), Great Crested Grebe (18) and Cormorant (32). Lough Owel is one of the most important fishing lakes in the Midlands and is especially good for Trout. The lake also holds an important population of White-clawed Crayfish (*Austropotamobius pallipes*), a species that is listed on Annex II of the E.U. Habitats Directive.
>
> Lough Owel supports nationally important populations of two species, Shoveler and Coot. It is also notable as it is used as a roost site on occasion by the internationally important Midlands Greenland White-fronted Goose flock. Greenland White-fronted Goose is listed on Annex I of the E.U. Birds Directive. Lough Owel is a Ramsar Convention site.'

4.3.4 Lough Ennell SPA

The SPA is located 24.3km south of the proposed wind farm site and 4.5km south of the proposed grid connection route. Due to this distance, there is no potential for significant indirect effects as a result of disturbance. There is hydrological connectivity between the proposed grid connection route and the SPA approximately 9.2km (hydrological distance) downstream. Taking a precautionary approach, a potential pathway for indirect effects in the form of deterioration of water quality resulting from pollution, associated with the construction phase of the Proposed Development was identified. Consequently, there is potential for deterioration of the wetland habitat of the following SCI species.

- Pochard *Aythya ferina* [A059]
- Tufted duck *Aythya fuligula* [A061]
- Coot *Fulica atra* [A125]
- Wetland and Waterbirds [A999]

The generic Conservation Objectives are available at the following link https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO004044.pdf
The relevant SCIs and their associated conservation objectives are presented in Table 4-9.

Table 4-9 SCIs and Conservation Objectives

Special Conservation Interest (SCI)	Conservation Objective
Wetland and Waterbirds	*'To maintain or restore the favourable conservation condition of the wetland habitat at Lough Ennell SPA as a resource for the regularly-occurring migratory waterbirds that utilise it.'*
Pochard Aythya ferina [A059] Tufted duck Aythya fuligula [A061] Coot Fulica atra [A125]	"*To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests of this SPA.*"

4.3.4.1 Review of site-specific pressures and threats

As per the Natura 2000 Data Form, the site-specific threats, pressures and activities with potential to impact on the SPA were reviewed and considered in relation to the Proposed Development. These are provided in Table 4-10.

Table 4-10 Site-specific threats, pressures and activities

Negative Impacts			
Rank	Threats and Pressures		Inside/Outside
High	E01	Urbanised areas, human habitation	Outside
High	A08	Fertilisation	Outside
Low	G05.01	Trampling, overuse	Inside
Medium	G01.02	walking, horseriding and non-motorised vehicles	Outside
Low	F03.01	Hunting	Inside
Medium	B	Sylviculture, forestry	Outside
Medium	G01.01	nautical sports	Inside
Medium	F02.03	Leisure fishing	Inside

A pathway for impact with regard to 'Sylviculture, forestry' was identified as there will be some tree felling required as part of the Proposed Development.

4.3.4.2 Special Conservation Interests

Lough Ennell SPA has been assessed for potential impact in relation to water pollution that could result in subsequent habitat deterioration of all SCI species. The following relevant information on the special conservation interests of Lough Ennell SPA has been extracted from the site synopsis (NPWS, 2014).

'The site is a Special Protection Area (SPA) under the E.U. Birds Directive, of special conservation interest for the following species: Pochard, Tufted Duck and Coot. The E.U. Birds Directive pays particular attention to wetlands and, as these form part of this SPA, the site and its associated waterbirds are of special conservation interest for Wetland & Waterbirds.

Lough Ennell is one of the most important Midland lakes for wintering waterfowl, with nationally important populations of Pochard (738), Tufted Duck (1,303) and Coot (433) - all figures are mean peaks for the 5 winters 1995/96-1999/2000. The population of Tufted Duck represents over 3% of the all-Ireland population. The site is also utilised by an internationally important population of non-migratory Mute Swan (340). Other species which occur include Golden Plover (1,000 in 1998/99), Lapwing (673), Mallard (93), Little Grebe (30), Great Crested Grebe (24) and Goldeneye (22).

Lough Ennell is of ornithological significance for wintering waterfowl, with three migratory species having populations of national importance. The occurrence of Golden Plover in the vicinity of the lake is of note as this species is listed on Annex I of the E.U. Birds Directive. Lough Ennell is a Ramsar Convention Site.'

4.3.5 Lough Derravaragh SPA

The SPA is located 4.8km south of the proposed wind farm site and 70m east of the proposed grid connection route. The Proposed Development is located within the potential core foraging range of Whooper Swan which is an SCI species associated with the SPA (SNH Guidelines (2016). The proposed grid connection route is located approximately 70m west of the SPA. Therefore, potential for disturbance to the remaining bird species associated with the SPA have also been considered. Given that the SPA is located hydrologically downstream of the Proposed Development site there is potential for indirect effects on surface water quality through the run off of silt, hydrocarbons, cementitious material and other pollutants during the construction phase of the Proposed Development. The following SCIs were identified as having potential to be impacted by the Proposed Development and will be assessed further:

- Whooper swan *Cygnus cygnus* [A038]
- Pochard *Aythya ferina* [A059]
- Tufted duck *Aythya fuligula* [A061]
- Coot *Fulica atra* [A125]
- Wetland and Waterbirds [A999]

The generic Conservation Objectives are available at the following link https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO004043.pdf

The relevant SCIs and their associated conservation objectives are presented in Table 4-11.

Table 4-11 SCIs and Conservation Objectives

Special Conservation Interest (SCI)	Conservation Objective
Whooper Swan	Detailed conservation objectives are not available for this site. These SCI species have the generic conservation objective: '*To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA*'.
Pochard	
Tufted Duck	
Coot	

Wetland and Waterbirds	Detailed conservation objectives are not available for this site. These SCI species have the generic conservation objective: '*To maintain or restore the favourable conservation condition of the wetland habitat at Lough Derravaragh SPA as a resource for the regularly-occurring migratory waterbirds that utilise it.*

4.3.5.1 Review of site-specific pressures and threats

As per the Natura 2000 Data Form, the site-specific threats, pressures and activities with potential to impact on the SPA were reviewed and considered in relation to the Proposed Development. These are provided in Table 4-12.

Table 4-12 Site-specific threats, pressures and activities

Negative Impacts			
Rank	Threats and Pressures		Inside/Outside
Medium	F03.01	Hunting	Inside
High	A05.01	Animal breeding,	Outside
Medium	B	Sylviculture, forestry	Outside
Medium	F02.03	Leisure fishing	Inside
High	A08	Fertilisation	Outside

A pathway for impact with regard to 'Sylviculture, forestry' was identified as there will be some tree felling required as part of the Proposed Development.

4.3.5.2 SCI Species and Habitats

Lough Derravaragh SPA has been assessed for disturbance to all SCI species as well as Wetland and Waterbirds. The following relevant extracts have been taken from the site synopsis for the SPA (NPWS, 2014);

> 'Lough Derravaragh is one of the most important midland lakes for wintering waterfowl. It supports nationally important populations of Whooper Swan (102), Pochard (3,129), Tufted Duck (1,073) and Coot (1,358) - all counts are mean peaks for the five winters 1995/96-1999/2000. The Pochard population is of particular note as it represents over 6% of the all-Ireland population total, and at times has exceeded the threshold for international importance (i.e. 3,500). Other species which occur include Mute Swan (159), Little Grebe (42) Great Crested Grebe (34), Cormorant (34), Wigeon (207), Teal (52), Mallard (195), Pintail (6), Shoveler (12), Goldeneye (46), Golden Plover (158) and Lapwing (1,079). The lake is occasionally used as a roost site by small numbers of Greenland White-fronted Goose. Lough Derravaragh is of major ornithological importance as it regularly supports nationally important populations of four species, and at times is used by the internationally important population of Greenland White-fronted Goose which is based in the region. Also of note is that three of the species which occur

at the site, Greenland White-fronted Goose, Whooper Swan and Golden Plover, are listed on Annex I of the E.U. Birds Directive. Lough Derravaragh is a Ramsar Convention site '

4.3.6 Lough Iron SPA

The SPA is located 11.4km south west of the proposed wind farm site, 3km from the proposed junction works in Joanstown and 4.3km west of the proposed grid connection route. The windfarm site is located outside the potential core foraging range of SCI species associated with the SPA (SNH Guidelines (2016). It is also located outside the zone of sensitivity of any species that is listed as particularly sensitive to wind energy development in Mc Guinness et.al (2015).

There will be no direct effects on the supporting wetland habitat of waterbirds within the SPA. However, taking a precautionary approach, a potential pathway for indirect effects in the form of deterioration of water quality resulting from pollution, associated with the construction phase of the Proposed Development was identified. Consequently, there is potential for deterioration of the wetland habitat of all SCI species as listed below:

- Whooper Swan *Cygnus cygnus* [A038]
- Wigeon *Anas penelope* [A050]
- Teal *Anas creca* [A052]
- Shoveler *Anas clypeata* [A056]
- Coot *Fulica atra* [A125]
- Golden Plover *Pluvialis apricaria* [A140]
- Greenland White-fronted Goose *Anser albifrons flavirostris* [A395]

The generic Conservation Objectives are available at the following link https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO004046.pdf

The relevant SCIs and their associated conservation objectives are presented in Table 4-13.

Table 4-13 SCIs and Conservation Objectives

Special Conservation Interest (SCI)	Conservation Objective
Whooper Swan	Detailed conservation objectives are not available for this site. These SCI species have the generic conservation objective: '*To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA'.*
Wigeon	
Teal	
Shoveler	
Golden Plover	
Pochard	
Greenland White Fronted goose	
Coot	

Wetland and Waterbirds	Detailed conservation objectives are not available for this site. These SCI species have the generic conservation objective: '*To maintain or restore the favourable conservation condition of the wetland habitat at Lough Derravaragh SPA as a resource for the regularly-occurring migratory waterbirds that utilise it.*

4.3.6.1 Review of site-specific pressures and threats

As per the Natura 2000 Data Form, the site-specific threats, pressures and activities with potential to impact on the SPA were reviewed and considered in relation to the Proposed Development. These are provided in Table 4-14.

Table 4-14 Site-specific threats, pressures and activities

Negative Impacts			
Rank	Threats and Pressures		Inside/Outside
High	B	Sylviculture, forestry	Inside
Medium	A04	Grazing	Inside
Medium	B	Sylviculture, forestry	Outside
High	A08	Fertilisation	Outside
Medium	A08	Fertilisation	Inside

A pathway for impact with regard to 'Sylviculture, forestry' was identified as there will be some tree felling required as part of the Proposed Development.

4.3.6.2 SCI Species and Habitats

Lough Iron SPA has been assessed for potential impact in relation to water pollution that could result in subsequent habitat deterioration of all SCI species. The following relevant extracts have been taken from site synopsis for the SPA (NPWS, 2014);

> 'Lough Iron is of international importance as a site for wintering waterfowl. It is a traditional haunt for the internationally important Midland lakes Greenland White-fronted Goose flock (426 - five year mean peak between 1994/95 and 1998/99). The site also supports an internationally important population of Whooper Swan (214) and nationally important numbers of Wigeon (1,229), Teal (759), Shoveler (164), Coot (293) and Golden Plover (2,200) - all figures are five year mean peaks for the period 1995/96 to1999/2000).
>
> Lough Iron SPA is of high ornithological importance, primarily for supporting internationally important populations of Whooper Swan and Greenland White-fronted Goose. The site also holds a notable diversity of other waterfowl, including dabbling

duck, diving duck and waders. It is of note that three of the species which regularly occur, Greenland White-fronted Goose, Whooper Swan and Golden Plover, are listed on Annex I of the E.U. Birds Directive. Lough Iron is a Ramsar Convention site and a Wildfowl Sanctuary.'

4.3.7 Garriskil Bog SPA

The SPA is located approx. 1.4km from the proposed grid connection route 7.2km from the wind farm site. In accordance with SNH Guidelines (2016), the wind farm site is located within the potential core foraging range of SCI species associated with the SPA. However, as per the NPWS site synopsis, the last record of Greenland White-fronted Goose at the site was from 1986/87 (43 individuals). The following is an extract from the NPWS site synopsis for the SPA,

At the time this site was designated as a Special Protection Area (SPA) it was known to be utilised by part of an internationally important population of Greenland White-fronted Goose centered around the midland lakes. The geese appear to have abandoned these peatland sites in favour of grassland sites elsewhere.

Given that lack of evidence to suggest that the SCI species utilise the SPA, and the lack of potential for the proposed development to result in significant effects thereon (following detailed bird surveys at the site and as presented in the bird survey report prepared in response to the request for further information), potential impacts on the populations of the SCI species for which the SPA was designated are considered highly unlikely. However, following an extremely precautionary principle and due to the fact that the wind farm site is within the core foraging range of the SCI species the following SCI associated with Garriskil Bog SPA is considered further:

- Greenland white-fronted goose *Anser albifrons flavirostris* [A395]

The generic conservation objective document for this SPA is available at the following link https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO004102.pdf

The relevant SCI and associated conservation objectives are presented in Table 4-15.

Table 4-15 SCI and Conservation Objectives

Special Conservation Interest (SCI)	Conservation Objective
Greenland white-fronted goose	Detailed conservation objectives are not available for this site. This SCI species has the generic conservation objective: '*To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA*'.

4.3.7.1 Review of site-specific pressures and threats

As per the Natura 2000 Data Form, the site-specific threats, pressures and activities with potential to effect on the SPA were reviewed and considered in relation to the Proposed Development. These are provided in Table 4-16.

Table 4-16 Site-specific threats, pressures and activities

Negative Impacts			
Rank	Threats and Pressures		Inside/Outside
L	A04	Grazing	Outside
L	J02.05.02	Modifying structures of inland water courses	Inside
L	D01.04	Railway lines, TGV	Outside
L	D01.04	Railway lines, TGV	Inside
L	B01	Forest planting on open ground	Outside
L	J01	Fire and fire suppression	Inside
L	A10	Restructuring agricultural land holding	Outside
L	A04	Grazing	Inside
M	J02.05.02	Modifying structures of inland water courses	Outside

A pathway for impact with regard to 'Modifying structures of inland water courses' was identified as there will be some minor upgrades to water crossings as a result of the Proposed Development.

4.3.7.2 SCI Species and Habitats

Garriskil Bog SPA has been assessed for potential impact in relation to disturbance to Greenland white-fronted goose. The following relevant extracts have been taken from the site synopsis for the SPA (NPWS, 2012);

> 'At the time this site was designated as a Special Protection Area (SPA) it was known to be utilised by part of an internationally important population of Greenland White-fronted Goose centred around the midland lakes. The geese appear to have abandoned these peatland sites in favour of grassland sites elsewhere. Greenland White-fronted Goose is regarded as a special conservation interest for this SPA.
>
> The site is within the range of the midland lakes Greenland White-fronted Goose flock, which is centred on four major lakes (Derravaragh, Iron, Owel and Ennell). The last record of Greenland White-fronted Goose at this site was in 1986/87 (43 individuals).'

4.3.8 EPA River Catchments and Watercourses

The Proposed Development site is located within three sub-catchments. The main proposed wind farm site is located in the Inny (Shannon) SC_20 with the proposed grid connection route located in the Inny (Shannon)_SC_30 and Brosna_SC_10.

The EPA Envision map viewer was consulted on 3rd February 2021 regarding the water quality status of the Rivers which run within and directly adjacent to the Study Area. The river Glore runs through the Study Area, and the River Monktown borders the mid-eastern boundary of the site. Both rivers join with the river Inny which borders the western edge of the boundary. The Biotic Index of Water Quality (BIWQ) was developed in Ireland by the Environmental Protection Agency (EPA). Q-values are assigned using a combination of habitat characteristics and structure of the macro-invertebrate community within the waterbody. Individual macro-invertebrate families are classified according to their sensitivity to organic pollution and the Q-value is assessed based primarily on their relative abundance within a sample.

There are two sampling stations located adjacent to the study area, one on the river Glore downstream of the western border of the site at the Camagh bridge. This sampling station has been assigned a Moderate Status (Q3-4). A second sampling station in proximity is the bridge at Rockbrook located to the east of the site. This sampling station has been assigned a Good Status (Q4).

River Basin Management Plans (RBMPs) have been published for all River Basin Districts in Ireland in accordance with the requirements of the Water Framework Directive. The Water Framework Directive Status Report 2010 - 2015, published by the Environmental Protection Agency (EPA). The River Glore where it passes through the Proposed Development site has been assessed as 'At risk'. The River Inny along the western boundary of the main windfarm site has been assessed as 'At risk' along the Proposed Development site boundary and 'Not at risk' where it continues past the southern extent of the site. The River Inny is assessed as 'Not at risk' where it crosses the proposed grid connection route at Shrubbywood and 'At risk' where it discharges from Lough Derravaragh.

4.4 Ecological Survey results

4.4.1 Habitat survey

The Coole study area is dominated by Cutover Raised Bog (PB4) (see Plates 4-1 & 4-2 below). Much of Coole bog comprises milled peat and is divided up by drains, spaced approximately 15m apart, which separate long parallel Peat production fields. The lands to the east of the site comprise agricultural land. The edge of the main windfarm site is bordered by Conifer Plantation to the east and south while the lands surrounding T15 are predominantly agricultural in nature. The River Inny borders the west of the site and the River Glore, a tributary of the Inny, runs in an east to west direction through the study area.

Almost all the cutover bog within the study area has been used for peat production and the existing drainage network is maintained. Cutover bog areas are relatively dry with no vegetation cover, other than occasional plants recorded on the sloping banks of drains.

For ease of description, the main wind farm study area can be divided up into two distinct sections: North of the Glore River and South of the Glore River (including the section to the south of the local road which connects the R396 with the R394). In addition, the proposed borrow pit, grid connection and turbine delivery routes are also described in the sections below. A habitat map of the Proposed Development is provided in Figure 4-1 and 4-2.

North of the Glore River

This area is dominated by milled cutover bog. Conifer plantation is the dominant habitat to the north east and south. To the north east, the cutover bog is fringed by Non-Annex I Bog woodland (Plate 4-3). The bog woodland is quite open and the ground cover is dominated by Bramble (*Rubus fruticosus* agg.), Ivy (*Hedera helix*), Purple Moor-grass (*Molinia caerulea*) and Bracken (*Pteridium aquilinum*). Other species present include Broad Buckler Fern (*Dryopteris dilatata*), Heather (*Calluna vulgaris*), Honeysuckle (*Lonicera periclymenum*) with occasional Hawthorn (*Crataegus monogyna*) and Gorse (*Ulex europaeus*). There are some narrow sections of Degraded raised bog (PB1), dominated by Ling Heather, along the margins. These areas are partially drained (Plate 4-4).

To the north, outside the site boundary is an area that has been stripped entirely of peat. This area is at a significantly lower gradient compared to the remaining cutover bog within the site boundary. To the west, the cutover bog is bordered by an intact area of remnant raised bog habitat which surrounds a small dystrophic lake (Plate 4-5). The dominant vegetation recorded from the remnant bog section comprised Ling (*Calluna vulgaris*) and Common Cottongrass (*Eriophorum vaginatum*). Bryophytes were abundant throughout with *Sphagnum cuspidatum*, *Sphagnum papillosum*, *Sphagnum magellanicum* and *Sphagnum capillifolium* recorded. The lichen *Cladonia portentosa* was common. The dystrophic lake was fringed by a floating mat of poor fen vegetation dominated by Bottle Sedge (*Carex rostrata*). Bog bean (*Menyanthes trifoliata*) was also recorded.

Continuing west, an area of Non Annex I bog woodland was recorded along with a fringe of wet grassland and scrub along the banks of the River Inny. Fringes of Reed and large sedge swamp (FS1), dominated by Common reed (*Phragmites australis*) were recorded immediately adjacent to the River Inny (Plate 4-6).

The Glore River is a tributary of the Inny and was classified as a Lowland depositing river (FW2). The Glore River marks the southern boundary of the northern section of the main proposed wind farm site. The watercourse was surrounded by a narrow strip of Mixed Broadleaved/conifer Woodland (WD2). Species recorded included Poplar (*Populus* sp.), Scots Pine (*Pinus sylvestris*), Spruce (*Picea sitchensis)* and Grey Willow (*Salix cinerea*).

A number of small silt ponds, associated with the existing onsite drainage network, occur and were classified as Other artificial lakes and ponds (FL8). The on-site drainage features (FW4) drain into the silt ponds (Plate 4-7). Vegetation recorded from the ponds included Pondweed (*Potamogeton natans*), Reedmace (*Typha latifolia*) and Water Horsetail *(Equisetum sp.).*

The banks of the Glore River were heavily vegetated (Plate 4-8). Species recorded included Reed Canary Grass (*Phalaris arundinacea*), Floating sweet grass (*Glyceria fluitans*), Hogweed (Heracleum sphondylium), Angelica (*Angelica sylvestris*), Great Willowherb (*Epilobium hirsutum*), Nettle (*Urtica dioica*), Creeping Thistle (*Cirsium arvense*), Brambles (*Rubus fruticosus* agg.), Meadowsweet (*Filipendula ulmaria*), Bindweed (*Calystegia sepium*). *Sparganium emersum* and Pondweed (*Potamogeton* sp.) were the only instream vegetation recorded. Small stands of Bracken (*Pteridium aquilinum*) were also recorded.

The proposed T15 is located to the east of the site within agricultural grassland categorized as Improved Agricultural Grassland (GA1)/Wet Grassland (GS4). The proposed access road to T15 will follow the local road (L5775) from the centre of the main windfarm site in an easterly direction before travelling north across a number of agricultural fields comprising Improved Agricultural Grassland (GA1), Dry Meadows and Grassy Verges (GS2) and a species rich Wet Grassland (GS4) located immediately north of the Glore River. The grassland habitats supported species including Meadowsweet (*Filipendula ulmaria*), Conglomerate Rush (*Juncus conglomeratus*), Meadow Buttercup (*Ranunculus acris),* Sheep Sorrell (*Rumex acetosa*), Yorkshire Fog (*Holcus lanatus*), Sweet Vernal grass (*Anthoxanthum odoratum*), Broadleaved Dock (Rumex obtusifolius), Silverweed (*Potentilla anserina*), Cock's-foot (Dactylus glomerata), Dandelion (*Taraxcum officinale agg.*) Nettle (*Urtica dioica*), Broadleaved Plantain (*Plantago lanceolata*) and Clover (*Trifolium spp.*) and did not correspond to any grassland habitat listed under Annex I. The access road will cross the River Glore via a clear span

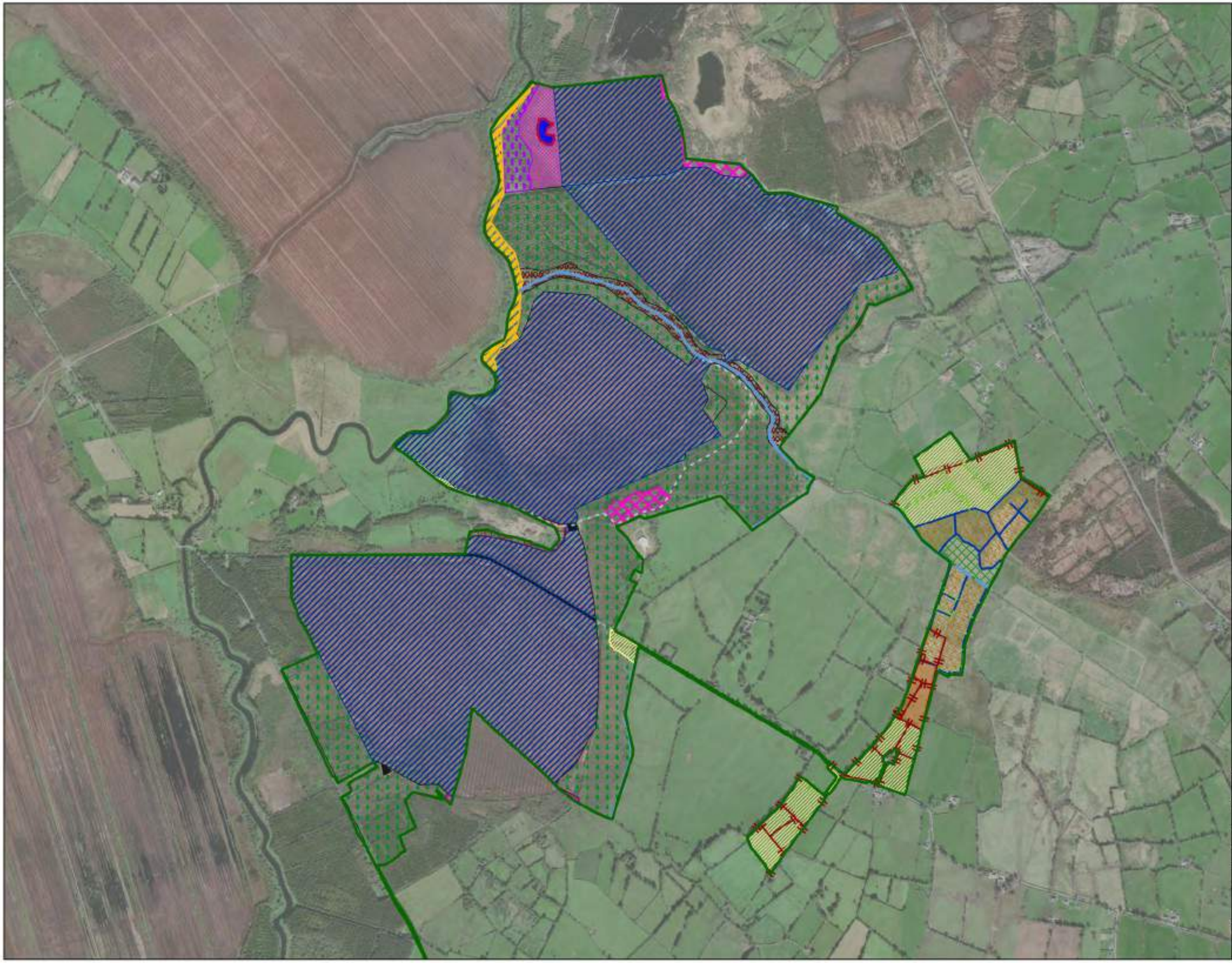
bridge to access the turbine location. The fields along the proposed access road are demarcated by Treeline (WL2) (Plate 4-9) and Hedgerow (WL1) (Plate 4-10) supporting species such as Ash (*Fraxinus excelsior*), Sycamore (*Acer pseudoplatanus),* Willow *(Salix spp.)* and Hawthorn (*Crataegus monogyna*). Species within the field at the proposed Turbine 15 location included Yorkshire Fog (*Holcus lanatus*), Pernnial Rye-grass (*Lolium perenne*), Sweet Vernal Grass (*Anthoxanthum odoratum*), Conglomerate Rush (*Juncus conglomerataus*), Red Fescue (*Festuca rubra*), Tormentil (*Potentilla erecta*), Sheep Sorrell (*Rumex acetosa*) and Cock's-foot (*Dactylus glomerata*) (Plate 4-11).

South of the Glore River

This area is dominated by cutover bog. Conifer plantation, dominated by Lodgepole Pine and (*Pinus contorta*) and Spruce (*Picea stichensis*) is the dominant habitat to the north and east. Exiting forestry access tracks were classified as Spoil and bare ground (ED2).

The River Inny forms the western boundary of the site. The watercourse is fringed by a narrow strip of Wet grassland (GS4). Toward the south western corner of the site is an area which is relatively dry and dominated by a mosaic of degraded/cutover bog and grassland dominated by Yorkshire Fog, Creeping Bent and occasional Soft Rush.

Continuing south, and crossing the existing local road, the study area continues to be dominated by Cutover bog. The proposed new access road to Turbine 14 leaves the local road and travels south traversing Conifer Plantation (WD4) supporting species of Lodgepole Pine and (*Pinus contorta*) and Spruce (*Picea sitchensis*) adjacent to this Cutover Bog (PB4) habitat. Turbine 14 will be located within this conifer plantation approximately 700m south of the local road as shown in Plate 4-12.


Map Legend
EIAR Site Boundary
Buildings and artificial surfaces(BL3)
Dystrophic lakes (FL1)
Improved agricultural grassland (GA1)
Dry meadows and grassy verges (GS2)
Wet grassland (GS4)
Wet grassland/Scrub (GS4/WS1)
Raised bog (PB1)
Cutover bog (PB4)
Poor fen and flush (PF2)
Mixed broadleaved/conifer woodland (WD2)
Conifer plantation (WD4)
Bog woodland (WN7)
Scrub (WS1)
Improved agricultural grass-land/Wet Grassland mosaic (GA1/GS4)
Bog Woodland/Scrub mosaic
Spoil and Bare Ground (ED2)
Depositing/ Lowland Rivers (FW2)
Drainage Ditches (FW4)
Hedgerows (WL1)
Treelines (WL2)
N
Microsoft product screen shots reprinted with permission from Microsoft Corporation.
Habitat Map
Coole Wind Farm, Co. Westmeath
HW
LK
200445
Figure 4-1
1:15000
2021.01.27
MKO
Planning and Environmental Consultants


Map Legend
EIAR Site Boundary
Buildings and artificial surfaces(BL3)
Dystrophic lakes (FL1)
Improved agricultural grassland (GA1)
Dry meadows and grassy verges (GS2)
Wet grassland (GS4)
Wet grassland/Scrub (GS4/WS1)
Raised bog (PB1)
Cutover bog (PB4)
Poor fen and flush (PF2)
Mixed broadleaved/conifer woodland (WD2)
Conifer plantation (WD4)
Bog woodland (WN7)
Scrub (WS1)
Improved agricultural grass-land/Wet Grassland mosaic (GA1/GS4)
Bog Woodland/Scrub mosaic
Spoil and Bare Ground (ED2)
Depositing/ Lowland Rivers (FW2)
Drainage Ditches (FW4)
Hedgerows (WL1)
Treelines (WL2)
N
Microsoft product screen shots reprinted with permission from Microsoft Corporation
Habitat Map - Link Road
Project Title
Coole Wind Farm, Co. Westmeath
Drawn By
HW
Checked By
LK
Project No.
200445
Drawing No.
Figure 4-2
Scale
1:4500
Date
2021.01.27
MKO
Planning and Environmental Consultants

Plate 4-1 Milled peat field (North of Wind Farm Site)

Plate 4-2 Milled peat field and typical drain (South of Glore River)

Plate 4-3 Bog Woodland WN7 Non Annex I (North western Wind Farm Site boundary)

Plate 4-4 Fringe of remnant Raised bog between Cutover Peat and Bog Woodland (North of Wind Farm Site)

Plate 4-5 Dystrophic Lake, fringing poor fen and remnant degraded raised bog.

Plate 4-6 River Inny, fringing reed swamp and adjacent wet grassland and willow scrub.

Plate 4-7 Silt Pond

Plate 4-8 Glore River Corridor

Plate 4-9 Example of Treeline (WL2) along the field boundaries on the proposed access road to Turbine 15

Plate 4-10 Young Hawthorn Hedgerow (WL1) along proposed access road to Turbine 15

Plate 4-11 Proposed location of T15 looking south categorised as a mosaic of Improved Agricultural Grassland (GA1)/Wet Grassland (GS4)

Plate 4-12 Proposed location of T14 within Conifer Plantation (WD4)

4.4.1.1.1 Proposed Borrow Pit

The proposed borrow pit is located approximately 700 metres east of the nearest proposed turbine location (T14). The proposed borrow pit is linked to the main area of the proposed wind farm site via the L5755 local road.

The habitats present at the borrow pit location included Improved agricultural grassland (GA1) surrounded by Hedgerow (WL1) and Treelines (WL2). The grassland is utilised for agricultural purposes. Species recorded form the sward included Perennial Ryegrass (*Lolium perenne*), Cocksfoot (*Dactylis glomerata*), Meadow Foxtail (*Alopecurus pratensis*), Meadow Grasses (*Poa* spp.), Creeping Thistle (*Cirsium arvense*), Chickweed (*Cerastium fontanum*), Soft Rush (*Juncus effuses*) and Nettle (*Urtica dioica*). Species recorded from the hedgerows included Hawthorn, Bramble, Dog Rose (*Rosa canina*). Treelines were dominated by Ash (*Fraxinus excelsior*) and Beech (*Fagus sylvatica*).

4.4.1.1.2 Habitats on the Grid Connection Route

The proposed grid connection route will be located within the carriageway/verge of existing public roads. There is no requirement to use habitats located outside the road carriageway except at the Northern and Southern ends where the connection points leave the public road for termination. All roads within/adjacent to the proposed cable route were classified as Building and Artificial Surfaces (BL3). Much of the cable route was bordered by a verge supporting Dry Meadows and Grassy Verges (GS2). Also present along the road, outside the working area, were Hedgerows (WL1), Treelines (WL2), Earth Banks (BL2), Stone Walls (BL1), Scrub (WS1), Spoil and Bare Ground (ED2), Flower Beds and Borders (BC4) and Buildings and Artificial Surfaces (BL3). No Annex I habitats were recorded within the road carriageway.

Habitats recorded beyond the road boundary included Improved Agricultural Grassland (GA1), Wet Grassland (GS4), Cutover Bog (PB4), Wet Heath (HH3) and Conifer Plantation (WD4). Less frequently recorded habitats included Mixed Woodland (WD2), Broadleaved Woodland (WD1), Amenity Grassland (GA2) and Reed and Large Sedge Swamps (FS1).

Peat Areas

Following consultation and correspondence with Westmeath County Council in relation to the proposed underground grid connection route, a peat stability assessment of sections of public roads underlain by peat of the grid connection route was carried out by Applied Ground Engineering Consultants (AGEC)[1],in April 2017. This geotechnical assessment report was previously submitted as part of the 13 Turbine Coole Wind Farm application, as detailed in Section 2.5.1 in Chapter 2 of the EIAR. The purpose of this assessment was to establish the ground conditions in three priority sections of road (as identified by Westmeath County Council at the time) with respect to construction of the underground cables and the potential effects on the structural integrity of the roads. While additional more detailed investigations have since been carried out into peat depths along the route, resulting in a more refined and robust construction methodology, the report findings in terms of ground conditions are still very useful, and are presented as Appendix 4-4 of Chapter 4 of the EIAR. The sections of road assessed by AGEC measure approximately 8 kilometres in total and are shown in Figure 4-15 of Chapter 4 of the EIAR. Following this, IONIC Consulting Engineers design of the cable and substation works required have incorporated any available historical data and reports described above, in addition to carrying out their own site investigations and are presented in Appendix 4-3 of the EIAR.

To further investigate the grid connection route, a geophysical investigation was conducted by APEX Geophysics Ltd. in October 2019 to determine the presence/thickness of peat along the grid connection route. This has been provided as Appendix 4-5 of the EIAR. As detailed in Section 2.6.3 in Chapter 2 of the EIAR, the intended approach, i.e. confirming that the grid connection could be laid without affecting the integrity of the road, was set out in correspondence issued to the Planning Authority in

[1] *AGEC Ltd were rebranded and became Fehily Timoney (FT) in 2019.*

September 2017 as detailed in Section 2.6.3 of the EIAR. Following that, further details relating to construction methodology and design were discussed at the two pre-planning meetings that took place on the 15th of August 2019, and the 4th of February 2020. The approaches discussed in these meetings were considered satisfactory by the Planning Authority at that time.

In summary, where the existing road is located on peat, specific engineering designs have been carried out in order to accommodate the cable within the road corridor in these areas. Three such areas where this is required were originally identified by geotechnical assessment carried out by AGEC and measure approximately 8km in total as described in Appendix 4-4 of Chapter 4 of the EIAR. In addition, a geophysical investigation was produced by APEX in October 2019 to determine the presence/thickness of peat along the route. This has been provided as Appendix 4-5 of Chapter 4 of the EIAR. and has informed the proposed construction methodologies. There are six options for cable laying in peat areas as detailed in Chapter 4 of the EIAR. IONIC Consulting Engineers design of the cable and substation works required have incorporated any available historical data and reports described above, in addition to carrying out their own site investigations and are presented in Appendix 4-3 of the EIAR.

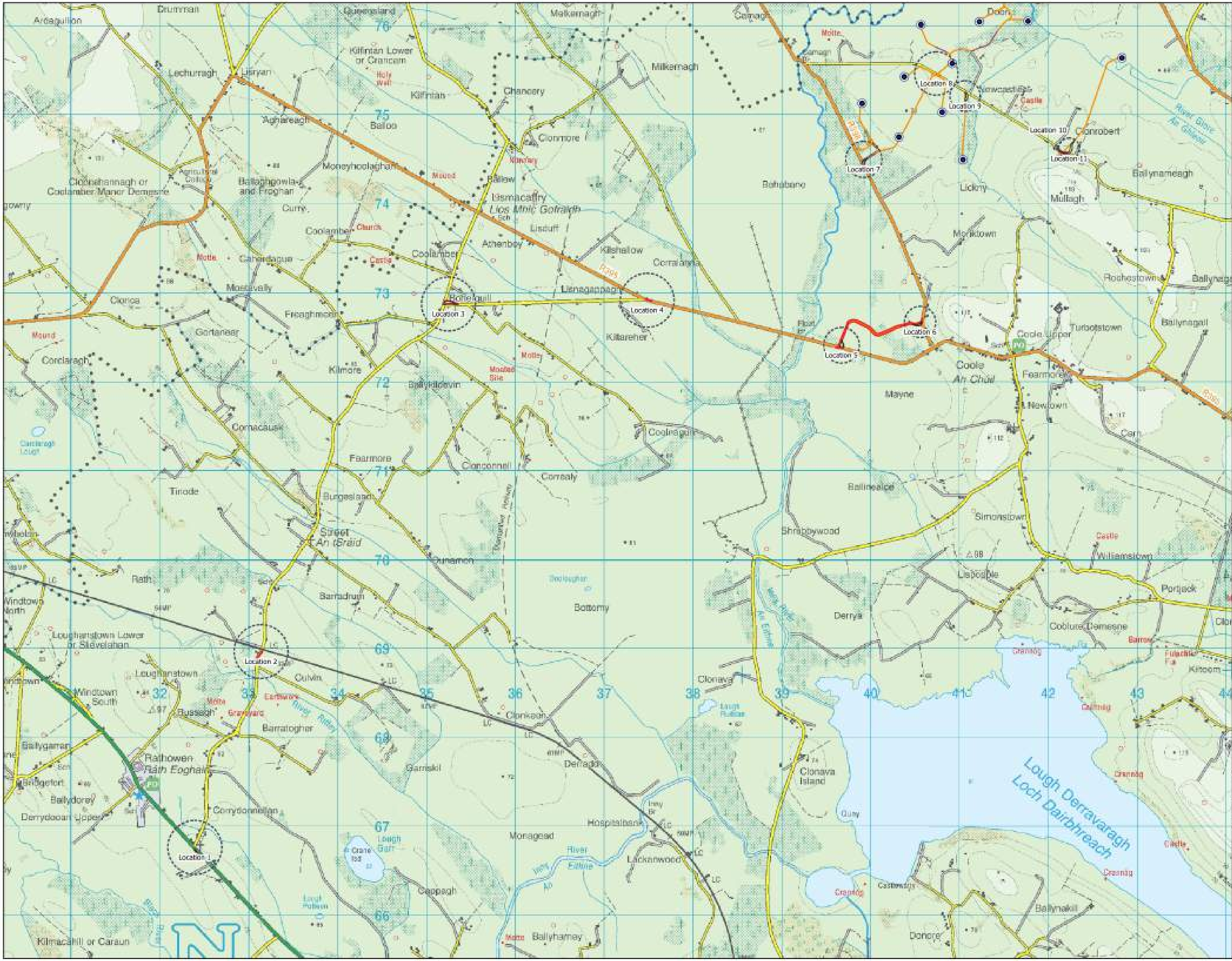
The below drawings are related to both public road and private road construction:
;

- Trench Type A (Through Floating Road Trench in Road with >2.5m to base of peat)
- Trench Type B (Through Floating Road Trench in Verge with >2.5m to base of peat)
- Trench Type C (Through Raised Floating Road Trench in Verge with <2.5m to base of peat)
- Trench Type D (Through Floating Road Trench in Verge with <2.5m to base of peat)
- Trench Type E1 (Through Floating Grid Route Track with >2.5m to base of peat)
- Trench Type E2 (Through Solid Grid Route Track with <2.5m to base of peat)

The exact location of the cable within the public road corridor will be subject to ESB/Eirgrid specifications and in agreement with Westmeath County Council prior to construction.

4.4.1.1.3 *Habitats on the Turbine Delivery Route*

The following locations are proposed for upgrade in order to facilitate the proposed turbine delivery route. These locations are shown in Figure 4-3 and described in the paragraphs below.



Map Legend

- Proposed Turbine Layout
- Internal Roads (new)
- Internal Roads (Upgrades to existing)
- Proposed Junction Works
- Proposed Junction Works Label
- Temporary Hardcore Surfacing Areas

N

Drawing Title	
Turbine Delivery Route - Junctions	
Project Title	
Coole Wind Farm Development	
Drawn By: EC	Checked By: MW
Project No.: 200445	Drawing No.: Figure 4-3
Scale: 1:37500	Date: 04.01.2021

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Location 1 - N4 Junction with L1927 (Joanstown Townland)
Small areas of Amenity grassland (GA1) and Dry Meadows and Grassy Verges (GS2) (combined total approximately 0.03 ha) on road verge will be surfaced over to allow turbine delivery vehicles to make right-hand turn.

Location 2 – Railway Line Level Crossing on the L1927
Small area of Dry Meadows and Grassy Verges (GS2) and approximately 80m of hedgerow will be temporarily removed to facilitate abnormally sized turbine vehicles to negotiate the rail crossing.

Location 3- L1927 and L5828 Local Roads Junction (Boherquill Townland)
Road widening works are proposed to allow transport vehicles to make right-hand turn. This will result in the loss of road side Dry Meadows and Grassy Verges (GS2), Improved agricultural grassland and a heavily trimmed Hawthorn (*Crataegus monogyna*) dominated Hedgerow (WL1). The total area to be surfaced is approximately 0.31 ha.

Location 4 – Gentle right turn from L5828 onto R395
Road widening works are proposed to facilitate abnormally sized vehicles. This will result in the loss of a minor area of road side Dry Meadows and Grassy Verges (GS2) habitat.

Location 5 and 6 - Site access junctions A and B that provide access/egress onto proposed link road (linking R395 and R396)
The habitat to either side of the junction with the proposed link road as accessed from the R395 comprises an area of Dry Meadows and Grassy Verges (GS2) and Cutover Bog (PB4). The proposed area for surfacing measures approximately 0.34 hectares. There will be no impacts to the south of the R395 as there is oversail only at this junction. There will also be minor impacts to the west of the R396 at access junction B. Approximately 20m of treeline and 14m of hedgerow will require removal at Junction B access/egress from the R396.

Location 7 – Site access junction C that provides access to the site from the R396
It is proposed to widen the turn into the proposed wind farm site to the east of the R396 to facilitate the delivery of turbines. This will result in the loss of 0.21 hectares hectares of trees and scrub associated with the edge of conifer plantation to facilitate hardcore surfacing measures.

Location 8 - Site access junction D which crosses the L5755
The swept path analysis undertaken for this location shows that the abnormally sized turbine vehicles will be able to negotiate this crossing with minor impacts on sections of hedge (over-sail) and grass verges.

Location 9 – Site access junction E which provides access to Turbine T14 located south of L5755
It is proposed to widen the turn into the proposed turbine T14 to the south of the L5755 to facilitate the delivery of the turbine. This will result in the loss of 0.21 hectares of Recolonising Bare Ground (ED3) and Scrub (WS1) dominated by Gorse (Ulex europaeus), Bracken (Pteridium aquilinium), Willow (Salix spp.) and Bramble (Rubus fruticosus agg.).

Location 10 – Site access junction F, which is the access junction off the L5755 to / from the proposed borrow pit
The analyses indicates that temporary visibility splays will be required at this junction in order to accommodate the construction vehicles. Approximately 80m of hedgerow will require removal along the proposed sightlines.

Location 11 - Site access junction G which provides access to turbine number 15 situated to the north of the L5755.

It is proposed to widen the turn into the proposed turbine T15 to the north of the L5755 to facilitate the delivery of the turbine. There are a number of mature Ash (Fraxinus excelsior) and Sycamore (Acer pseudoplatanus) trees that will require removal to facilitate the proposed works. These trees did not show any obvious signs of cracks or crevices but had occasional broken limbs and all supported dense ivy. As a result, these were assessed as having *Low-Moderate* potential to support roosting bats. The proposed area for hardcore surfacing measures 0.41 hectares and will result in the loss of Improved Agricultural Grassland (GA1).

4.4.1.1.4 Proposed Link Road West of Coole Village

The link road is described from east proceeding west. The proposed route diverges from the R396 to a minor access road (Building and Artificial Surfaces (BL3)), bordered by Drainage Ditches (FW4), Meadows and Grassy Verges (GS2), Treelines (WL2) and Earth Banks (BL2). Adjacent habitats include agricultural buildings (BL3) and Improved Agricultural Grassland (GA1).

Continuing west the proposed route traverses Conifer Plantation (WD4), comprising Sitka Spruce (*Picea sitchensis*) and Lodgepole Pine (*Pinus contorta*), and an area of milled Cutover Bog (PB4) before connecting with the R395 Regional Road.

4.4.1.2 Botanical Species Present

Species listed in Annex II of the EU Habitats Directive or additional flora listed in the Flora (Protection) Order (2015) or red list of vascular plants (Jackson *et. al* 2016) were not recorded.

4.4.1.3 Invasive Alien Species

During field surveys, a search for Invasive Alien Species (IAS) listed under the Third Schedule of the European Communities Regulations 2011 (S.I. 477 of 2015) was conducted.

No third schedule species were recorded within the wind farm site.

Bohemian Knotweed (*Fallopia bohemica*), Japanese Knotweed (*Fallopia japonica*), Himalayan Knotweed (*Persicaria walichii*) and Rhododendron (*Rhododendron ponticum*) were recorded along the proposed transport and grid connection routes. The observations were of isolated patches on the roadside verge. (See Table 4-14 below). A map showing the locations of Third Schedule species recorded is shown in Figure 4-4.

Table 4-17 Third Schedule Invasive Species

Common Name	Scientific Name	Grid Ref:	Notes
Bohemian Knotweed	*Fallopia bohemica*	240923; 270540	Recorded on the immediate roadside verge, measuring approx. 20m x 15m
Rhododendron	*Rhododendron ponticum*	239010 267335	Recorded on the immediate roadside verge
Japanese Knotweed	*Fallopia japonica*	240469 263629	Recorded on the immediate roadside verge measuring approx. 7m x 3m
Japanese Knotweed	*Fallopia japonica*	242144 255351	Recorded on the immediate roadside verge measuring approx. 16m x 3m
Himalayan Knotweed	*Persicaria wallicchii*	242601 256010	Along waters edge at bridge crossing of Lough Owel Feeder

Map Legend

- Bohemian Knotweed
- Himalayan Knotweed
- Japanese Knotweed
- Rhododendron
- EIAR Site Boundary

N

Drawing Title: Invasive Species

Project Title: Coole Wind Farm, Co. Westmeath

Drawn By	Checked By
LK	PR
Project No.	Drawing No.
200445	Figure 4-4
Scale	Date
1:98852	01.02.2021

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4.4.2 Fauna

4.4.2.1 Aquatic Fauna

A baseline assessment of the aquatic ecology in the vicinity of Coole wind farm, lands between Carnagh, Coolcraff, Derragh, Monktown, Clonsura, Doon, Derrycrave, Newcastle, Mullagh, Carlanstown, Clonrobert, Co. Westmeath was undertaken in 2022. This included an assessment of fisheries, biological water quality, protected aquatic species and habitats and serves as an update to an aquatic ecology assessment that was undertaken in 2016 and informed the EIAR and NIS that was prepared for the proposed development. These additional surveys inform build upon the surveys that were previously undertaken and provide additional and more recent baseline information on the aquatic environment in the vicinity of the Coole Wind Farm Site and inform this revised NIS. A summary of the main findings of the assessment is provided below and the Aquatic Baseline Report is provided in full in Appendix 3.

The current survey was undertaken at the same 8 no. survey sites as per Ecofact (2016) (Table 4.15, Figure 4.A). Furthermore, to reflect the addition of a proposed grid connection route (GCR) to the project design, an additional 6 no. sites were included in the current survey (i.e. watercourse crossings). This resulted in a total of n=14 aquatic survey sites. The nomenclature for the watercourses surveyed is per the Environmental Protection Agency (EPA).

Aquatic survey sites were present on the on the River Inny (EPA code: 26I01), Mayne Stream (26M92), Glore River (26G02), Monktown River (26M78), Froghanstown Stream (25F41), Ballynafid Stream (26B36), River Brosna (north) (26B28), an unnamed stream and a drainage channel (Table 2.1). The n=14 aquatic survey sites were located within the Inny_SC_020 and Inny_SC_030 river sub-catchments. The proposed wind farm and associated infrastructure were not located within a European site.

Aquatic surveys of the watercourses within the vicinity of the proposed wind farm project were conducted on Thursday 18th and Friday 19th August 2022. Survey effort focused on both instream and riparian habitats at each aquatic sampling location (**Table 4.15 & Figure 4.a**). Surveys at each of these sites included a fisheries habitat appraisal, electro-fishing survey (where possible), white-clawed crayfish survey, macrophyte & aquatic bryophyte survey and biological water quality sampling (Q-sampling) or macro-invertebrate sweep sampling. The survey approach ensured that any habitats and species of high conservation value would be detected to best inform mitigation for the wind farm project.

In addition to the ecological characteristics of the site, a broad aquatic and riparian habitat assessment was conducted utilising elements of the methodology given in the Environment Agency's 'River Habitat Survey in Britain and Ireland Field Survey Guidance Manual 2003' (EA, 2003) and the Irish Heritage Council's 'A Guide to Habitats in Ireland' (Fossitt, 2000). This broad characterisation helped define the watercourses' conformity or departure from naturalness. All sites were assessed in terms of:

- Physical watercourse/waterbody characteristics (i.e. width, depth etc.) including associated evidence of historical drainage
- Substrate type, listing substrate fractions in order of dominance (i.e. bedrock, boulder, cobble, gravel, sand, silt etc.)
- Flow type by proportion of riffle, glide and pool in the sampling area
- An appraisal of the macrophyte and aquatic bryophyte community at each site
- Riparian vegetation composition

Table 4.15 Location of n=14 aquatic survey sites in the vicinity of Coole wind farm, Co. Westmeath

Site no.	Watercourse	EPA code	Location	X (ITM)	Y (ITM)
1	River Inny	26I01	Coolnagun Bridge	638678	770052
2	River Inny	26I01	Float Bridge	639188	772506
3	River Inny	26I01	Carnagh Bridge	639122	775632
4	Mayne Stream	26M92	Ballin	640517	770359
5	Glore River	26G02	Doon	641798	776069
6	Glore River	26G02	Newcastle	642220	775848
7	Glore River	26G02	Bridge at Rockbrook	644300	774205
8	Monktown River	26M78	Newcastle	641180	775185
B1	Unnamed stream	n/a	GCR crossing, Clonava	638616	769821
B2	Drainage channel	n/a	GCR crossing, Clonava	638615	769557
B3	River Inny	21I01	Inny Bridge	638805	766735
B4	Froghanstown Stream	26F41	GCR crossing, L1819	640562	763362
B5	Ballynafid Stream	26B36	GCR crossing, N4	641296	760577
B6	Brosna North River	26B28	GCR crossing, L1773	642540	756035

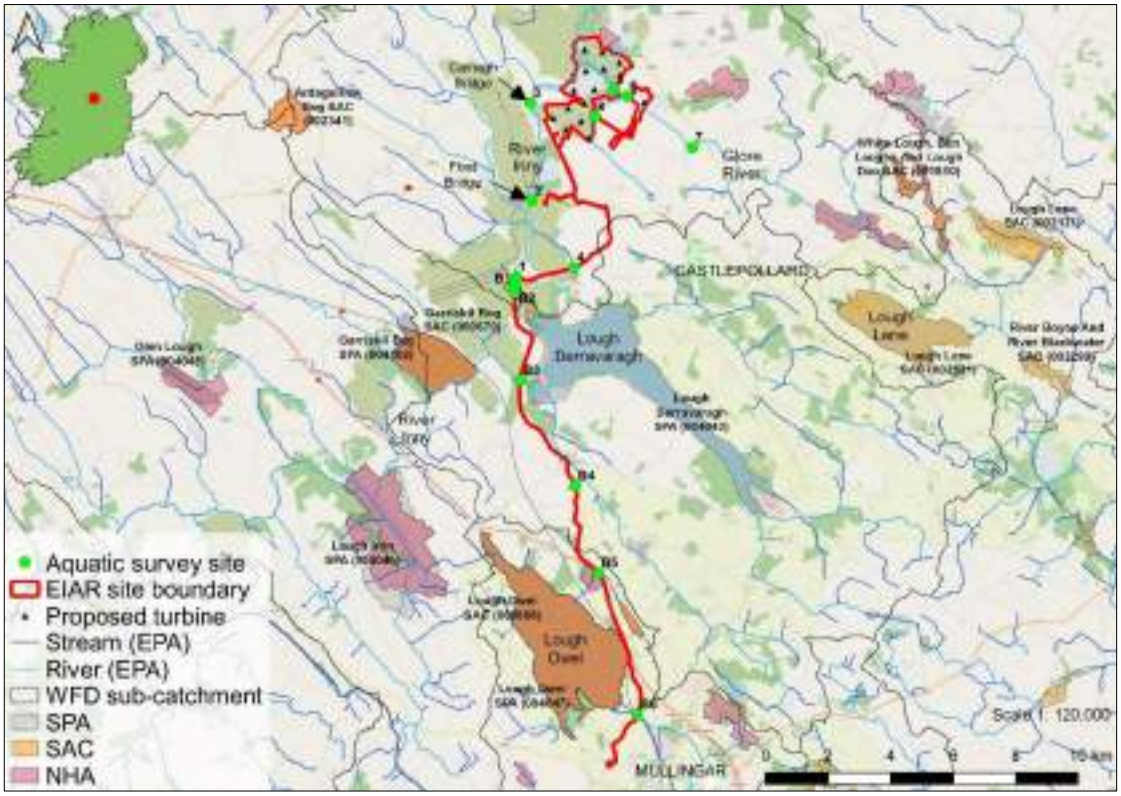

Figure 4a Overview of the n=14 aquatic survey site locations for Coole wind farm, Co. Westmeath

The full results of all the aquatic surveys that were undertaken in 2022 are provided in Appendix 3. In summary, the majority of watercourses in the vicinity of the proposed Coole wind farm were of at least **local importance (higher value)** in terms of their aquatic ecology. However, historical drainage pressures and or siltation have significantly reduced the quality of aquatic habitats on the Mayne Stream, Glore River, Monktown River, Froghanstown Stream, Ballynafid Stream and the Brosna North River.

Typically, larger watercourses with higher flow rates, greater water volumes and better connectivity, such as the River Inny and Glore River, are better able to buffer against such impacts and these watercourses supported the best quality aquatic habitats within the vicinity of the proposed wind farm for aquatic receptors of conservation value, such as salmonids, *Lampetra* sp., otter and or white-clawed crayfish.

With the exception of sites 3 on the River Inny and sites 6 & 7 on the Glore River (Q3-4), biological water quality was of **≤Q3 (poor status)** across all survey sites sampled.

4.4.2.2 Birds – Windfarm Site

Detailed maps and raw data are provided in Chapter 7: Ornithology of the EIAR that was prepared in support of this application and in the bird survey report that describes the surveys that were undertaken in 2021 and 2022 and is provided as Appendix 4. Information on the results of the detailed surveys of the SCI species which are potentially affected are provided below, namely:

- Whooper Swan
- Golden Plover
- Greenland White Fronted Goose
- Shoveler
- Coot
- Pochard
- Tufted Duck
- Wigeon
- Teal

4.4.2.2.1 *Whooper Swan*

Raw survey data for whooper swan is provided in Appendix 7-4 in Chapter 7 of the EIAR. Results summary tables are present in Appendix 7-3 in Chapter 7 of the EIAR.

Vantage Point Surveys

- 2015-2017 surveys

Whooper swan were observed on four occasions during the 2015-2017 Vantage Point Surveys at VP4 (see Appendix 7-4, Figure 7-1-1, Chapter 7 of the EIAR). Flights were recorded between the periods of November-March. Numbers recorded ranged from 1 to 7 birds. All flights were recorded within, or partially within, the potential collision risk zone. All observations were recorded within 500m of the wind farm site.

- 2018-2020 surveys

Whooper swan were observed on five occasions during the 2018-2020 Vantage Point Surveys at VP3 and VP5 (see Appendix 7-4, Figure 7-1-1, Chapter 7 of the EIAR). Flights were recorded between the periods of October-March. Numbers recorded ranged from 1 to 14 birds. All flights were recorded within the potential collision risk zone. All observations were recorded within, or partially within, 500m of the wind farm site.

- 2021-2022 Surveys

Whooper swan were observed on 25 occasions during the 2021 – 2022 Vantage Point Surveys. 19 of these surveys were within 500m of the windfarm site. (See Appendix 2, Figure 1.7 of 2021-2022 Bird Survey Report)

4.4.2.2.2 *Winter Transect Surveys*

- 2015-2017 surveys

Whooper swan were observed on two occasions during the 2015-2017 Winter Transect Surveys (see Appendix 7-4, Figure 7-5-1, Chapter 7 of the EIAR). On the 30th of October 2016, a flock of twelve birds was observed on a flooded area approximately 2.6km south-west of the Site. On the 28th of January 2017, a flock of eight birds was observed within the Site boundary.

- 2018-2020 surveys

Whooper swan were observed on only one occasion during the 2018-2020 Winter Transect Surveys (see Appendix 7-4, Figure 7-5-1, Chapter 7 of the EIAR). On the 20th of March 2020, three birds were observed travelling over cutover bog and improved agricultural grassland, approximately 1.7km south-west of the proposed wind farm site.

Whooper Swan was not recorded during the winter transect surveys in 2021-2022.

4.4.2.2.3 *Waterfowl Surveys*

- 2015-2017 surveys

Whooper swan were recorded on twenty-three occasions during Waterfowl Surveys (see Appendix 7-4, Table 1-3, Chapter 7 of the EIAR). Seven observations occurred during the 2016/2017 winter season with a maximum flock number of 40 birds recorded feeding at Lough Derravaragh, approximately 5.4km south of the Site. Sixteen observations occurred during the 2016/2017 winter season with numbers of birds ranging from 3 to 18. Whooper swan were observed at Lough Bane, Lough Kinale and Derragh Lough, Lough Sheelin and Lough Derravaragh.

- 2018-2020 surveys

Whooper swan were recorded on ninety-five occasions during Waterfowl Surveys (see Appendix 7-4, Table 1-3, Chapter 7 of the EIAR). Eighty-nine of these observations were recorded at Lough Iron, approximately 12.8km to the south-west of the proposed wind farm site. Those observations correspond to birds travelling or feeding on the lough. Numbers ranged from 2 to 96 birds. The remaining five observations were recorded at Lough Bane, Sheeling Lough SPA and Lough Derravaragh SPA. A maximum of 7 birds were recorded within 500m of the wind farm site at Lough Bane on a single occasion.

- 2021-2022 Surveys

Whooper Swan was recorded on 36 occasions during the waterfowl surveys with only three of these observations being on the site of the proposed wind farm. The birds were observed at Lough Iron, Derragh Lough, River Inny, Lough Bane and Lough Sheelin. There were no additional observations of this species during any of the other comprehensive surveys (See Appendix 2, Figure 6.7 in 2021 – 2022 Bird Survey Report)

4.4.2.3 Greenland White-fronted Goose

Raw survey data for Greenland white-fronted goose is provided in Appendix 7-4. Results summary tables are present in Appendix 7-3.

Vantage Point Surveys

- 2018-2020 surveys

Greenland white-fronted goose were observed on two occasions during the 2018-2020 Vantage Point Surveys (see Appendix 7-4, Figure 7-1-2). Flights were recorded in October 2018 and in February 2019. Numbers recorded ranged from 12 to 15 birds. Both flights were recorded within the potential collision risk zone. Both observations were recorded within 500m of the wind farm site.

- 2021-2022 surveys

Greenland White Fronted Goose were recorded on one occasion during the vantage point surveys. This was an observation of a flock of 14 birds commuting (See Appendix 2, Figure 1.2)

Winter Walkover Surveys

- 2021-2022 surveys

Greenland White Fronted Goose were recorded on one occasion during the winter walkover surveys. This was observation of five birds commuting over the wind farm site (See Appendix 2, Figure 5.2 of the 2021-2022 Bird Survey Report).

Waterfowl Surveys

- 2018-2020 surveys

Greenland white-fronted goose were recorded on twenty-six occasions during specific Waterfowl Surveys at Lough Iron (see Appendix 7-4, Table 1-5). Flock numbers were comprised between 4 and 238 birds, with an average flock composed of 75 individuals.

- 2021-2022 surveys

Greenland white-fronted goose were recorded on four occasions during the wildfowl surveys with no records within 500m of the wind farm site. All observations were of birds foraging at Piercefield, near Lough Iron (See Appendix 2, Figure 6.3 of the 2021 – 2022 Bird Survey Report)

There were no additional observations of this species during any of the other comprehensive surveys.

4.4.2.4 Golden Plover

Raw survey data for golden plover is provided in Appendix 7-4. Results summary tables are present in Appendix 7-3.

Vantage Point Surveys

- 2015-2017 surveys

Golden plover were recorded on sixty-six occasions during Vantage Point Surveys (see Appendix 7-4, Figure 7-1-3). Forty-six of these flight observations occurred within, or partially within, the Potential Collision Height. The majority of observations of birds in flight were within 500m of the proposed turbine layout. All observations of this species occurred during winter months. Twenty-nine of the sixty-three flights were recorded during the 2015/2016 winter season (October – April) with flocks between 1 and 125 birds recorded in flight and landing on areas of cutover bog. Thirty-seven flights were recorded during the 2016/2017 winter season with flocks ranging from individuals to 140 birds.

- 2018-2020 surveys

Golden plover were recorded on fifteen occasions during Vantage Point Surveys at VP3 and VP5 (see Appendix 7-4, Figure 7-1-3). Only seven of these flight observations occurred within, or partially within, the Potential Collision Height. Most observations of birds in flight were within 500m of the proposed turbine layout.

Fourteen observations of this species occurred during winter months. Seven of these fourteen flights were recorded during the 2018/2019 winter season (October – March) with flocks between 5 and 46 birds recorded in flight and landing on areas of cutover bog. Seven flights were recorded during the

2019/2020 winter season (September-March) with flocks ranging from individuals to 48 birds. The remaining flight occurred in April 2018 when 5 birds were observed travelling over cutover bog, conifer plantation and improved agricultural grassland. This flock is considered to be a migratory population.

- 2021-2022 surveys

Golden plover were recorded on nine occasions during the vantage point surveys, with 8 of these observations being within 500m of the wind farm site. Flocks of between six and 175 birds were recorded commuting or circling over the wind farm site (See . Appendix 2, Figure 1.1 of the 2021-2022 Bird Survey Reort)

Breeding Walkover Surveys

- 2021-2022

A single observation of three golden plover travelling at the beginning of April 2021. Likely remnant wintering birds en route north to summer breeding grounds – not breeding on site..

Winter Transect Surveys

- 2015-2017 surveys

Golden plover were recorded on nine occasions during the 2015-2017 Winter Transect Surveys (see Appendix 7-4, Figure 7-5-2). Seven observations occurred during the 2015/2016 winter season with a maximum flock number of 30 birds. Two observations occurred during the 2016/2017 winter season with numbers of birds ranging from 1 to 4. Five of the total nine observations were recorded within the Site boundary.

- 2018-2020 surveys

Golden plover were recorded on eleven occasions during Winter Transect Surveys (see Appendix 7-4, Figure 7-5-2). Four observations occurred during the 2018/2019 winter season with a maximum flock number of 140 birds recorded flying over cutover bog. Seven observations occurred during the 2019/2020 winter season with numbers of birds ranging from 2 to 50.

- 2021-2022 Surveys

Golden plover were recorded on four occasions. All were within 500m of the wind farm site and were observations of four to sixteen birds. There were two observations of birds commuting and two of birds roosting on the bog (See Appendix 2, Figure 5.1).

Waterfowl Surveys

- 2015-2017 surveys

Golden plover were recorded on eight occasions during Waterfowl Surveys in 2015/2017 (see Appendix 7-4, Table 1-8). Three observations occurred during the 2015/2016 winter season with a maximum flock number of 85 birds recorded feeding at Lough Derravaragh, approximately 5.4km south of the Site. Five observations occurred during the 2016/2017 winter season with numbers of birds ranging from 18 to 500. Golden plover were observed at Lough Kinale and Derragh Lough, Lough Derravaragh and Garriskil Bog.

- 2018-2020 surveys

Golden plover were recorded on two occasions during Waterfowl Surveys in 2018/2020 (see Appendix 7-4, Table 1-8). On the 20th of November 2018, 16 birds were observed roosting at Lough Bane. On the 3rd of January 2020, 58 birds were observed feeding at Lough Sheelin.

- 2021-2022 surveys

Golden plover were recorded on four occasions during these surveys, with none recorded within 500m of the wind farm site and flock =s of between 5 and 160 birds. All observations were of birds commuting or circling (See Appendix 2, Figure 6.2 of the 2021 – 2022 Bird Survey Report).

Incidental Observations

Incidental observations were also recorded during VPs watches (see Appendix 7-4, Table 1-9). These included evidences of roosting, from areas of cutover milled peat, on dates between 2015-2017 and 2018-2020 and non-visual records of calling birds.

There were no additional observations of this species during any of the other comprehensive surveys.

4.4.2.4.2 *Shoveler*

Raw survey data for Shoveler is provided in Appendix 7-4 in Chapter 7 of the EIAR. Results summary tables are present in Appendix 7-3 in Chapter 7 of the EIAR.

Winter Transect Surveys

- 2015-2017 surveys

Shoveler was recorded on a single occasion during Winter Transect Surveys (see Appendix 7-4, Figure 7-5-5, Chapter 7 of the EIAR). On the 28th of January 2017, a shoveler was flushed from Lough Bane, north of the Site.

Waterfowl Surveys

- 2015-2017 surveys

Shoveler were recorded on six occasions during the 2015/17 Waterfowl Surveys (see Appendix 7-4, Table 1-25, Chapter 7 of the EIAR). One observation occurred during the 2015/2016 winter season with a flock of 3 birds recorded feeding at Lough Derravaragh, situated approximately 5.4km to the south of the Site. The other five observations occurred during the 2016/17 winter season with numbers of birds ranging from 1 to 3. Shoveler were observed at Lough Bane, Derragh Lough, Bracklagh Lough, Lough Sheelin and Lough Derravaragh. Shoveler were recorded at Lough Bane within 500m of the wind farm site on a single occasion with one bird observed.

- 2018-2020 surveys

Shoveler was only recorded once during Waterfowl Surveys (see Appendix 7-4, Table 7-10, Chapter 7 of the EIAR). On the 7th of February 2020, an individual bird was observed feeding at Lough Derravaragh situated within 5.4km to the south of the proposed wind farm site and 1.9km east of the grid connection route.

- 2021 – 2022 Surveys

Shoveler was recorded on 11 occasions during the wildfowl distribution surveys in 2021 – 2022. None of these sightings were on the wind farm site or within 500m of it with birds recorded at Derragh Lough, Lough Iron and Lough Sheelin (See Appendix 2, Figure 6.10 of 2021 – 2022 Bird Survey Report).

There were no additional observations of this species during any of the other comprehensive surveys.

4.4.2.4.3 *Coot*

Raw survey data for coot is provided in Appendix 7-4 in Chapter 7 of the EIAR. Results summary tables are present in Appendix 7-3 in Chapter 7 of the EIAR.

Vantage Point Surveys

Coot were recorded on four occasions during the 2021-2022 surveys. All of the observations were on or within 500m of the site of the proposed wind farm. All observations were of one or two birds commuting (See Appendix 2, Figure 1.8)

Breeding Bird Surveys

Coot were only recorded on a single occasion during Breeding Bird Surveys (see Appendix 7-4, Figure 7-3-2). On the 26th of June 2019, an individual bird was recorded on a flooded area in bog, approximately 300m north of the proposed grid connection route.

Winter Transect Surveys

- 2015-2017 surveys

Coot were only recorded twice during the 2015-2017 Winter Transect Surveys (see Appendix 7-4, Figure 7-5-8, Chapter 7 of the EIAR). On the 14th of March 2016, two birds were observed along the cable route approximately 4km south of the Site. On the 27th of March 2017, four birds were observed at Lough Bane, adjacent to the Site boundary.

- 2018-2020 surveys

Coot were only recorded on a single occasion during Winter Transect Surveys (see Appendix 7-4, Figure 7-5-8). On the 20th of March 2020, an individual bird was recorded on a bog pond, approximately 180m north of the proposed grid connection route.

Waterfowl Surveys

- 2015-2017 surveys

Coot were recorded on one hundred and thirty-eight occasions during Waterfowl Surveys (see Appendix 7-4, Table 1-36, Chapter 7 of the EIAR). The species was recorded from the following sites: Lough Bane, Derragh Lough, Lough Kinale and Derragh Lough, Lough Sheelin, Bracklagh Lough and Lough Derravaragh. A maximum number of 1,565 coot was recorded at Lough Sheelin located approximately 4km from the Proposed Development Site. Coot were recorded at Lough Bane within 500m of the wind farm site on two occasions with a maximum of one bird observed.

- 2018-2020 surveys

Coot were recorded on one hundred and eighty-nine occasions during Waterfowl Surveys (see Appendix 7-4, Table 7-16, Chapter 7 of the EIAR). The species was recorded from the following sites: Lough Bane, Derragh Lough, Lough Kinale and Derragh Lough, Lough Sheelin and Lough Derravaragh. A maximum number of 760 coot was recorded at Lough Sheelin located approximately 4km from the Proposed Development Site. Coot were recorded at Lough Bane within 500m of the wind farm site on a single occasion with one bird observed.

- 2021-2022 Surveys

Coot were recorded on 167 occasions during the waterfowl surveys in 2021 and 2022. No birds were recorded within 500m of the site. Birds observed on Deragh Lough, Lough Iron Lough Kinale, Lough Sheelin, Lough Derravaragh, Bracklagh Lough and along the River Inny (See Appendix 2, Figure 6.8 of 2021 – 2022 Bird Survey Report)

There were no additional observations of this species during any of the other comprehensive surveys.

4.4.2.4.4 *Pochard*

Raw survey data for pochard is provided in Appendix 7-4, Chapter 7 of the EIAR. Results summary tables are present in Appendix 7-3, Chapter 7 of the EIAR.

Waterfowl Surveys

- 2015-2017 surveys

Pochard were recorded on thirty-two occasions during the 2015/17 Waterfowl Surveys (see Appendix 7-4, Table 1-28, Chapter 7 of the EIAR). Thirteen observations occurred during the 2015/16 winter season with a maximum flock number of 483 birds recorded feeding at Lough Sheelin, approximately 4km north-east of the Proposed Development Site. Nineteen observations occurred during the 2016/17 winter season with numbers of birds ranging from 2 to 211. Pochard were observed at Lough Kinale and Derragh Lough, Lough Sheelin, Bracklagh Lough and Lough Derravaragh.

- 2018-2020 surveys

Pochard were recorded on thirty occasions during Waterfowl Surveys (see Appendix 7-4, Table 1-28, Chapter 7 of the EIAR). Fourteen observations occurred during the 2018/2019 winter season with a maximum flock number of 142 birds recorded feeding at Lough Sheelin, approximately 4km north-east of the Proposed Development Site. Sixteen observations occurred during the 2019/2020 winter season with numbers of birds ranging from individuals to 225. Pochard were observed at Lough Bane, Derragh Lough, Lough Kinale and Derragh Lough, Lough Sheelin, Bracklagh Lough and Lough Derravaragh. Pochard were recorded at Lough Bane within 500m of the wind farm site on a single occasion with one bird observed.

- 2021-2022 surveys

Pochard were recorded on 18 occasions during the wildfowl surveys. There were no records within 500m of the wind farm site. Birds observed at wetland west of Lough Bane, Lough Iron, Lough Derravarragh, Lough Sheelin, Lough Kinale, Derragh Lough, and Robinstown (See Appendix 2, Figure 6.9 of 2021 – 2022 Bird Survey report).

There were no additional observations of this species during any of the other comprehensive surveys.

4.4.2.4.5 *Tufted Duck*

Raw survey data for tufted duck is provided in Appendix 7-4. Results summary tables are present in Appendix 7-3 of the EIAR

Waterfowl Surveys

- 2015-2017 surveys

Tufted duck were recorded on eighty-eight occasions during the 2015/17 Waterfowl Surveys (see Appendix 7-4, Table 1-3, Chapter 7 of the EIAR). Thirty-five observations occurred during the 2015/16 winter season with a maximum flock number of 552 birds recorded feeding at Lough Kinale, approximately 2km north-west of the proposed wind farm site. Fifty-three observations occurred during the 2016/17 winter season with numbers of birds ranging from individuals to 668 birds. Tufted duck were observed at Derragh Lough, Lough Kinale and Derragh Lough. Lough Sheelin, Bracklagh Lough and Lough Derravaragh.

- 2018-2020 surveys

Tufted duck were recorded on ninety-nine occasions during Waterfowl Surveys (see Appendix 7-4, Table 7-14, Chapter 7 of the EIAR). Fifty observations occurred during the 2018/2019 winter season with a maximum flock number of 384 birds recorded feeding at Lough Sheelin, approximately 4km north-east of the proposed wind farm site. Forty-nine observations occurred during the 2019/2020 winter season with numbers of birds ranging from individuals to 408 birds. Tufted duck were observed at Derragh Lough, Lough Kinale and Derragh Lough. Lough Sheelin, Bracklagh Lough and Lough Derravaragh.

Tufted duck were recorded on 48 occasions during the wildfowl surveys. There were no records within 500m of the wind farm site. Birds were observed at Lough Kinale, Bracklagh Lough, Lough Sheelin, Lough Derravaragh, Deragh Lough, Lough Iron and Robinstown (See Appendix 2, Figure 6.12 of the 2021 – 2022 bird survey report).

Incidental Observations

Incidental observations were also recorded during VPs watches (see Appendix 7-4, Table 7-3, Chapter 7 of the EIAR). These included evidence of roosting from areas of cutover milled peat, on dates between 2015-2017 and 2018-2020 and non-visual records of calling birds.

There were no additional observations of this species during any of the other comprehensive surveys.

4.4.2.4.6 *Wigeon*

Raw survey data for wigeon is provided in Appendix 7-4. Results summary tables are present in Appendix 7-3 of the EIAR

Winter Transect Surveys

- 2015-2017 surveys

Wigeon was recorded on five occasions during Winter Transect Surveys (see Appendix 7-4, Figure 7-5-6). Two observations occurred during the 2015/16 winter season with numbers ranging from 1 to 7 birds, the remaining three observations occurred during the 2016/17 winter season with numbers up to 17 birds. All observations were recorded at Lough Bane, north of the wind farm site.

- 2021 – 2022 surveys

Wigeon was recorded on one occasion when a flock of eight birds was observed foraging on the wind farm site (See Appendix 2, Figure 5.5 of the 2021 – 2022 Bird Survey Report)

Waterfowl Surveys

- 2015-2017 surveys

Wigeon were recorded on twenty-four occasions during the 2015/17 Waterfowl Surveys (see Appendix 7-4, Table 1-27). Six observations occurred during the 2015/16 winter season with a maximum flock number of 39 birds recorded feeding/roosting at Lough Derravaragh, approximately 5.4km to the wind farm site. Eighteen observations occurred during the 2016/17 winter season with numbers of birds ranging from 1 to 78. Wigeon were observed at Lough Bane, Lough Kinale and Derragh Lough, Bracklagh Lough, Lough Sheelin and Lough Derravaragh. Wigeon were recorded at Lough Bane within 500m of the wind farm site on seven occasions with a maximum of 78 birds observed.

- 2018-2020 surveys

Wigeon were recorded on twenty-two occasions during Waterfowl Surveys (see Appendix 7-4, Table 1-27). Twelve observations occurred during the 2018/2019 winter season with a maximum flock number of 51 birds recorded feeding at Lough Bane, adjacent to the proposed Site boundary. Ten observations occurred during the 2019/2020 winter season with numbers of birds ranging from 2 to 44. Wigeon were observed at Lough Bane, Derragh Lough, Lough Kinale and Derragh Lough, Bracklagh Lough, Lough Sheelin and Lough Derravaragh. Wigeon were recorded at Lough Bane within 500m of the wind farm site on thirteen occasions with a maximum of 51 birds observed.

- 2021 – 2022 surveys

Wigeon were recorded on 37 occasions during the wildfowl surveys. Only eight of these records were within 500m of the wind farm site. Birds were observed at Derragh Lough, Lough Derravaragh, Lough Sheelin, Lough Iron, Lough Kinale and Lough Bane (See Appendix 2, Figure 6.13 of the 2021 – 2022 Bird Survey Report).

There were no additional observations of this species during any of the other comprehensive surveys.

4.4.2.4.7 *Teal*

Raw survey data for teal is provided in Appendix 7-4. Results summary tables are presented in Appendix 7-3 of the EIAR

Vantage Point Surveys

- 2015-2017 surveys

Teal were observed only once during Vantage Point Surveys (see Appendix 7-4, Figure 7-1-10). On the 18th of December 2016, seven birds were observed travelling over an area of cutover bog and woodland, within the proposed wind farm site. This flight was partially recorded at potential collision height.

Winter Transect Surveys

- 2015-2017 surveys

Teal were recorded on nine occasions during the 2015/17 Winter Transect Surveys (see Appendix 7-4, Figure 7-5-7). Seven observations occurred during the 2015/16 winter season with numbers of birds ranging from 1 to 50. Two observations occurred during the 2016/17 winter season with a maximum flock number of 3 birds recorded in drainage ditches. Six observations were recorded within the proposed wind farm site.

- 2018-2020 surveys

Teal were recorded on seven occasions during Winter Transect Surveys (see Appendix 7-4, Figure 7-5-7). Three observations occurred during the 2018/2019 winter season with a maximum flock number of

9 birds recorded flushed from areas of drainage ditch and cutover bog. Four observations occurred during the 2019/2020 winter season with numbers of birds ranging from 1 to 3. All seven observations were recorded along the grid connection route.

- 2021-2022 Surveys

Teal were recorded on three occasions on the wind farm site. There was one observation of two birds commuting, one of two birds roosting and one of a flock of 22 birds foraging (See Appendix 2, Figure 5.4. of the 2021-2022 Bird Survey Report)

Waterfowl Surveys

- 2015-2017 surveys

Teal were only recorded on twenty-five occasions during the 2015/17 Waterfowl Surveys (see Appendix 7-4, Table 1-33). Ten observations occurred during the 2015/16 winter season with a maximum flock number of 54 birds recorded feeding at Lough Derravaragh, approximately 5.4km south of the proposed wind farm site. Fifteen observations occurred during the 2016/17 winter season with numbers of birds ranging from individuals to 84 birds. Teal were observed at Lough Bane, Derragh Lough, Lough Kinale and Derragh Lough. Lough Sheelin, Bracklagh Lough and Lough Derravaragh. Teal were recorded at Lough Bane within 500m of the wind farm site on five occasions with a maximum of 22 birds observed.

- 2018-2020 surveys

Teal were only recorded on three occasions during Waterfowl Surveys (see Appendix 7-4, Table 1-33). All observations occurred during the 2018/2019 winter season with a maximum flock number of 122 birds recorded feeding at Lough Derravaragh, approximately 5.4km south of the proposed wind farm site. In addition, teal were observed at Lough Bane and Lough Kinale and Derragh Lough SPA. Teal were recorded at Lough Bane within 500m of the wind farm site on a single occasion with 6 birds observed.

- 2021-2022 Surveys

There were41 observations of teal during these surveys, with only seven recorded within 500m of the wind farm site. Birds were observed at wetland west of Lough Bane, Lough Iron, Lough Derravarragh, Lough Sheelin, Lough Kinale, Derragh Lough, and Robinstown (See Appendix 2, Figure 6.11 of the 2021 – 2022 Bird Survey Report).

There were no additional observations of this species during any of the other comprehensive surveys.

4.4.2.5 Birds - Grid Connection Route

Bird surveys were conducted as part of the multidisciplinary surveys along the proposed grid connection route carried out by MKO in 2017, 2019, 2020, 2021 and 2022. These surveys were undertaken in addition to the dedicated bird surveys carried out between 2013 and 2022 as part of the permitted Coole Wind Farm. The grid connection works will be confined to the existing road corridor, conifer plantation and Mullingar substation. No supporting habitat for any SCI species was present, therefore no potential for any habitat loss exists. In addition, due to the location of the works within the existing road corridor and conifer plantation, no potential for disturbance or displacement was identified.

Whooper Swan which is an SCI of Lough Derravaragh SPA was recorded on the River Inny approximately 56m from the road corridor and 1km from the boundary of Lough Derravarragh SPA. No other Annex I or SCI species associated with any European site were recorded.

5. ASSESSMENT OF POTENTIAL EFFECTS AND ASSOCIATED MITIGATION

5.1 Potential for Direct Effects on the European Sites

The proposed wind farm site lies entirely outside of the boundaries of EU designated sites. The proposed grid connection is located within the existing N4 corridor along the boundary of Lough Owel SAC and Lough Owel SPA and will not impact on any habitat listed for protection under these designated sites. There is no potential for direct impact on any European Site.

5.2 Potential for Ex Situ Habitat Loss, Disturbance, Displacement and Collision of SCI Species of European Sites

5.2.1 Non Key Ornithological Receptors

Following the extensive surveys and assessments undertaken, no potential for significant effects in the form of habitat loss, disturbance, displacement or collision as a result of the wind farm on the following SCI species of Screened In European Sites was identified and they were not assessed to be Key Ecological Receptors. This assessment was provided in Section 7.6 of the EIAR and has been confirmed in the 2021-2022 Bird Survey Report.

- Shoveler

This species was not recorded on site during the extensive suite of surveys undertaken. No roosting evidence was recorded. There is no evidence to suggest that the development Site is of significance to this species. No potential for adverse effects on this species associated with Lough Owel SPA or Lough Iron SPA in the form of ex situ habitat loss, disturbance, displacement or collision is anticipated.

- Pochard

This species was recorded on the wind farm site on a single occasion during the extensive suite of surveys undertaken. No roosting evidence was recorded during the extensive surveys undertaken. There is no evidence to suggest that the development Site is of significance to this species. No potential for adverse effects on this species associated with Lough Ennell SPA or Lough Derravarragh SPA in the form of ex situ habitat loss, disturbance, displacement or collision is anticipated.

- Tufted Duck

This species was not recorded on the wind farm site during the extensive suite of surveys undertaken. No roosting evidence was recorded. There is no evidence to suggest that the development Site is of significance to this species. No potential for adverse effects on this species associated with Lough Ennell SPA or Lough Derravarragh SPA in the form of ex situ habitat loss, disturbance, displacement or collision is anticipated.

- Coot

This species was recorded within 500m of the wind farm site on only seven occasions during the extensive suite of surveys undertaken. There is no evidence to suggest that the development Site is of significance to this species. No potential for adverse effects on this species associated with Lough Owel SPA, Lough Ennell SPA, Lough Iron SPA or Lough Derravarragh SPA in the form of ex situ habitat loss, disturbance, displacement or collision is anticipated.

5.2.2 Key Ornithological Receptors

The following SCI species were identified as Key Ornithological Receptors and a more detailed consideration of potential impacts in relation to ex situ habitat loss, disturbance, displacement and collision is provided.

5.2.2.1 Potential for Effect on Whooper Swan

Lough Derravarragh SPA is located 4.8km south of the proposed windfarm site and 70m east of the proposed grid connection route. The development is located within the potential core foraging range of Whooper Swan which is an SCI species of Lough Derravarragh SPA (SNH Guidelines (2016). Consequently, the potential for ex situ impacts on Whooper Swan is assessed further in Table 5-1 below. This impact assessment utilises data from the EIAR as submitted and the 2021-2022 Bird Survey Report.

Table 5-1 Impact Assessment - Whooper Swan

Analysis of potential effects on Whooper Swan	
Ex-Situ Habitat Loss	The wind farm site is dominated by cutover bog, this is not considered suitable for wintering whooper swan. There were no whooper swans observed utilising the habitats within the wind farm site. The unfavourable nature of this habitat limits the potential for construction activities to result in ecologically significant habitat loss for whooper swan. Adverse effects on any SPA population can be discounted.
Disturbance , displacement and Barrier Effect	There were 25 observations of whooper swan commuting during this period, compared to an average of three flights per winter presented in Section 7.4.1 of the EIAR (twelve flights total over a four-year period). The number of birds per flock remained similar to those presented in Section 7.4.1 of the EIAR, with between two and sixteen birds being observed. However, the number of flights over the wind farm site remains low and given that the habitats on site are unlikely to attract whooper swan significant disturbance impacts are not predicted. Adverse effects on any SPA population can be discounted. No foraging areas were recorded on, or within 500m of, the wind farm site and there was no evidence of roosting on, or within 1km of, the wind farm site. Whooper swan were rarely recorded flying over the wind farm site during surveys presented in the EIAR. The frequency of flights increased slightly between March 2021 and March 2022 compared to data presented in

Analysis of potential effects on Whooper Swan	
	Section 7.4.2 of the EIAR, but whooper swans were still infrequently observed. Survey results indicate that the wind farm site does not lie on a migratory corridor for this species. Therefore, no barrier effect is predicted. Based on the complete dataset there is no potential for significant displacement effects given that whooper swans were not dependent on the habitats of the whooper swan for roosting or feeding. Furthermore, it is unlikely that any significant displacement impact will result during the operational phase, given the low level of flight activity and particularly the low numbers recorded per flight. Adverse effects on any SPA population can be discounted.
Collision	The collision risk has been calculated at a ratio of 0.79 collisions per year. The results of this analysis are not significantly different from the collision risk reported in the EIAR as lodged. No significant effects on the species are predicted and adverse effects on any SPA population can be discounted.

5.2.2.2 Potential Effect on Greenland White Fronted Goose

Lough Iron SPA is located 11.4km from the proposed windfarm site, 4.3km from the proposed grid connection route and 3km from some minor junction works at Joanstown. The development is located outside the potential core foraging range of Greenland White Fronted Goose, which is an SCI species of Lough Iron SPA SPA (SNH Guidelines (2016). Garriskil Bog SPA is located 7.2km from the wind farm site and 1.4km from the grid connection route. It is located within the core foraging range for this species. However, the geese have not been present within the SPA in recent years (since 1987). Notwithstanding the above, following an extremely precautionary principle, the potential for ex situ impacts on Greenland White Fronted Goose is assessed further in Table 5-2 below. This impact assessment utilises data from the EIAR as submitted and the 2021-2022 Bird Survey Report.

Table 5-2 Impact Assessment – Greenland White Fronted Goose

Analysis of potential effects on Greenland White Fronted Goose	
Ex Situ Habitat Loss	The vast majority of observations were of flocks recorded at Lough Iron, approximately 12.8km from the wind farm site. During surveys between March 2021 and March 2022, there was only one observation of a flock of fourteen birds commuting over the wind farm site. A similar rate of occurrence was reported in Section 7.8.2.2 of the EIAR (one observation every two years). There was no evidence of roosting or foraging within 1km of the wind farm site. Significant effects with regard to direct habitat loss are not predicted and no adverse effects on any SPA populations will occur.

Analysis of potential effects on Greenland White Fronted Goose	
Disturbance, Displacement and Barrier Effect	This species was not recorded utilising habitats on, or within 500m of, the wind farm site. The species was observed flying over the site on only one occasion between March 2021 and March 2022. Given the low numbers recorded and the abundance of suitable habitats in the wider surroundings of the wind farm site, significant impacts are not predicted. Similar to the data outlined in Section 7.8.2.2 of the EIAR, there was only one observation of birds commuting over the wind farm site between March 2021 and March 2022. Given this low rate of occurrence, it is reasonable to conclude that there was no regularly used commuting corridor or migratory route that crossed the wind farm site. There was no foraging birds recorded on, or within 500m of, the wind farm site. Similarly, there was no evidence of roosting birds on, or within 1km of, the wind farm site. No significant displacement or barrier effects are predicted and no adverse effects on any SPA populations will occur.
Collision	The species was recorded flying within the potential collision risk zone during Vantage Point surveys. A "Random" collision risk analysis has been undertaken. The collision risk has been calculated to be 0.04 collisions per year, or one bird every 25 years. The results of this analysis are not significantly different from the collision risk reported in the EIAR as lodged. No significant effects are predicted. and no adverse effects on any SPA populations will occur.

5.2.2.3 Potential for Effect on Golden Plover

Lough Iron SPA is located 11.4km from the proposed windfarm site, 4.3km from the proposed grid connection route and 3km from some minor junction works at Joanstown. The development is located outside the potential core foraging range of Greenland White Fronted Goose, which is an SCI species of Lough Iron SPA SPA (SNH Guidelines (2016). However, following an extremely precautionary principle, the potential for ex situ habitat loss, disturbance, displacement, barrier effect and collision are considered in this assessment in Table 5-3 below. This impact assessment utilises data from the EIAR as submitted and the 2021-2022 Bird Survey Report.

Table 5-3 Impact Assessment – Golden Plover

Analysis of potential effects on Golden Plover	
Ex Situ Habitat Loss	In contrast to the data presented in Section 7.8.2.3 of the EIAR, there were no observations of golden plover utilizing habitats on, or within 500m of, the wind farm site between March 2021 and March 2022.

Analysis of potential effects on Golden Plover	
	Significant effects with regard to direct habitat loss are not predicted, given the development infrastructure is confined to a narrow corridor, therefore direct habitat loss will be minimal. Furthermore, the habitats within the Site are not of particularly high quality and there is an abundance of similar habitat in the surrounding area. No regular commuting/migratory flights were recorded that would constitute evidence of connectivity between any SPA and the Proposed Development area. The evidence of surveys was that the local population was largely resident during the winter months in local areas of cutover bog.
Disturbance, Displacement and Barrier Effect	As per McGuinness et al. (2015) the zone of sensitivity for the species is 800m during the breeding season only. The species is not identified as being particularly sensitive to wind farm developments during the wintering period. This species was recorded commuting or circling over the bog on, or within 500m of, the wind farm site during the winter season. Numbers of county importance were observed on six occasions on, or within 500m of, the wind farm site. This is a marked reduction in the use of the Site compared to the regular use of the Site as reported in the EIAR. Given the abundance of similar suitable habitats in the wider surroundings of the wind farm site, significant impacts are not predicted. A review of 29 studies suggests golden plover will approach wind turbines to an average distance of 175m in non-breeding season (Hötker et al., 2006). There were 10 observations of golden plover within 200m of the proposed turbine layout during surveys between March 2021 and March 2022. In the event of displacement, there are sufficient areas of suitable habitat in the wider area to render such an effect inconsequential. Furthermore, habitats within the wind farm site (e.g. cutover bog) are not of particularly high quality. There is no evidence to suggest that the wind farm site lies on a migratory/ regular commuting route for the species therefore barrier effect is not anticipated. Significant displacement or barrier effects are not predicted. No adverse effects on any population associated with any SPA are predicted.
Collision	The species was recorded flying within the potential collision risk zone during Vantage Point surveys. A “Random” collision risk analysis has been undertaken.

Analysis of potential effects on Golden Plover	
	The collision risk has been calculated to be 10.6 collisions per year. It is noted that this is a reduction in the number of predicted collisions (34) reported in the EIAR as lodged (EIAR Appendix 7-5). This change is a result of incorporating new research into the analysis that shows golden plover to avoid colliding with turbines a high proportion of the time. The evidence of surveys was that the local population was largely resident during the winter months in local areas of cutover bog. As such, no adverse effects on any SPA populations will occur.

5.2.2.4 Potential for Effect on Wigeon

Lough Iron SPA is located 11.4km from the proposed windfarm site, 4.3km from the proposed grid connection route and 3km from some minor junction works at Joanstown. Following an extremely precautionary principle, the potential for ex situ habitat loss, disturbance, displacement, barrier effect and collision are considered in this assessment in Table 5-4 below. This impact assessment utilises data from the EIAR as previously submitted with no further update to the impact assessment following the 2021-2022 Bird Surveys as the species was rarely recorded during this period.

Table 5-4 Impact Assessment – Wigeon

Analysis of potential effects on Wigeon	
Ex Situ Habitat Loss	During winter season surveys, the species was regularly recorded feeding/roosting at Lough Bane, approximately 300m from the closest turbine, north of the proposed wind farm site. Wigeon activity was confined to this area locally. No infrastructure is proposed in this location. Significant effects with regard to direct habitat loss are not predicted and no adverse effects on any SPA populations will occur.
Disturbance, Displacement and Barrier Effect	Disturbance from construction activities could result in the loss of wigeon wintering habitat at Lough Bane, 300m north of the wind farm site. However, impacts at this location will be limited due to the screening provided by scrub/woodland between the wind farm site and the lough and given the habitats of the lough are not of particularly high quality or unique to the local area. It is noted that the majority of Proposed Development infrastructure will be sited in cutover bog, a habitat of very limited ecological value to this species. Wigeon activity within 500m of the proposed turbines was confined to Lough Bane. A 500m buffer of the proposed turbines would overlap with approx. 50% of the lough. However, impacts at this location will be limited due to the screening provided by scrub/woodland between the wind farm site and the lough and given the habitats of the lough are not of particularly high quality or unique to the local area. It is noted that the majority of the Proposed Development site is located in cutover bog. A habitat not favoured by this species.

Analysis of potential effects on Wigeon	
	Should any potential displacement effect occur, there are extensive areas of suitable habitat in the wider area, to render this potential impact inconsequential. Significant displacement effects are not anticipated at county, national of international scale and, given the abundance of similar suitable habitats in the wider surroundings of the Proposed Development significant impacts are not predicted. No adverse effects on any population associated with any SPA are predicted.
Collision	The species was not recorded during Vantage Point Surveys. Collision related mortality is not likely to significantly impact this species.

5.2.2.5 Potential for Effect on Teal

Lough Iron SPA is located 11.4km from the proposed windfarm site, 4.3km from the proposed grid connection route and 3km from some minor junction works at Joanstown. Following an extremely precautionary principle, the potential for ex situ habitat loss, disturbance, displacement, barrier effect and collision are considered in this assessment in Table 5-5 below. This impact assessment utilises data from the EIAR as previously submitted with no further update to the impact assessment following the 2021-2022 Bird Surveys as the species was rarely recorded during this period.

Table 5-5 Impact Assessment – Teal

Analysis of potential effects on Teal	
Ex Situ Habitat Loss	Teal was rarely recorded on Site or within 500m of the wind farm site. The Site is dominated by cutover bog which provides unsuitable wintering habitat for the species. Extensive areas of suitable roosting and foraging habitat will remain post-construction and there is an abundance of suitable habitat in the surrounding area. Significant effects with regard to direct habitat loss are not predicted and no adverse effects on any SPA populations will occur.
Disturbance, Displacement and Barrier Effect	In four years of surveying this species was infrequently recorded onsite or within 500m of the wind farm site. The majority of onsite habitats (e.g. cutover bog, forestry and grassland) are unsuitable for this species. Furthermore, the Proposed Development Site does not contain habitats that are unique to the local area. Therefore, were displacement to occur it would not result in the loss of a scarce resource for the local teal population. As previously discussed, the Proposed Development Site does not contain habitats that are of a particularly high quality or unique to the local area. Therefore, were displacement to occur it would not result in the loss of a scarce resource for the local teal population. Furthermore, this species was infrequently recorded onsite or within 500m of the wind farm site. Significant displacement effects are not predicted. No adverse effects on any population associated with any SPA are predicted.

Analysis of potential effects on Teal	
Collision	The species was recorded flying within the potential collision risk zone during VP surveys. A "Random" collision risk analysis has been undertaken and full details are provided in Appendix 7-5 of the EIAR The collision risk has been calculated at a ratio of 0.010 collisions per year or one bird every 97 years. The predicted collision risk is insignificant. As such, no adverse effects on any SPA populations will occur.

5.3 Bird Disturbance as a result of Construction of the Grid Connection

A potential pathway for indirect effects in the form of bird disturbance was identified, potentially affecting the following SPAs as a result of proximity to the proposed wind farm site and/or grid connection route:

- Lough Owel SPA (004047)
  - Shoveler *Anas clypeata [A056]*
  - Coot *Fulica atra*
- Lough Derravaragh SPA (004043)
  - Whooper swan *Cygnus cygnus [A038]*
  - Pochard *Aythya farina [A059]*
  - Tufted duck *Aythya fuligula [A061]*
  - Coot *Fulica atra [A125]*

This section describes the measures that are in place to mitigate adverse negative effects associated with the Proposed Development on avian receptors. Effects on avian receptors have been addressed in two ways:

- Design of the Proposed Development.
- Management of the development phases.

5.3.1 Mitigation by Design

The Proposed Development has been designed to avoid ecologically sensitive areas and has been constraint led from the initial design phase. The project design has followed the basic principles outlined below to eliminate the potential for ecological effects on KERs where possible and to minimise such effects where total elimination is not possible.

The development has been designed to:

- avoid any direct, in-direct or residual adverse effects on European sites or other designated sites for nature conservation.
- to avoid effects on habitats that correspond to those that are listed on Annex I of the EU Habitats Directive outside of the European and nationally designated sites.

- minimise direct or indirect effects on any habitats or species that were classified as being of National, County or Local Importance (Higher Value) in the design of the scheme

Through careful planning and design, direct or indirect effects on receptors of International, Nation al & County importance have been avoided at the design stage. In addition, the proposed development layout minimises the potential for effects on receptors of Local Importance (Higher Value).

During the site surveys, it was noted that all works associated with the proposed grid connection route will be undertaken in the road, short term and typical of road maintenance works. No works are proposed outside the confines of the road corridor and given the nature and scale of the temporary cable laying works no adverse effects relating to disturbance are anticipated. The project design has followed the basic principles outlined below to eliminate the potential for significant effects on avian receptors:

The project design has followed the basic principles outlined below to eliminate the potential for significant effects on avian receptors:

- The grid connection route has been selected to utilise built infrastructure for the majority of its length (i.e. cables to be laid within public roads). Cables will be laid underground to avoid effects on roadside hedgerows and disturbance to nesting birds.

5.3.2 Mitigation During Construction, Operation and Decommissioning

The following section describe the mitigation and best practise measures to be implemented during each phase of the Proposed Development.

5.3.2.1 Construction Phase Mitigation

A Construction and Environmental Management Plan (CEMP) has been prepared. The CEMP will be in place prior to the start of the construction phase. Best practice measures which form part of the design of the project are included in Chapter 4 of the EIAR. The CEMP is included as Appendix 2. A summary of the relevant points included in the CEMP are provided below and in the following sections:

- All removal of woody vegetation will be undertaken in accordance with Section 40 of the Wildlife Act 1976 as amended.
- The removal of woody vegetation will be undertaken outside the bird breeding season which runs from the 1st of March to the 31st of August inclusive. Where sections of woody vegetation are removed for the purposes of the junction and road upgrades, these will be replaced with suitable hedge/tree species which are common in the local context.
- In line with best practise, no construction works are permitted 1st of March to the 31st of August inclusive within a 350m radius of the lapwing breeding territories, as provided in Confidential Appendix 7-7 in Chapter 7 of the EIAR.
- In line with best practise, no construction works are permitted 1st of March to the 31st of August inclusive within a 500m radius of the barn owl breeding site, as provided in Confidential Appendix 7-7 in Chapter 7 of the EIAR.
- During the construction phase, noise limits, noise control measures, hours of operation (i.e. dusk and dawn is high faunal activity time) and selection of plant items will be considered in relation to disturbance of birds.
- Plant machinery will be turned off when not in use.

- All plant and equipment for use will comply with the industry best practise Construction Plant and Equipment Permissible Noise Levels Regulations and other relevant legislation.
- An Ecological Clerk of Works (ECoW) will be appointed. Duties will include:
    - Undertake a pre-construction transect/walkover bird survey to ensure that significant effects on breeding birds will be avoided.
    - Inform and educate on-site personnel of the ornithological and ecological sensitivities within the Proposed Development site.
    - Oversee management of ornithological and ecological issues during the construction period and advise on ornithological issues as they arise.
    - Provide guidance to contractors to ensure legal compliance with respect to protected species onsite.
    - Liaise with officers of consenting authorities and other relevant bodies with regular updates in relation to construction progress.

5.3.2.2 Operational Phase Mitigation

No operational phase impacts associated with the operation of the grid connection requiring mitigation were identified.

5.3.2.3 Decommissioning Phase Mitigation

It is proposed to leave all cable ducts in place following the cessation of operation of the wind farm, with the only works potentially being the removal of the cables, which will be removed from access joints on or adjacent to the public road and without the requirement for excavation. No requirement for mitigation was identified

5.4 Deterioration of Water Quality

There is hydrological connectivity between the Proposed Development and downstream European Sites via watercourses within the site boundary.

The proposed works have the potential to cause deterioration in surface water quality during the construction, operational and decommissioning phase of the development due to the release of pollutants including suspended solids and hydrocarbons, potentially affecting the following QIs/SCIs, in the absence of mitigation:

- Lough Owel SAC (000688)
    - Hard oligo-mesotrophic waters with benthic vegetation of *Chara spp.* [3140]
    - Alkaline fens [7230]
    - Transition mires and quaking bogs [7140]
    - *Austropotamobius pallipes* (White-clawed Crayfish) [1092]
- Lough Ennell SAC (000685)
    - *Alkaline fens [7230]*
- Lough Owel SPA (004047)
    - *Shoveler Anas clypeata [A056]*
    - *Coot Fulica atra*
    - *Wetland and Waterbirds [A999]*

- Lough Ennell SPA (004044)
  - *Pochard Aythya ferina [A059]*
  - *Tufted duck Aythya fuligula [A061]*
  - *Coot Fulica atra [A125]*
  - *Wetland and Waterbirds [A999]*

- Lough Derravaragh SPA (004043)
  - *Whooper swan Cygnus cygnus [A038]*
  - *Pochard Aythya farina [A059]*
  - *Tufted duck Aythya fuligula [A061]*
  - *Coot Fulica atra [A125]*
  - *Wetland and Waterbirds [A999]*

- Lough Iron SPA (004046)
  - *Whooper Swan Cygnus cygnus [A038]*
  - *Wigeon Anas penelope [A050]*
  - *Teal Anas creca [A052]*
  - *Shoveler Anas clypeata [A056]*
  - *Coot Fulica atra [A125]*
  - *Golden Plover Pluvialis apricaria [A140]*
  - *Greenland White-fronted Goose Anser albifrons flavirostris [A395]*

5.4.1.1 Mitigation by Design

The design of the Proposed Development, as described in Chapter 4 of the EIAR and in the CEMP, Appendix 4-4 of Chapter 4 sets out very clearly how the Proposed Development, including the underground cabling, has been designed and will be operated in accordance with best industry practice to avoid any significant effects outside the site including the prevention of impacts on watercourses. This design includes suitable precautionary mitigation to make certain that the Proposed Development will not adversely affect the integrity of European sites.

The development has been designed to avoid effects on the watercourses that provide connectivity to relevant European Sites. This section demonstrates how this has been achieved:

- All major infrastructure such as turbines, substations and site compounds will be over 50m from any main watercourse (identified on EPA watercourse mapper) and 10m from any large drainage channels on the site.
- There will be 2 no. crossings over the River Glore as part of the Proposed Development. The first crossing comprises the replacement of an existing timber bridge with a 5m clear span bridge connecting Turbines T5-T12 to Turbines T1-T4. The second crossing will comprise a new 5m clear-span bridge to provide access to T15. A third crossing will be required to provide access to Turbine T1 located to the north of an OPW drain. This will require a 3-metre clear span bridge. Figure 4-24 in Chapter 4 of the EIAR shows the typical clear span bridge design. There will be no instream works required as part of the Proposed Development. The typical construction methodology for the installation of clear span bridges is provided below:
  - The access road on the approach to the watercourse will be completed to a formation level which is suitable for the passing of plant and equipment required for the installation of the watercourse crossing.
  - All drainage measures along the proposed road will be installed in advance of the works.
  - The abutment will consist of concrete panels which will be installed on a concrete lean mix foundation to provide a suitable base. The base will be excavated to rock or competent ground with a mechanical excavator with the foundation formed in-situ

using a semi-dry concrete lean mix. The base will be excavated along the stream bank with no instream works required.
- Access to the north or opposite side of the river for excavation and foundation installation will require the installation of pre-cast concrete slab across the river to provide temporary access for the excavator.
- All pre-cast concrete panels and slabs/beams will be installed using a crane which will be set up on the southern side of the stream and will be lifted into place from the stream back with no contact with the watercourse.
- A concrete deck will be poured over the beams/slabs which span across the river. This will be shuttered, sealed and water tested before concrete pouring can commence.
- The upgrade of existing access tracks and construction of new tracks will involve some works within 50m of watercourses and new watercourse crossings. However, no instream works are proposed, and a suite of measures are in place to avoid any adverse effects on watercourses. These measures are described in full in the Chapter 9 'Hydrology' of the EIAR.
- No construction materials or construction waste will be placed within a 50-metre buffer zone around watercourses during the windfarm.

5.4.1.2 Morphological Changes to Surface Watercourses and Drainage Patterns

Diversion, culverting, road and grid cable crossing of surface watercourses can result in morphological changes, changes to drainage patterns and alteration of aquatic habitats. Construction of structures over watercourses has the potential to significantly interfere with water quality and flows during the construction phase.

It is proposed that 1 no. existing watercourse crossings will be upgraded and 2 no. new watercourse crossings will be required to facilitate the wind farm access roads within the Wind Farm Site. These crossing are further described in Section 4.8.3 of Chapter 4 of the EIAR and included in Figures 4-23 to 4-25

Along sections of proposed and existing access roads, the Grid Connection Route cable will be constructed within the road crossing. Section 4.8.7.5 in Chapter 4 of the EIAR details the water crossing locations along the proposed Grid Connection Route and describes the proposed crossing construction methodology. Additional details are presented below.

- All proposed new stream crossings will ensure that the existing banks remain undisturbed. No in-stream excavation works are proposed and therefore there will be no impact on the stream at the proposed crossing location;
- Within the Wind Farm Site where the Grid Connection Route runs adjacent to a proposed access road or an existing access road proposed for upgrade, the Grid Connection Route cable will pass over any culvert (where one exists or is proposed) within the access road;
- Where a Grid Connection Route cable stream crossing is required, the cable will pass over the watercourse via suspended ducting thereby avoiding any morphological impacts;
- Any guidance / mitigation measures proposed by the OPW or the Inland Fisheries Ireland will be incorporated into the design of the proposed crossings. A 10m buffer is applied to the main drain (i.e. drain D1) to allow for future OPW maintenance;
- Works will be completed in accordance with the requirements of "Inland Fisheries Ireland (2016): Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters"; and,

- All access road river/stream crossings will require a Section 50 application (Arterial Drainage Act, 1945). The river/stream crossings will be designed in accordance with OPW guidelines/requirements on applying for a Section 50 consent.

5.4.1.3 Construction Phase Mitigation

Mitigation measures have been incorporated into the Proposed Development for the prevention of water pollution. The Proposed Development includes a detailed drainage plan that is shown in the design drawings included in Appendix 9-3 of the EIAR. This plan and all the associated measures have been taken into account in this assessment. The drainage philosophy overall is to minimise waters arising on site, to adequately treat any water that may arise and to ensure that the hydrological function of the watercourses on the site and in the wider catchment are not affected by the proposed works. This philosophy including all associated mitigation measures to protect local surface water quality are fully described in the CEMP (see Appendix 2) and Chapter 9 'Hydrology' of the EIAR.

The Inland Fisheries Ireland (2016): *Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters*; and the Scottish Natural Heritage (SNH) *Good Practice During Wind Farm Construction* (SNH, 2019, 4th Edition) will also be adhered to.

All detailed mitigation measures for the protection of water quality are fully described below and in Section 4.7, Chapter 4 of the accompanying EIAR, the CEMP, Appendix 4-4 of Chapter 4 (and Sections 9.5.3 – 9.5.4 Chapter 9 'Water' of the EIAR. The following subsections describe the mitigation measures proposed for the construction phase of the Proposed Development.

5.4.1.3.1 *Wind Farm Site Watercourse Crossings*

It is proposed to replace the existing timber bridge over the River Glore within the proposed wind farm site with a 5-metre clear span bridge. The proposed bridge crossing will form part of the internal site road network, connecting Turbines T5-T12 to Turbines T1-T4. The crossing location is at Grid Reference E 641,560 N 776,452, as shown in Figure 4-23 of Chapter 4 of the EIAR. The design avoids the requirement for in-stream works.

A second crossing will be required to provide access to Turbine T1 located to the north of an OPW drain. This will require a 3-metre clear span bridge as shown on Figure 4-24 (see Chapter 4 of the EIAR) which shows the typical clear span bridge design.

A third crossing will be required to provide access to Turbine T15 over the River Glore. This will require a 5-metre clear span bridge as shown in Figure 4-25 which shows the typical clear span bridge design (see Chapter 4 of the EIAR). The clear span bridge's will be constructed to the specifications of the OPW bridge design guidelines 'Construction, Replacement or Alteration of Bridges and Culverts - A Guide to Applying for Consent under Section 50 of the Arterial Drainage Act, 1945', and in consultation with Inland Fisheries Ireland. Abutments will be constructed from precast units combined with in-situ foundations, placed within an acceptable backfill material.

5.4.1.3.2 *Underground Cable Watercourse/Culvert Crossings*

A general description of the various construction methods employed at watercourse/ culvert crossings are described in the following paragraphs below. A list of the stream crossings along the underground cable route and the proposed crossing method at each location is provided in Table 4-3, Chapter 4 of the EIAR.

The stream crossing locations are shown in Figure 4-21 of Chapter 4 of the accompanying EIAR. The crossing locations for all culvert crossings are also shown on the underground cable route drawings

included as Appendix 4-1, Chapter 4 of the accompanying EIAR . Details of all culvert crossing are also provided in Appendix 4-7, Chapter 4 of the accompanying EIAR.

5.4.1.3.3 *Crossings over Culverts – Option 1*

The watercourse at any of the crossings will not be disturbed because no instream works or bridge/culvert alterations are proposed. Watercourses will not be directly impacted upon since no instream works or bridge/culvert alterations are proposed. Where adequate cover exists above a culvert, the ESB/Eirgrid specified flat formation ducting arrangement will be used where the cable ducts pass over a culvert maintaining 300mm minimum clearance to the top of the culvert . A heavy duty steel plate will be placed over the ducts as distance between the road surface and the ducts will have been reduced. See Figure 4-27 in Chapter 4 of the EIAR.

5.4.1.3.4 *Crossing under Piped Culverts – Option 2*

Where adequate cover does not exist between the top of the culvert and the finished surface of the road the cable ducts will be passed under the culvert as outlined in Figure 4-28 in Chapter 4 of the EIAR. A 300mm minimum separation distance will be maintained between the top of the ducts and the bottom of the piped culvert. A heavy duty steel plate will be placed above the ducting extending for 1m at either side of the culvert.

5.4.1.3.5 *Flatbed Formation over Culverts – Option 3*

Where cable ducts are to be installed over an existing culvert where sufficient cover cannot be achieved to install the ducts as per option 1, the ducts will be laid in a shallow trench the depth of which will be determined by the location of the top of the culvert. The ducts will be laid in this trench in a flatbed formation over the existing culvert and will be encased in 6mm thick steel galvanized plate with a 30N concrete surround as per ESB/Eirgrid specification. This method of duct installation is further detailed in Figure 4-29 in Chapter 4 of the EIAR.

5.4.1.3.6 *Outside of Bridge Decking – Option 4*

Where sufficient cover and road width isn't available to place the ducting in the bridge decking, the cable can be placed in an stainless steel conduit with a minimum wall thickness of 4mm secured to the outside of the bridge deck supported by cleats at 1m intervals as per ESB/Eirgrid specifications. This method of crossing a bridge structure is detailed in Figure 4-30 in Chapter 4 of the EIAR.

5.4.1.3.7 *Directional Drilling – Option 5*

In the event that none of the above methods are appropriate, directional drilling will be utilised. The directional drilling method of duct installation will be carried out using Vermeer D36 x 50 Directional Drill (approximately 22 tonnes) or similar. The launch and reception pits will be excavated with a suitably sized excavator. The drilling rig will be securely anchored to the ground by means of anchor pins which will be attached to the front of the machine. The drill head will then be secured to the first drill rod and the operator shall commence to drill into the launch pit to a suitable angle which will enable him to obtain the depths and pitch required to the line and level of the required profile. Drilling of the pilot bore shall continue with the addition of 3.0m long drill rods, mechanically loaded and connected into position.

During the drilling process, a mixture of a natural, inert and fully biodegradable drilling fluid such as Clear Bore™ and water is pumped through the centre of the drill rods to the reamer head and is forced into void and enables the annulus which has been created to support the surrounding sub soil and thus prevent collapse of the reamed length. Depending on the prevalent ground conditions, it may be necessary to repeat the drilling process by incrementally increasing the size of the reamers. When the reamer enters the launch pit, it is removed from the drill rods which are then passed back up the bore

to the reception pit and the next size reamer is attached to the drill rods and the process is repeated until the required bore with the allowable tolerance is achieved.

The use of a natural, inert and biodegradable drilling fluid such as Clear Bore™ is intended to negate any potential adverse impacts arising from the use of other, traditional polymer-based drilling fluids and will be used sparingly as part of the drilling operations. It will be appropriately stored prior to use and deployed in the required amounts to avoid surplus. Should any excess drilling fluid accumulate in the reception or drilling pits, it will be contained and removed from the site in the same manner as other subsoil materials associated with the drilling process to an approved disposal site.

Backfilling of launch and reception pits will be conducted in accordance with the normal specification for backfilling excavated trenches. The directional drilling methodology is further detailed in Figure 4-31 in Chapter 4 of the EIAR.

5.4.1.3.8 *Construction Phase Drainage Management*

Drains will be excavated and stilling ponds constructed to eliminate any suspended solids within surface water running off the site. The following best practice drainage measures have been incorporated into the Proposed Development for the protection of surface water quality, as fully described in Section 4.2.4 of the CEMP, Appendix 4-4 of Chapter 4 :

- Interceptor drains will be installed up gradient of any works areas to collect surface flow runoff and prevent it reaching excavations and construction areas of the site where it might otherwise have come into contact with exposed surfaces and picked up silt and sediment. The drains will be used to divert upslope runoff around the works area to a location where it can be redistributed over the ground surface as sheet flow. This will minimise the volume of potentially silty runoff to be managed within the construction area.
- Collector drains or swales are shallow drains that will be used to intercept and collect run off from construction areas of the site during the construction phase. Drainage swales will remain in place to collect runoff from roads and hardstanding areas of the proposed development during the operational phase.
- The velocity of flow in the interceptor drains and collector drains, particularly on sloped sections of the channel, will be controlled by check dams, which will be installed at regular intervals along the drains to ensure flow in the collector drain is non-erosive. Check dams will also be installed in some existing artificial drainage channels that will receive waters from works areas of the site.
- A level spreader will be constructed at the end of each interceptor drain to convert concentrated flows in the drain, into diffuse sheet flow on areas of vegetated ground. The levels spreaders will be located downgradient of any proposed works areas in locations where they are not likely to contribute further to water ingress to construction areas of the site, or areas where they are not likely to give rise to peat stability issues.
- Vegetation filters are the existing vegetated areas of land that will be used to accept surface water runoff from upgradient areas. The selection of suitable areas to use as vegetation filters will be determined by the size of the contributing catchment, slope and ground conditions.
- Stilling ponds will be used to attenuate runoff from works areas of the site during the construction phase, and will remain in place to handle runoff from roads and hardstanding areas of the proposed development during the operational phase.
- A “siltbuster” or similar equivalent piece of equipment will be available to filter any water pumped out of excavation areas if necessary, prior to its discharge to stilling ponds or swales.
- Dewatering silt bags allow the flow of water through them while trapping any silt or sediment suspended in the water. The silt bags provide a passive non-mechanical

method of removing any remaining silt contained in the potentially silt-laden water collected from works areas within the site.
- Silt fences will be installed as an additional water protection measure around existing watercourses in certain locations, particularly where watercourse crossings take place.
- Sediment entrapment mats, consisting of coir or jute matting, will be placed at the outlet of the silt bag to provide further treatment of the water outfall from the silt bag. Sedimats will be secured to the ground surface using stakes/pegs. The sedimat will extend to the full width of the outfall to ensure all water passes through this additional treatment measure.
- All new proposed culverts and proposed culvert upgrades will be suitably sized for the expected peak flows in the watercourse.

5.4.1.3.9 *Hydrocarbons and Waste Material*

The use of hydrocarbons during the construction process leads to the potential for pollution to enter the wider environment, including drainage ditches and watercourses. Leaks in poorly maintained plant and machinery could lead to hydrocarbon dispersal over works areas. Leaks in fuel storage tanks and spillages during refuelling operations could lead to larger releases of hydrocarbons into the environment.

The following measures are proposed to avoid impacts on the wider environment as a result of pollution.

Refuelling, Fuel and Hazardous Materials Storage

- Onsite re-fuelling of machinery will be carried out using a mobile double skinned fuel bowser. The fuel bowser, a double-axel custom-built refuelling trailer will be re-filled off site (Wind Farm Site and Grid Connection Route), and will be towed around the site by a 4x4 jeep to where machinery is located. The 4x4 jeep will also carry fuel absorbent material and pads in the event of any accidental spillages. The fuel bowser will be parked on a level area in the construction compound when not in use and only designated trained and competent operatives will be authorised to refuel plant on site. Mobile measures such as drip trays and fuel absorbent mats will be used during all refuelling operations;
- Refuelling or maintenance of machinery will not occur within 100m of a watercourse;
- Fuels stored on site will be minimised;
- Any diesel or fuel oils stored at the temporary site compound will be bunded. The bund capacity will be sufficient to contain 110% of the storage tank's maximum capacity;
- The electrical control building at the Wind Farm Site will be bunded appropriately to the volume of oils likely to be stored, and to prevent leakage of any associated chemicals and to groundwater or surface water. The bunded area will be fitted with a storm drainage system and an appropriate oil interceptor;
- The plant used will be regularly inspected for leaks and fitness for purpose; and,
- An emergency plan for the construction phase to deal with accidental spillages will be contained within Environmental Management Plan. Spill kits will be available to deal with accidental spillages.

5.4.1.3.10 *Concrete Pouring*

Because of the scale of the main concrete pours that will be required to construct the Proposed Development, the main pours will be planned days or weeks in advance. Special procedures will be adopted in advance of and during all concrete pours to minimise the risk of pollution. These will include:

- Using weather forecasting to assist in planning large concrete pours, and avoiding large pours where prolonged periods of heavy rain is forecast.
- Restricting concrete pumps and machine buckets from slewing over watercourses while placing concrete.
- Ensuring that excavations are sufficiently dewatered before concreting begins and that dewatering continues while concrete sets.
- Ensuring that covers are available for freshly placed concrete to avoid the surface washing away in heavy rain.
- The small volume of water that will be generated from washing of the concrete lorry's chute will be directed into a temporary lined impermeable containment area, or a Siltbuster-type concrete wash unit (https://www.siltbuster.co.uk/sb_prod/siltbuster-roadside-concrete-washout-rcw/) or equivalent.
- Disposing of surplus concrete after completion of a pour in agreed suitable locations away from any watercourse or sensitive habitats.

5.4.1.3.11 *Outline Peat Stability Management Plan*

Minimal peat excavation is likely to be required on site due to the proposed construction techniques for the site. With the exception of Turbine T5 and T15, all turbines and their associated crane hardstands are likely to require a piled foundation as a result of the depth of peat and soft lacustrine deposits present. In addition, piled foundations may be required for the substation building. It is anticipated that the substation platform and construction compound platform will likely be constructed using floating techniques. The proposed construction method for all the new proposed access roads is a floated technique.

The total estimated volume of peat and overburden to be excavated during the construction phase of the proposed development is 97,980m3. These quantities were calculated by FT as part of the Peat and Spoil Management Plan presented in Appendix 4-2 of the EIAR

Peat instability or failure refers to a significant mass movement of a body of peat that would have an adverse impact on proposed wind farm development and the surrounding environment. Peat failure excludes localised movement of peat that could occur below an access road, creep movement or erosion type events. In the absence of appropriate mitigation, the consequence of peat failure at the study area may result in:

- Death or injury to site personnel;
- Damage to machinery;
- Damage or loss of access tracks;
- Drainage disrupted;
- Site works damaged or unstable;
- Contamination of watercourses, water supplies by sediment particulates; and,
- Degradation of the environment.

A Geotechnical & Peat Stability Assessment Report has been prepared by AGEC which provides a Geotechnical Risk Register for the site and includes details of the required mitigation/control measures. These mitigation measures are summarised below and in Appendix 8-1 of the EIAR.

The peat stability assessment indicates that there is insignificant risk of peat failure. The following mitigation measures are recommended and should be taken into account when preparing Construction Method Statements for the proposed development:

- Avoidance of uncontrolled concentrated water discharge onto peat slopes identified as being unsuitable for such discharge.
- Avoidance of unstable excavations. All excavations shall be suitably supported to prevent collapse and development of tension cracks.

- Avoidance of placing fill and excavations in the vicinity of steeper peat slopes, that is at the crest or toe of the slope.
- Installation and regular monitoring of geotechnical instrumentation, as appropriate, during construction in areas of possible poor ground, such as deeper peat deposits.
- Site reporting procedures to ensure that working practices are suitable for the encountered ground conditions. Ground conditions to be assessed by suitably experienced geotechnical engineer.
- Regular briefing of all site staff (e.g. toolbox talks) to provide feedback on construction and ground performance and to promote reporting of any observed change in ground conditions.
- Routine inspection of wind farm site by contractor to include an assessment of ground stability conditions (e.g. cracking, excessive floating road settlement, disrupted surface, closed-up drains) and drainage conditions (e.g. blocked drains, absence of water in previously flowing drains, springs, etc).
- Peat movement monitoring posts will be installed upslope and downslope of access roads and at locations where peat depths are greater than 4.0m.

5.4.1.4 Field Monitoring

Field chemistry measurements of unstable parameters, (pH, conductivity, temperature) analyses will be carried out by either the Environmental Manager or the Project Hydrologist at all surface water monitoring locations. In-situ field monitoring will be completed on a weekly basis (with some parameters monitored monthly). In-situ field monitoring will also be completed after major rainfall events, i.e. after events of >25mm rainfall in any 24-hour period. The supervising hydrologist will monitor and advise on the readings collected by in-situ field monitoring.

5.4.1.5 Monitoring Parameters

Parameter	EQS	Event	Methodology
Visual Inspection	No abnormal change	Daily	Field Inspection and photographic record.
pH	4.5<pH>9.0	Weekly	Field Measurement (Handheld probe)
Dissolved Oxygen	No abnormal change	Weekly	Field Measurement (Handheld probe)
Conductivity	No abnormal change	Weekly	Field Measurement (Handheld probe)
Temperature	No abnormal change	Weekly	Field Measurement (Handheld probe)
Ammonia	High Status ≤0.04mg/L Good Status ≤0.065mg/L	Monthly	Accredited Laboratory Analysis

Nitrate	-	Monthly	Accredited Laboratory Analysis
BOD	High Status ≤1.3 mg/L Good Status ≤1.5 mg/L	Monthly	Accredited Laboratory Analysis
Total Petroleum Hydrocarbons	Below Detection Limit	Monthly/Following potential hydrocarbon spill	Accredited Laboratory Analysis
Orthophosphate	High Status ≤0.025 Good Status ≤0.035		
Alkalinity	No abnormal change	Monthly/Following potential cement leaching	

5.4.2 Operation Phase Mitigation

The operational phase drainage system will be installed and constructed in conjunction with the road and hardstanding construction work as described below:

- Runoff from individual turbine hardstanding areas will not be discharged into the existing drain network, but discharged locally at each turbine location through settlement ponds and buffered outfalls onto vegetated surfaces;
- Interceptor drains will be installed up-gradient of all proposed infrastructure to collect clean surface runoff, in order to minimise the amount of runoff reaching areas where suspended sediment could become entrained. It will then be directed to areas where it can be re-distributed over the ground by means of a level spreader;
- Swales/road side drains will be used to collect runoff from access roads and turbine hardstanding areas of the site, likely to have entrained suspended sediment, and channel it to settlement ponds for sediment settling;
- On steep sections of access road transverse drains ('grips') will be constructed where appropriate in the surface layer of the road to divert any runoff off the road into swales/road side drains;
- Check dams will be used along sections of access road drains to intercept silts at source. Check dams will be constructed from a 4/40mm non-friable crushed rock;
- Settlement ponds, emplaced downstream of road swale sections and at turbine locations, will buffer volumes of runoff discharging from the drainage system during periods of high rainfall, by retaining water until the storm hydrograph has receded, thus reducing the hydraulic loading to watercourses; and,
- Settlement ponds will be designed in consideration of the greenfield runoff rate.

5.4.2.1 Decommissioning Phase Mitigation

The wind turbines proposed as part of the Proposed Development are expected to have a lifespan of approximately 30 years. Following the end of their useful life, the equipment may be replaced with a

new technology, subject to planning permission being obtained, or the Proposed Development may be decommissioned fully.

Upon decommissioning of the Proposed Development, the wind turbines will be disassembled in reverse order to how they were erected. The turbines will be disassembled with the same model of cranes that were used for their erection. The turbine will be removed from site using the same transport methodology adopted for delivery to site initially. The turbine materials will be transferred to a suitable recycling or recovery facility.

All above ground turbine components would be separated and removed off-site for recycling. Turbine foundations would remain in place underground and would be covered with earth and reseeded as appropriate. Leaving the turbine foundations in-situ is considered a more environmentally prudent option, as to remove that volume of reinforced concrete from the ground could result in environment emissions such as noise, dust and/or vibration.

Site roadways will be in use for purposes other than the operation of the Proposed Development by the time the decommissioning of the Proposed Development is to be considered, and therefore it may be more appropriate to leave the site roads in situ for future use. It is envisaged that the roads will provide a useful means of extracting the commercial forestry crop which exists on the site. If it were to be confirmed that the roads were not required in the future for any other useful purpose, they could be removed where required.

A Decommissioning Plan has been prepared (Appendix 4-11, Chapter 4 of the EIAR) the detail of which will be agreed with the local authority prior to any decommissioning. The Decommissioning Plan will be updated prior to the end of the operational period in line with decommissioning methodologies that may exist at the time and will agreed with the competent authority at that time. The potential for effects during the decommissioning phase of the Proposed Development has been fully assessed in the accompanying EIAR and within this NIS.

6. ASSESSMENT OF RESIDUAL ADVERSE EFFECTS

The potential for significant effects on each of the individual Qualifying Interests (QIs) and Special Conservation Interests (SCIs) that were identified as being at risk of potential effects in the AA Screening Report are assessed in this section in view of the Conservation Objectives of those habitats and species.

6.1 Lough Owel SAC

A watercourse flows under the N4 where the cable is to be laid and provides hydrological connectivity with this SAC. The proposed works have the potential to cause deterioration in surface water quality through the run-off of silt, hydrocarbons, cementitious material and other pollutants during the construction phase of the development potentially affecting the following habitats and species:

- Hard oligo-mesotrophic waters with benthic vegetation of *Chara spp.* [3140]
- Alkaline fens [7230]
- Transition mires and quaking bogs [7140]
- *Austropotamobius pallipes* (White-clawed Crayfish) [1092]

6.1.1 Hard oligo-mesotrophic waters with benthic vegetation of *Chara spp.* [3140]

The identified pathways for effect are deterioration in water quality during the construction phase of the development, potentially resulting in deterioration of the downstream Hard oligo-mesotrophic waters with benthic vegetation of *Chara spp.* habitat.

The conservation objective for this QI is:

> *'To maintain the favourable conservation condition of Hard oligo-mesotrophic waters with benthic vegetation of Chara spp. in Lough Owel SAC.'*

Targets and attributes for the conservation of this habitat are available in the detailed Conservation Objective document (NPWS, 2018). An assessment of the Proposed Development against the nominated attributes and targets for this habitat is provided in Table 6-1 below.

Table 6-1 Targets and attributes associated with the conservation objectives for Hard oligo-mesotrophic waters with benthic vegetation of Chara spp

Attribute	Target	Assessment
Habitat area	Area stable or increasing, subject to natural processes.	This habitat was not identified within or adjacent to the Proposed Development site. All works a restricted to the existing N4 road. A range of mitigation measures, outlined in Section 3.3 of this report, in the hydrology chapter of the accompanying EIAR and in the accompanying CEMP are in place to avoid water pollution in European Sites during the
Habitat distribution	No decline, subject to natural processes	
Typical species	Typical species present, in good condition, and demonstrating typical abundances and distribution	

Attribute	Target	Assessment
Vegetation composition: characteristic zonation	All characteristic zones should be present, correctly distributed and in good condition	construction, operational and decommissioning phase. Taking into consideration the preventative measures to avoid impact, it can be concluded that the Proposed Development will not result in any impacts which could adversely affect the extent of this habitat within the SAC.
Vegetation distribution: maximum depth	Maintain maximum depth of vegetation, subject to natural processes	
Hydrological regime: water level fluctuations	Maintain/restore appropriate hydrological regime necessary to support the habitat	Following the implementation of mitigation as described above, any potential pathway for effect on this habitat is robustly blocked. There will be no alteration to the hydrological regime, lake substratum, water quality or fringing habitat area as a result of the Proposed Development.
Lake substratum quality	Maintain appropriate substratum type, extent and chemistry to support the vegetation	
Water quality: transparency	Maintain/restore appropriate Secchi transparency. There should be no decline in Secchi depth/transparency	
Water quality: nutrients	Maintain/restore the concentration of nutrients in the water column to sufficiently low levels to support the habitat and its typical species	
Water quality: phytoplankton biomass	Maintain/restore appropriate water quality to support the habitat, including high chlorophyll a status	
Water quality: phytoplankton composition	Maintain/restore appropriate water quality to support the habitat, including high phytoplankton composition status	
Water quality: attached algal biomass	Maintain trace/absent attached algal biomass (<5% cover)	
Water quality: macrophyte status	Maintain high macrophyte status	
Acidification status	Maintain appropriate water and sediment pH, alkalinity and cation concentrations to support the habitat, subject to natural processes	
Water colour	Maintain appropriate water colour to support the habitat	
Dissolved organic carbon (DOC)	Maintain appropriate organic carbon levels to support the habitat	
Turbidity	Maintain appropriate turbidity to support the habitat	

Attribute	Target	Assessment
Fringing habitat: area and condition	Maintain the area and condition of fringing habitats necessary to support the natural structure and functioning of habitat 3140	

6.1.2 Alkaline Fens [7230]

The identified pathways for effect are deterioration in water quality during the construction phase of the Proposed Development, potentially affecting this downstream habitat. Following the precautionary principle, there is potential for water pollution to result in deterioration of the substrate on which this habitat is formed and potential impediment of ground flora and regeneration of sedge and reed species that predominate in this habitat.

The conservation objective for this habitat is:

'To maintain the favourable conservation condition of Alkaline fens in Lough Owel SAC.'

Targets and attributes for the conservation of this habitat are available in the detailed Conservation Objective document (NPWS, 2018). The targets and attributes for this habitat have been reviewed and considered in relation to the current development and are described in Table 6-2.

Table 6-2 Assessment of development against targets and attributes of calcareous fens

Attribute	Target	Assessment
Habitat area	Area stable or increasing, subject to natural processes	This habitat was not identified within or adjacent to the Proposed Development site. All works a restricted to the existing N4 road. A range of mitigation measures, outlined in Section 3.3 of this report, in the hydrology chapter of the accompanying EIAR and in the accompanying CEMP are in place to avoid water pollution in European Sites during the construction, operational and decommissioning phase. Taking into consideration the preventative measures to avoid impact, it can be concluded that the Proposed Development will not result in any impacts which could adversely affect the extent of this habitat within the SAC. There will be no alteration to any alkaline fen habitat within the SAC in terms of size, habitat area or distribution associated with the Proposed Development.
Habitat distribution	No decline, subject to natural processes	
Ecosystem function: soil nutrients	Maintain soil pH and nutrient status within natural ranges	Following the implementation of mitigation, the pathway for any effect on this habitat is robustly blocked such that there is no potential for alteration to the ecosystem function of this
Ecosystem function: peat formation	Maintain active peat formation, where appropriate	

Attribute	Target	Assessment
Ecosystem function: hydrology - groundwater levels	Maintain, or where necessary restore, appropriate natural hydrological regimes necessary to support the natural structure and functioning of the habitat	habitat within the SAC associated with the Proposed Development.
Ecosystem function: hydrology - surface water flow	Maintain, or where necessary restore, as close as possible to natural or semi-natural, drainage conditions	
Ecosystem function: water quality	Maintain appropriate water quality, particularly pH and nutrient levels, to support the natural structure and functioning of the habitat	
Community diversity	Maintain variety of vegetation communities, subject to natural processes	Following the implementation of mitigation as described above, any potential pathway for effect on this habitat is robustly blocked. The Proposed Development will have no impact on the ecological processes that influence the vegetation composition of this habitat.
Vegetation composition: brown mosses	Maintain adequate cover of typical brown moss species	
Vegetation composition: typical vascular plants	Maintain adequate cover of typical vascular plant species	
Vegetation composition: native negative indicator species	Cover of native negative indicator species at insignificant levels	
Vegetation composition: non-native species	Cover of non-native species less than 1%	
Vegetation composition: native trees and shrubs	Cover of scattered native trees and shrubs less than 10%	
Vegetation composition: soft rush and common reed cover	Total cover of soft rush (Juncus effusus) and common reed (Phragmites australis) less than 10%	
Vegetation structure: litter	Total cover of litter not more than 25%	
Physical structure: disturbed bare ground	Cover of disturbed bare ground not more than 10%	
Physical structure: tufa formations	Disturbed proportion of vegetation cover where tufa is present is less than 1%	
Indicators of local distinctiveness	No decline in distribution or population sizes of rare, threatened or scarce species associated with the habitat; maintain features of local	

Attribute	Target	Assessment
	distinctiveness, subject to natural processes	

6.1.3 Transition mires and quaking bogs [7140]

The identified pathways for effect are deterioration in water quality during the construction phase of the Proposed Development. Following the precautionary principle, there is potential for water pollution to result in deterioration of the substrate on which this habitat is formed and potential impediment of ground flora.

The conservation objective for this QI is:

> '*To maintain the favourable conservation condition of Transition mires and quaking bogs in Lough Owel SAC*

Targets and attributes for the conservation of this habitat are available in the detailed Conservation Objective document (NPWS, 2018). An assessment of the Proposed Development against the nominated attributes and targets for this habitat is provided in Table 6-3 below.

Table 6-3 Targets and attributes associated with the conservation objectives for Transition mires and quaking bogs

Attribute	Target	Assessment
Habitat area	Area stable or increasing, subject to natural processes	This habitat was not identified within or adjacent to the Proposed Development site. All works will be restricted to the existing N4 road. A range of mitigation measures, outlined in Section 3.3 of this report, in the hydrology chapter of the accompanying EIAR and in the accompanying CEMP are in place to avoid water pollution in European Sites during the construction, operational and decommissioning phase. Taking into consideration the preventative measures to avoid impact, it can be concluded that the Proposed Development will not result in any impacts which could adversely affect the extent of this habitat within the SAC.
Habitat distribution	No decline, subject to natural processes	
Ecosystem function: soil nutrients	No decline, subject to natural processes	Following the implementation of mitigation as described above, any potential pathway for effect on this habitat is robustly blocked. There will be no alteration to the ecosystem function or hydrological regime as a result of the Proposed Development.
Ecosystem function: peat formation	Maintain soil pH and nutrient status within natural ranges	
Ecosystem function: hydrology - groundwater levels	Maintain, or where necessary restore, appropriate water levels necessary to support the natural structure and functioning of the habitat	

Attribute	Target	Assessment
Ecosystem function: hydrology – flow patterns	Maintain, or where necessary restore, appropriate topography and water movement regime necessary to support the natural structure and functioning of the habitat	
Ecosystem function: water quality	Maintain, or where necessary restore, appropriate water quality to support the natural structure and functioning of the habitat	
Community diversity	Maintain variety of vegetation communities, subject to natural processes	Following the implementation of mitigation as described above, any potential pathway for effect on this habitat is robustly blocked. The Proposed Development will have no impact on the ecological process that influence the vegetation composition of this habitat.
Vegetation composition: typical vascular plants and bryophytes	Maintain adequate cover of typical vascular plant and bryophyte species	
Vegetation composition: native negative indicator species	Native negative indicator species at insignificant levels	
Vegetation composition: non-native species	Cover of non-native species less than 1%	
Physical structure: drainage	Area showing signs of drainage from heavy trampling, tracking or ditches less than 10%	
Physical structure: disturbed bare ground	Cover of disturbed bare ground not more than 10%.	
Indicators of local distinctiveness	No decline in distribution or population sizes of rare, threatened or scarce species associated with the habitat; maintain features of local distinctiveness, subject to natural processes	

6.1.4 White-clawed Crayfish [1092]

The identified pathways for effect are deterioration in water quality during the construction phase of the Proposed Development, potentially affecting this downstream habitat. Following the precautionary principle, there is potential for water pollution to result in deterioration of the habitat which supports White-clawed Crayfish.

The conservation objective for this species is:

> *'To maintain the favourable conservation condition of White-clawed Crayfish in Lough Owel SAC.'*

Targets and attributes for the conservation of this habitat are available in the detailed Conservation Objective document (NPWS, 2018). The targets and attributes for this habitat have been reviewed and considered in relation to the Proposed Development and are described in Table 6-4.

Table 6-4 Assessment of development against targets and attributes of alkaline fens

Attribute	Target	Assessment
Distribution	No reduction from baseline. See map 5	The supporting habitat for this species was not identified within or adjacent to the Proposed Development site during the surveys. All works will be restricted to the existing N4 road. A range of mitigation measures, outlined in Section 3.3 of this report, in the hydrology chapter of the accompanying EIAR and in the accompanying CEMP are in place to avoid water pollution in European Sites during the construction, operational and decommissioning phase. Taking into consideration the preventative measures to block any pathway for effect, it can be concluded that the Proposed Development will not result in any impact which could adversely affect White-clawed Crayfish or the aquatic habitat which supports this species.
Population structure: recruitment	Juveniles and/or females with eggs should be present in all occupied 1km squares, subject to natural processes and availability of suitable habitat	
Negative indicator species	No instances of disease	
Water quality	Maintain appropriate water quality, particularly pH and nutrient levels, to support the natural structure and functioning of lake habitat 3140	
Habitat quality: heterogeneity	No decline in heterogeneity or habitat quality	

6.1.5 Determination

Following an examination, evaluation and analysis, in light of best scientific knowledge, and, on the basis of objective information, having taken into account the relevant mitigation measures, it can be concluded that the Proposed Development will not have an adverse impact on Lough Owel SAC.

6.2 Lough Ennell SAC

The SAC is located approximately 4.2km south of the proposed grid connection route and 24.2km from the proposed wind farm site. There is hydrological connectivity between the proposed grid connection route and the SAC approximately 8.8km (hydrological distance) downstream. The proposed works have the potential to cause deterioration in surface water quality through the run-off of silt, hydrocarbons, cementitious material and other pollutants during the construction phase of the development potentially affecting the following habitat:

- Alkaline fens [7230]

6.2.1 Alkaline Fens [7230]

The identified pathways for effect are deterioration in water quality during the construction phase of the Proposed Development, potentially affecting this downstream habitat. Following the precautionary principle, there is potential for water pollution to result in deterioration of the substrate on which this habitat is formed and potential impediment of ground flora and regeneration of sedge and reed species that predominate in this habitat.

The conservation objective for this habitat is:

'To maintain the favourable conservation condition of Alkaline fens in Lough Ennell SAC.'

Targets and attributes for the conservation of this habitat are available in the detailed Conservation Objective document (NPWS, 2018). The targets and attributes for this habitat have been reviewed and considered in relation to the current development and are described in Table 6-5.

Table 6-5 Assessment of development against targets and attributes of calcareous fens

Attribute	Target	Assessment
Habitat area	Area stable or increasing, subject to natural processes	This habitat was not identified within or adjacent to the Proposed Development site during the surveys and no works will take place within 4.2km of the SAC. A range of mitigation measures, outlined in Section 3.3 of this report, in the hydrology chapter of the accompanying EIAR and in the accompanying CEMP are in place to avoid water pollution in European Sites during the construction, operational and decommissioning phase. Taking into consideration the preventative measures to avoid impact, it can be concluded that the Proposed Development will not result in any impacts which could adversely affect the extent of this habitat within the SAC. There will be no alteration to any calcareous fen habitat within the SAC in terms of size, habitat area or distribution associated with the Proposed Development.
Habitat distribution	No decline, subject to natural processes	
Ecosystem function: soil nutrients	Maintain soil pH and nutrient status within natural ranges	Following the implementation of mitigation, the pathway for any effect on this habitat is robustly blocked such that there is no potential for alteration to the ecosystem function of this habitat within the SAC associated with the Proposed Development.
Ecosystem function: peat formation	Maintain active peat formation, where appropriate	
Ecosystem function: hydrology - groundwater levels	Maintain, or where necessary restore, appropriate natural hydrological regimes necessary to support the natural structure and functioning of the habitat	
Ecosystem function: hydrology - surface water flow	Maintain, or where necessary restore, as close as possible to natural or semi-natural, drainage conditions	
Ecosystem function: water quality	Maintain appropriate water quality, particularly pH and nutrient levels, to support the natural structure and functioning of the habitat	

Attribute	Target	Assessment
Community diversity	Maintain variety of vegetation communities, subject to natural processes	Following the implementation of mitigation as described above, any potential pathway for effect on this habitat is robustly blocked. The Proposed Development will have no impact on the ecological process that influence the vegetation composition of this habitat.
Vegetation composition: brown mosses	Maintain adequate cover of typical brown moss species	
Vegetation composition: typical vascular plants	Maintain adequate cover of typical vascular plant species	
Vegetation composition: native negative indicator species	Cover of native negative indicator species at insignificant levels	
Vegetation composition: non-native species	Cover of non-native species less than 1%	
Vegetation composition: native trees and shrubs	Cover of scattered native trees and shrubs less than 10%	
Vegetation composition: soft rush and common reed cover	Total cover of soft rush (Juncus effusus) and common reed (Phragmites australis) less than 10%	
Vegetation structure: litter	Total cover of litter not more than 25%	
Physical structure: disturbed bare ground	Cover of disturbed bare ground not more than 10%	
Physical structure: tufa formations	Disturbed proportion of vegetation cover where tufa is present is less than 1%	
Indicators of local distinctiveness	No decline in distribution or population sizes of rare, threatened or scarce species associated with the habitat; maintain features of local distinctiveness, subject to natural processes	

6.2.2 Determination

Following an examination, evaluation and analysis, in light of best scientific knowledge, and, on the basis of objective information, having taken into account the relevant mitigation measures, it can be concluded that the Proposed Development will not have an adverse impact on Lough Ennell SAC.

6.3 Lough Owel SPA

The proposed grid connection route is located within the existing N4 corridor along the boundary of the SPA. A watercourse flows under the N4 where the cable is to be laid and provides hydrological connectivity with this SPA.

The proposed works have the potential to cause deterioration of water quality during the construction, phase of the development These effects could occur in the form of release of suspended solids or hydrocarbons during the works associated with the laying of cable for the grid connection. These impacts could potentially affect the wetland habitat of the SCI species associated with the SPA.: On a precautionary basis, due to the close proximity of the grid connection route, a potential pathway for indirect effects was identified in the form of bird disturbance and deterioration of habitat as described above. These impacts have the potential to adversely affect the following SCIs:

- 'Wetland and Waterbirds [A999]
- Shoveler *Anas clypeata* [A056]
- Coot *Fulica atra* [A125]

6.3.1 Wetland and Waterbirds [A999]

The identified pathways for effect are deterioration in water quality and therefore habitat quality during the construction phase of the development. Following the precautionary principle, this could potentially affect food availability and the nesting/foraging value of the wetland habitat.

The conservation objective for this SCI is:

> *'To maintain or restore the favourable conservation condition of the wetland habitat at Lough Owel SPA as a resource for the regularly-occurring migratory waterbirds that utilise it.'*

There are no specific conservation objectives for this SPA. As a result, example objectives for this wetland habitat have been taken from other sites with site-specific conservation objectives in order to provide further assessment as per the table below.

Table 6-6 Targets and attributes associated with the site-specific conservation objectives for Wetland and Waterbirds [A999].

Attribute		Target	Assessment
Habitat area		The permanent area occupied by wetland habitat should be stable other than that occurring from natural patterns of variation.	There will be no direct loss or decrease in wetland habitat associated with the Proposed Development as the footprint of the development is entirely outside of the boundary of the SPA. The potential for indirect effect as a result of deterioration in water quality during the construction phase was considered. Deterioration of water quality could potentially lead to adverse impacts on of food availability and nesting/foraging habitat.

Attribute		Target	Assessment
			A range of mitigation measures, outlined in Section 3.3 of this report, in the hydrology chapter of the accompanying EIAR and in the accompanying CEMP are in place to avoid water pollution in any European Site during the construction, operational and decommissioning phase. Taking into consideration the preventative measures to avoid impact, it can be concluded that the Proposed Development will not result in any impacts which could adversely affect the extent of this habitat within the SPA. There will be no deterioration in the condition of downstream wetland habitat and therefore no reduction in habitat area as a result of the Proposed Development.

6.3.2 SCI Species (Shoveler and Coot)

According to the bird surveys carried out between 2015-2017, 2018-2020 or 2021 - 2022 shoveler were not recorded at the proposed wind farm site (including 500m buffer). The Proposed Development has no potential to result in direct habitat loss, displacement or barrier effect on Shoveler .

Coot was recorded within 500m of the wind farm site on only seven occasions during the extensive suite of surveys undertaken. There is no evidence to suggest that the development Site is of significance to this species. No potential for adverse effects on this species associated with Lough Owel SPA in the form of ex situ habitat loss, disturbance, displacement or collision is anticipated.

The development Site is not of significance to these species.

Following the precautionary principle, the potential for the construction of the grid connection adjacent to the SPA has the potential to result in disturbance to these species and there is also the potential for water pollution to result in habitat deterioration for the species.

No site-specific conservation objectives are available for Lough Owel SPA, however other sites with this SCI species were reviewed to further inform the assessment. The extrapolated targets and attributes for this SCI have been reviewed and considered in relation to the current development as described below.

Table 6-7 Targets and attributes associated with the nominated conservation objectives for Shoveler and Coot

Attribute	Target	Assessment
Population trend	Long term population trend stable or increasing	The proposed grid connection works will be short-term in duration and restricted to the existing N4 road corridor. There will be no loss of potential supporting habitat for any SCI species. The proposed grid connection works will be similar in nature, scale and duration to road maintenance works and will not result in any adverse effects as a result of disturbance. There is no potential for

		the Proposed Development to adversely affect the population trend within the SPA. A range of mitigation measures, outlined in Section 3.3 of this report, in the hydrology chapter of the accompanying EIAR and in the accompanying CEMP are in place to avoid water pollution in any European Site during the construction, operational and decommissioning phase. Taking into consideration the preventative measures to avoid impact, it can be concluded that the Proposed Development will not result in any impacts which could adversely affect the extent of this habitat within the SPA. There will be no deterioration in the condition of downstream wetland habitat and therefore no effect on population trend as a result of the Proposed Development.
Distribution	There should be no significant decrease in the range, timing and intensity of use of areas by these SCI species, other than that occurring from natural patterns of variation.	The proposed grid connection works will be short-term in duration and restricted to the existing N4 road corridor. There will be no loss of potential supporting habitat for any SCI species. The proposed grid connection works will be similar in nature, scale and duration to road maintenance works and will not result in any adverse effects as a result of disturbance. The Proposed Development will not adversely affect the distribution of the species within the SPA. Similarly, with the mitigation as described above in place, there is no potential for any deterioration in water quality to result in adverse effects on species distribution.

6.3.3 Determination

Following an examination, evaluation and analysis, in light of best scientific knowledge, and, on the basis of objective information, having taken into account the relevant mitigation measures, it can be concluded that the Proposed Development will not have an adverse impact on Lough Owel SPA.

6.4 Lough Ennell SPA

The SPA is located 4.5km south of the proposed grid connection route and 24.4km south of the proposed wind farm site. Due to this distance there is no potential for significant indirect effects as a result of disturbance. There is hydrological connectivity between the proposed grid connection route and the SPA approximately 9.2km (hydrological distance) downstream. Taking a precautionary approach, a potential pathway for indirect effects in the form of surface water deterioration through the run off of silt, hydrocarbons, cementitious material and other pollutants during the construction phase was identified. These impacts could potentially affect the wetland habitat of the SCI species associated with the SPA. These include:

- Pochard *Aythya ferina* [A059]
- Tufted duck *Aythya fuligula* [A061]
- Coot *Fulica atra* [A125]
- Wetland and Waterbirds [A999]

The identified pathways for effect are deterioration in water quality and therefore habitat quality during the construction phase of the development. Following the precautionary principle, this could potentially affect food availability and the nesting/foraging value of the wetland habitat and the habitat of the other SCI species.

Site specific conservation objectives documents are not available for this site. The conservation objectives for this site are::

> *"To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests of this SPA."*

> '*To maintain or restore the favourable conservation condition of the wetland habitat at Lough Ennell SPA as a resource for the regularly-occurring migratory waterbirds that utilise it'.*

There are no specific conservation objectives for this SPA. As a result, example objectives for this wetland habitat have been taken from other sites with site-specific conservation objectives in order to provide further assessment.

6.4.1 Wetland and Waterbirds [A999]

Table 6-8 Example targets and attributes associated with the site-specific conservation objectives for Wetland and Waterbirds [A999].

Attribute	Target	Assessment
Habitat area	The permanent area occupied by wetland habitat should be stable other than that occurring from natural patterns of variation.	There will be no direct loss or decrease in wetland habitat associated with the Proposed Development as the footprint of the development is entirely outside of the boundary of the SPA. The potential for indirect effect as a result of deterioration in water quality during the construction phase was considered. Deterioration of water quality could potentially lead to adverse impacts on of food availability and nesting/foraging habitat.

Attribute	Target	Assessment
		A range of mitigation measures, outlined in Section 3.3 of this report, in the hydrology chapter of the accompanying EIAR and in the accompanying CEMP are in place to avoid water pollution in any European Site during the construction, operational and decommissioning phase. Taking into consideration the preventative measures to avoid impact, it can be concluded that the Proposed Development will not result in any impacts which could adversely affect the extent of this habitat within the SPA. There will be no deterioration in the condition of downstream wetland habitat and therefore no reduction in habitat area as a result of the Proposed Development.

6.4.2 SCI Species

Table 6-9 Targets and attributes associated with the nominated conservation objectives for pochard, tufted duck and coot

Attribute	Target	Assessment
Population trend	Long term population trend stable or increasing	A range of mitigation measures, outlined in Section 3.3 of this report, in the hydrology chapter of the accompanying EIAR and in the accompanying CEMP are in place to avoid water pollution in any European Site during the construction, operational and decommissioning phase. Taking into consideration the preventative measures to avoid impact, it can be concluded that the Proposed Development will not result in any impacts which could adversely affect the extent of this habitat within the SPA. There will be no deterioration in the condition of downstream wetland habitat and therefore no effect on population trend as a result of the Proposed Development.
Distribution	There should be no significant decrease in the range, timing and intensity of use of areas by these SCI species, other than that occurring from natural patterns of variation.	With the mitigation as described above in place, there is no potential for any deterioration in water quality to result in adverse effects on species distribution.

6.4.3 Determination

Following an examination, evaluation and analysis, in light of best scientific knowledge, and, on the basis of objective information, having taken into account the relevant mitigation measures, it can be concluded that the Proposed Development will not have an adverse impact on Lough Ennell SPA.

6.5 Lough Derravarragh SPA

Given that the SPA is located hydrologically downstream of the Proposed Development site there is potential for indirect effects on surface water quality through the run off of silt, hydrocarbons, cementitious material and other pollutants during the construction phase of the Proposed Development. These impacts could potentially affect the wetland habitat of the SCI species associated with the SPA. The proposed grid connection route is located approximately 70m west of the SPA. Therefore, potential for disturbance to the SCI species associated with the SPA have also been considered. The following SCIs were identified as having potential to be impacted by the Proposed Development are considered below:

- Whooper swan *Cygnus cygnus* [A038]
- Pochard *Aythya ferina* [A059]
- Tufted duck *Aythya fuligula* [A061]
- Coot *Fulica atra* [A125]
- Wetlands and Waterbirds[A999]

In addition, the Proposed Development is located within the potential core foraging range of Whooper Swan which is an SCI species associated with the SPA (SNH Guidelines (2016) and the potential for ex situ habitat loss, disturbance, displacement, barrier effect and collision was considered in this NIS.

The conservation objectives for this SPA are

> *'To maintain or restore the favourable conservation condition of the wetland habitat at Lough Derravarragh SPA as a resource for the regularly-occurring migratory waterbirds that utilise it.'*
>
> *"To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests of this SPA."*

There are no specific conservation objectives for this SPA. As a result, example objectives for this wetland habitat have been taken from other sites with site-specific conservation objectives in order to provide further assessment.

6.5.1 Wetland and Waterbirds [A999]

Table 6-10 Targets and attributes associated with the site-specific conservation objectives for Wetland and Waterbirds [A999].

Attribute		Target	Assessment
Habitat area		The permanent area occupied by wetland habitat should be stable other than that occurring from natural patterns of variation.	There will be no direct loss or decrease in wetland habitat associated with the Proposed Development as the footprint of the development is entirely outside of the boundary of the SPA. The potential for indirect effect as a result of deterioration in water quality during the construction phase was considered. Deterioration of water quality could potentially lead to adverse impacts on of food availability and nesting/foraging habitat. A range of mitigation measures, outlined in Section 3.3 of this report, in the hydrology chapter of the accompanying EIAR and in the accompanying CEMP are in place to avoid water pollution in

Attribute		Target	Assessment
			any European Site during the construction, operational and decommissioning phase. Taking into consideration the preventative measures to avoid impact, it can be concluded that the Proposed Development will not result in any impacts which could adversely affect the extent of this habitat within the SPA. There will be no deterioration in the condition of downstream wetland habitat and therefore no reduction in habitat area as a result of the Proposed Development.

6.5.2 SCI Species affected by Water Pollution and Disturbance

Table 6-11 Targets and attributes associated with the nominated conservation objectives for whooper swan, pochard, tufted duck and Coot

Attribute	Target	Assessment
Population trend	Long term population trend stable or increasing	The proposed grid connection works will be short-term in duration and restricted to the existing road corridor. There will be no loss of potential supporting habitat for any SCI species. The proposed grid connection works will be similar in nature, scale and duration to road maintenance works and will not result in any adverse effects as a result of disturbance. There is no potential for the Proposed Development to adversely affect the population trend within the SPA. A range of mitigation measures, outlined in Section 3.3 of this report, in the hydrology chapter of the accompanying EIAR and in the accompanying CEMP are in place to avoid water pollution in any European Site during the construction, operational and decommissioning phase. Taking into consideration the preventative measures to avoid impact, it can be concluded that the Proposed Development will not result in any impacts which could adversely affect the extent of this habitat within the SPA. There will be no deterioration in the condition of downstream wetland habitat and therefore no effect on population trend as a result of the Proposed Development.
Distribution	There should be no significant decrease in the range, timing and intensity of use of areas by these SCI species, other than that occurring from natural patterns of variation.	The proposed grid connection works will be short-term in duration and restricted to the existing N4 road corridor. There will be no loss of potential supporting habitat for any SCI species. The proposed grid connection works will be similar in nature, scale and duration to road maintenance works and will not result in any adverse effects as a result of disturbance. The Proposed Development will not adversely affect the distribution of the species within the SPA.

		Similarly, with the mitigation as described above in place, there is no potential for any deterioration in water quality to result in adverse effects on species distribution.

6.5.3 Whooper Swan

Table 6-12 Targets and attributes associated with the nominated conservation objectives for Whooper Swan

Attribute	Target	Assessment
Population trend	Long term population trend stable or increasing	The detailed assessment provided in Section 5 of this NIS has found that there is no potential for the proposed development to result in adverse effects on this species associated with this SPA as a result of ex situ habitat loss, disturbance, displacement, barrier effect or collision. It can therefore be concluded that there is no potential for the development to result in any adverse effect on the population trend within the SPA
Distribution	There should be no significant decrease in the range, timing and intensity of use of areas by whooper swan, other than that occurring from natural patterns of variation.	The detailed assessment provided in Section 5 of this NIS has found that there is no potential for the proposed development to result in adverse effects on this species associated with this SPA as a result of ex situ habitat loss, disturbance, displacement, barrier effect or collision. It can therefore be concluded that there is no potential for the development to result in any adverse effect on the distribution of the species within the SPA

6.5.4 Determination

Following an examination, evaluation and analysis, in light of best scientific knowledge, and, on the basis of objective information, having taken into account the relevant mitigation measures, it can be concluded that the Proposed Development will not have an adverse impact on Lough Derravarragh SPA.

6.6 Lough Iron SPA

Given that the SPA is located hydrologically downstream of the Proposed Development site there is potential for indirect effects on surface water quality through the run off of silt, hydrocarbons, cementitious material and other pollutants during the construction phase of the Proposed Development. These impacts could potentially affect the wetland habitat of the SCI species associated with the SPA. The following SCIs were identified as having potential to be impacted by the Proposed Development are considered below:

- Whooper Swan *Cygnus cygnus* [A038]
- Wigeon *Anas penelope* [A050]
- Teal *Anas creca* [A052]
- Shoveler *Anas clypeata* [A056]
- Coot *Fulica atra* [A125]
- Golden Plover *Pluvialis apricaria* [A140]
- Greenland White-fronted Goose *Anser albifrons flavirostris* [A395]
- Wetland and Waterbirds [A999]

In addition, following the precautionary principle, the Proposed Development has been assessed for the potential for ex situ habitat loss, disturbance, displacement, barrier effect and collision in respect of Greenland white fronted goose, whooper swan and golden plover.

The conservation objectives for this SPA are

> *'To maintain or restore the favourable conservation condition of the wetland habitat at Lough Iron SPA as a resource for the regularly-occurring migratory waterbirds that utilise it.'*
>
> *"To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests of this SPA."*

There are no specific conservation objectives for this SPA. As a result, example objectives for this wetland habitat have been taken from other sites with site-specific conservation objectives in order to provide further assessment.

6.6.1 Wetland and Waterbirds [A999]

Table 6-13 Targets and attributes associated with the site-specific conservation objectives for Wetland and Waterbirds [A999].

Attribute	Target	Assessment
Habitat area	The permanent area occupied by wetland habitat should be stable other than that occurring from natural patterns of variation.	There will be no direct loss or decrease in wetland habitat associated with the Proposed Development as the footprint of the development is entirely outside of the boundary of the SPA. The potential for indirect effect as a result of deterioration in water quality during the construction phase was considered. Deterioration of water quality could potentially lead to adverse impacts on of food availability and nesting/foraging habitat. A range of mitigation measures, outlined in Section 3.3 of this report, in the hydrology chapter of the accompanying EIAR and in the accompanying CEMP are in place to avoid water pollution in any European Site during the construction, operational and decommissioning phase. Taking into consideration the preventative measures to avoid impact, it can be concluded that the Proposed Development will not result in any impacts which could adversely affect the extent of this habitat within the SPA. There will be no deterioration in the condition of downstream wetland habitat and therefore no reduction in habitat area as a result of the Proposed Development.

6.6.2 SCI Species affected by Water Pollution

Table 6-14 Targets and attributes associated with the nominated conservation objectives for whooper swan, wigeon, teal, shoveler, golden plover, Greenland white fronted goose and coot

Attribute	Target	Assessment
Population trend	Long term population trend stable or increasing	A range of mitigation measures, outlined in Section 3.3 of this report, in the hydrology chapter of the accompanying EIAR and in the accompanying CEMP are in place to avoid water pollution in any European Site during the construction, operational and decommissioning phase. Taking into consideration the preventative measures to avoid impact, it can be concluded that the Proposed Development will not result in any impacts which could adversely affect the extent of this habitat within the SPA. There will be no deterioration in the condition of downstream wetland habitat and therefore no effect on population trend as a result of the Proposed Development.
Distribution	There should be no significant decrease in the range, timing and intensity of use of areas by these SCI species, other than that occurring from natural patterns of variation.	With the mitigation as described above in place, there is no potential for any deterioration in water quality to result in adverse effects on species distribution.

6.6.3 SCI Species assessed for Habitat loss, Disturbance and Collision

Table 6-12 Targets and attributes associated with the nominated conservation objectives for Whooper Swan, Greenland white fronted goose and golden plover

Attribute	Target	Assessment
Population trend	Long term population trend stable or increasing	The detailed assessment provided in Section 5 of this NIS has found that there is no potential for the proposed development to result in adverse effects on these species associated with this SPA as a result of ex situ habitat loss, disturbance, displacement, barrier effect or collision. It can therefore be concluded that there is no potential for the development to result in any adverse effect on the population trend within the SPA
Distribution	There should be no significant decrease in the range, timing and intensity of use of areas by whooper swan, other than that occurring from natural patterns of variation.	The detailed assessment provided in Section 5 of this NIS has found that there is no potential for the proposed development to result in adverse effects on these species associated with this SPA as a result of ex situ habitat loss, disturbance, displacement, barrier effect or collision. It can therefore be concluded that there is no potential for the development to result in any adverse effect on the distribution of the species within the SPA

6.6.4 Determination

Following an examination, evaluation and analysis, in light of best scientific knowledge, and, on the basis of objective information, having taken into account the relevant mitigation measures, it can be concluded that the Proposed Development will not have an adverse impact on Lough Iron SPA.

6.7 Garriskil Bog SPA

Following the precautionary principle, the Proposed Development has been assessed for the potential for ex situ habitat loss, disturbance, displacement, barrier effect and collision in respect of Greenland white fronted goose.

The conservation objective for this SPA is

> *"To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests of this SPA."*

There are no specific conservation objectives for this SPA. As a result, example objectives for this wetland habitat have been taken from other sites with site-specific conservation objectives in order to provide further assessment.

6.7.1 Greenland white fronted goose

Table 6-12 Targets and attributes associated with the nominated conservation objectives for, Greenland white fronted goose

Attribute	Target	Assessment
Population trend	Long term population trend stable or increasing	The detailed assessment provided in Section 5 of this NIS has found that there is no potential for the proposed development to result in adverse effects on this species associated with this SPA as a result of ex situ habitat loss, disturbance, displacement, barrier effect or collision. It can therefore be concluded that there is no potential for the development to result in any adverse effect on the population trend within the SPA
Distribution	There should be no significant decrease in the range, timing and intensity of use of areas by whooper swan, other than that occurring from natural patterns of variation.	The detailed assessment provided in Section 5 of this NIS has found that there is no potential for the proposed development to result in adverse effects on this species associated with this SPA as a result of ex situ habitat loss, disturbance, displacement, barrier effect or collision. It can therefore be concluded that there is no potential for the development to result in any adverse effect on the distribution of the species within the SPA

6.7.2 Determination

Following an examination, evaluation and analysis, in light of best scientific knowledge, and, on the basis of objective information, having taken into account the relevant mitigation measures, it can be concluded that the Proposed Development will not have an adverse impact on Lough Iron SPA.

6.8 Invasive Species

Third Schedule invasive species Bohemian Knotweed, Japanese Knotweed, Himalayn Knotweed and Rhododendron were recorded along the proposed grid connection route (see Table 4-14). The following mitigation will be adhered to in relation to these species:

- All earthworks machinery will be thoroughly pressure-washed prior to arrival on site and prior to their further use elsewhere.
- Care will be taken not to disturb or cause the movement of invasive species fragments, either intentionally or accidentally.
- Stands of Knotweed will be clearly demarcated by temporary fencing and tracking within them will be strictly avoided. A minimum buffer of seven metres will be applied to avoid disturbance of lateral Knotweed rhizomes.
- Where works occur within 7m of a Knotweed stand these will be carried out under the supervision of a suitably qualified ecologist.
- Where a Knotweed stand is encountered along the road the grid connection will be laid on the opposite side of the road to avoid excavation of potential Knotweed root material insofar as possible.
- Should removal of Knotweed off site be required this will be done so under the supervision of an ecologist in line with NPWS licencing.
- The machinery must be thoroughly cleaned down under supervision of an ecologist prior to moving away from the Knotweed contaminated area.
- All contractors and staff will be briefed about the presence, identification and significance of Knotweed before commencement of works.
- Good construction site hygiene will be employed to prevent the spread of these species with vehicles thoroughly cleaned down prior to leaving any site with the potential to have supported invasive species. All plant and equipment employed on the construction site (e.g. excavator, footwear, etc.) will be thoroughly cleaned down on site to prevent the spread of invasive plant species such as Knotweed and Rhododendron. All clean down must be undertaken in areas with no potential to result in the spread of invasive species.
- When working at locations in proximity to natural watercourses, a suitable barrier will be erected between the watercourse and the stand of invasive species. This will assist in preventing the spread of any invasive species into the watercourse during their removal.
- Any soils or subsoils contaminated with invasive species will sent for disposal to an appropriately licenced facility.
- The treatment and control of invasive alien species will follow guidelines issued by the National Roads Authority - *The Management of Noxious Weeds and Non-native Invasive Plant Species on National Roads* (NRA 2010) and Irish Water (2016) *Information and Guidance Document on Japanese Knotweed*, *'The Management of Invasive Alien Plant Species on National Roads- Standard' and 'The Management of Invasive Alien Plant Species on National Roads- Technical Guidance'*.

6.9 Conclusion of Impact Assessment

Following an examination, evaluation and analysis, in light of best scientific knowledge and the conservation objectives of the site, and, on the basis of objective information, having taken into account the relevant mitigation measures, it can be concluded that the Proposed Development will not have an adverse impact on any European Site.

It will not prevent the QIs/SCIs of any European Sites from achieving favourable conservation status in the future as defined in Article 1 of the EU Habitats Directive. A definition of Favourable Conservation Status is provided below:

> *'conservation status of a species means the sum of the influences acting on the species concerned that may affect the long-term distribution and abundance of its populations within the territory referred to in Article 2;*

The conservation status will be taken as 'favourable' when:

- *Population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats, and*
- *The natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future, and*
- *There is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.'*

Based on the above, it can be concluded in view of best scientific knowledge, on the basis of objective information that the Proposed Development will not adversely affect the Qualifying Interests/Special Conservation Interests associated with any European Designated Sites, namely the following:

- Lough Owel SAC (000688)
- Lough Ennell SAC (000685)
- Lough Owel SPA (004047)
- Lough Ennell SPA (004044)
- Lough Derravaragh SPA (004043)
- Lough Iron SPA (004046)
- Garriskil Bog SPA (004102)

7. IN COMBINATION EFFECTS

A search and review in relation to plans and projects that may have the potential to result in cumulative and/or in-combination impacts on European Sites was conducted. This assessment focuses on the potential for cumulative in-combination effects on the European Sites where potential for adverse effects was identified at the screening stage (Appendix 1). This included a review of online Planning Registers, development plans and other available information and served to identify past and future plans and projects, their activities and their predicted environmental effects.

7.1 Development context – Ecological Plans and Policies

The following development plans have been reviewed and taken into consideration as part of this assessment:

- Westmeath County Development Plan 2021-2027
- Westmeath Biodiversity Action Plan 2014 -2020

The review focused on policies and objectives that relate to Natura 2000 sites and natural heritage. Policies and objectives relating to sustainable land use were also reviewed and are detailed in Table 7-1.

Table 7-1 Review of land use and spatial plans 2021 -2027

Westmeath County Development Plan 2021 - 2027	
Key Policies/Issues/Objectives Directly Related to European Sites In The Zone of Influence	**Assessment of Potential Impact on European Sites**
CPO 12.4: It is Council policy to protect and conserve Special Areas of Conservation, candidate Special Areas of Conservation, Special Protection Areas and candidate Special Protection Areas, designated under the EU Birds and Habitats Directives respectively.	The Development plan was comprehensively reviewed, with particular reference to Policies and Objectives that relate to the Natura 2000 network and other natural heritage interests. No potential for cumulative impacts when considered in conjunction with the current proposal were identified. There will be no impact on designated sites as a result of deterioration in water quality. Best practice preventative measures will be implemented to avoid effects on water quality, as outlined in section 3.3 of this report, the hydrology chapter and in the CEMP (Appendix 2). There will be no adverse effects on sensitive aquatic receptors listed as QIs/SCIs of European Sites, as a result of deterioration in water quality. There will be no impact on European designated sites as a result of the Proposed Development. The development will not affect the conservation status of any QI species or habitat or SCI species of any EU designated site. The development will not prevent the QIs/SCIs of the European Sites from achieving favourable conservation status in the future as defined in Article 1 of the EU Habitats Directive.
CPO 12.5: It is Council policy to Ensure that no plans, programmes, etc. or projects giving rise to significant cumulative, direct, indirect or secondary impacts on European Sites arising from their size or scale, land take, proximity, resource requirements, emissions (disposal to land, water or air), transportation requirements, duration of construction, operation, decommissioning or from any other effects shall be permitted on the basis of this Plan (either individually or in combination with other plans, programmes, etc. or projects).	
CPO 12.6: It is Council policy to ensure that any plan or project that could have a significant adverse impact (either by themselves or in combination with other plans and projects) upon the conservation objectives of any Natura 2000 Site or would result in the deterioration of any habitat or any species reliant on that habitat will not be permitted.	
CPO 12.7: It is Council policy to assess any plan or project in accordance with Article 6 of the Habitats Directive to determine whether the plan or project is likely to have a significant effect on the site either individually or cumulatively upon the integrity, conservation objectives and qualifying interest of any Natura 2000 Site.	
CPO 12.8: It is Council policy to require an ecological appraisal for development not directly connected with or necessary to the management of Natura Sites, or a proposed Natura Site and which are likely to have significant effects on that site either individually or cumulatively.	
CPO 12.9: It is Council policy to identify and provide appropriate buffer zones between Designated Sites and local biodiversity features and areas zoned for development	

Westmeath County Development Plan 2021 - 2027	
Key Policies/Issues/Objectives Directly Related to European Sites In The Zone of Influence	**Assessment of Potential Impact on European Sites**
CPO 12.10: It is Council policy prepare Strategic Habitat Management Plans for Natura 2000 Sites in Council ownership in consultation with the National Parks and Wildlife Service and relevant stakeholders.	
CPO 12.11: It is Council policy promote the maintenance and as appropriate, achievement of favourable conservation status of habitats and species and to improve the ecological coherence of the Natura 2000 network, by maintaining and where appropriate, developing features in the landscape which are of major importance for wild fauna and flora.	
CPO 12.12: It is Council policy to require that new development proposals affecting designated sites have regard to the sensitivities identified in the SEA Environmental Report prepared in respect of this plan.	
CPO 12.13 It is Council policy to protect, manage and enhance the natural heritage, biodiversity, landscape and environment of County Westmeath, in recognition of its importance as both a non-renewable resource and a natural asset.	Any treeline and/or hedgerow removed as part of the Proposed Development will be replaced as part of the design of the project. Where removal of woodland is required to widen roads within the site between T5 and T9 these works will be kept to a minimum and the woodland will be retained as part of the operation of the windfarm. All tree removal within the development site has been accounted for in the replanting assessment for this project.
CPO 12.24 It is Council policy to protect and where possible enhance biodiversity and ecological connectivity, including woodlands, trees, hedgerows, semi-natural grasslands, rivers, streams, natural springs, wetlands, geological and geo-morphological systems, other landscape features, natural lighting conditions, and associated wildlife where these form part of the ecological network and/or may be considered as ecological corridors or stepping stones in the context of Article 10 of the Habitats Directive. Appropriate mitigation and/or compensation to conserve biodiversity, landscape character and green infrastructure networks will be required where habitats are at risk or lost as part of a development.	
CPO 12.25 It is Council policy to recognise that nature conservation is not just confined to designated sites and acknowledge the need to protect non-designated habitats and landscapes and to conserve the biological diversity.	
CPO 12.27 Prevent the spread of invasive species within the plan area, including requiring landowners and developers to adhere to best practice guidance in relation to the control of invasive species.	Invasive species listed on the Third Schedule of the European Communities Birds and Habitats Regulations 2011 (S.I. 477/2011) have been identified along the proposed grid connection route. No invasive species were recorded within the Wind Farm Site. Site specific
CPO 12.28 Ensure that proposals for development do not lead to the spread or introduction of invasive species. If developments are proposed on sites where invasive species are or were previously present, the applicant will be required to submit a control and management program for the particular invasive species as part	

Westmeath County Development Plan 2021 - 2027	
Key Policies/Issues/Objectives Directly Related to European Sites In The Zone of Influence	**Assessment of Potential Impact on European Sites**
of the planning process and to comply with the provisions of the European Communities Birds and Habitats Regulations 2011 (S.I. 477/2011). **CPO 12.29** Support, as appropriate, the National Parks and Wildlife Service's efforts to seek to control and manage the spread of non-native invasive species on land and water. Where the presence of non-native invasive species is identified at the site of any Proposed Development or where the proposed activity has an elevated risk of resulting in the presence of these species, details of how these species will be managed and controlled will be required.	mitigation in relation to these species has been described within this NIS to prevent the spread of invasive species during the proposed works.
Westmeath Biodiversity Action Plan 2014-2020	
Actions for Biodiversity Actions for Biodiversity are divided under the following headings : › Protection and Development of the Ecological Network › Monitoring and Research › Raising Awareness **Protection and Development of the Ecological Network** › Promoting habitats connectivity through: ▪ Raising awareness,	The Biodiversity Plan was comprehensively reviewed, with particular reference to Actions that relate to the Natura 2000 network. No potential for cumulative impacts when considered in conjunction with the current proposal were identified.

Westmeath County Development Plan 2021 - 2027	
Key Policies/Issues/Objectives Directly Related to European Sites In The Zone of Influence	**Assessment of Potential Impact on European Sites**
▪ Incorporating planning and legislation, ▪ Education, Protection, ▪ Establishing new connections. › Preparing management plans for conservation worthy habitats. **Monitoring and Research** › Identifying Local Biodiversity Sites. › Assessing gaps in knowledge on Westmeath biodiversity. › Seeking to fill these gaps by both professional and volunteer bodies (applies also to Raising Awareness). › Facilitating free public access to information on Westmeath biodiversity (applies also to Raising Awareness). **Raising Awareness** › Promoting and/or delivering biodiversity education among Members of the Public and Local authorities employees. › Facilitating and promoting free public access to nature enjoyment. › Raising pride of local biodiversity. › Bringing together communities in protecting, enhancing and enjoying nature (applies also to Protection and Development of the Ecological Network).	

7.1.1 Proposed Wind Farm Site

A review of Westmeath Council Planning Register shows the following planning applications lodged within the site of the currently proposed wind farm:

Forestry Entrances Pl. Ref. No. 98/1092

Planning application by Coillte Teo, for new forestry entrances. Permission was granted by the Planning Authority on the 03/12/98 subject to 2 no. conditions.

Permitted Coole Wind Farm Pl. Ref. No. 17/6292/ABP-300686-18

Coole Wind Farm Ltd. applied to Westmeath County Council in October 2017 for planning permission for the construction of a wind farm consisting of 13 no. wind turbines, upgrade of existing internal access roads and provision of new internal access roads, an on-site substation, underground cabling, temporary construction compound and all ancillary infrastructure. Permission was refused by the Planning Authority, however, the Board granted permission for the proposal following a first party appeal under PL25M.300686 in March 2019.

All elements of the permitted project, including an assessment of the proposed cable route were assessed as part of the EIS/EIAR submitted with the above application.

Grid Connection

A planning application for the electrical connection of the permitted Coole wind farm to the national grid which included for expansion of the above-mentioned onsite substation and upgrade works to the existing Mullingar substation was submitted to Westmeath County Council on 22nd May 2020 and was considered under Pl. Ref 20/6121. This application was lodged following An Bord Pleanála confirming that permission should be lodged with Westmeath after considering the S182A status or otherwise of the grid connection works under PL25M.304794. A Further Information Request (FIR) was issued by Westmeath County Council on the 17th July 2020 in relation to that application. That application was subsequently withdrawn. A copy of the Further Information Request is included in Appendix 2-1 of the EIAR. Table 1-2 below provides a summary of the various further information points that were raised and references where these points have been dealt with within the EIAR and application documentation.

In preparing the NIS for the Proposed Development, the applicant and design team have considered in full the previous applications for both Coole Wind Farm and the Coole Grid Connection, along with the Further Information Request that was issued in July 2020.

7.1.2 Applications in the Vicinity of the Proposed Wind Farm Site

The majority of planning applications in the immediate vicinity of the proposed wind farm site are related to the provision and/or alteration of one-off housing and agricultural developments. Applications which are not of an individual domestic or agricultural nature in the vicinity of the EIAR study area include the following:

Peat Operations

- **Pl Ref. 88/313**: Planning application to retain peat moss processing plant and buildings at Doon, Castlepollard. The planning authority granted planning permission on 10th February 1989.
- **ABP-307853-20** - Substitute Consent - Extra Time Westland Horticulture Limited due to be submitted 23rd day of November, 2020

- **ABP 305835 –** Leave to Apply Substitute Consent by Westland Horticulturefor peat harvesting on lands at Lower Coole, Mayne, Ballinealoe and Clonsura County Westmeath was granted on 1st May 2020

- **ABP 306242**- Substitute Consent Application for Peat Extraction Mountdillon, Duil na Gun, Co. Westmeath, Milkernagh, Co. Westmeath and Co. Longford and Coolcraff, Co. Longford. The decision by An Bord Pleanala was subsequently quashed by Order of the High Court in May 2021.

Other Applications

- **Pl Ref. 11/2043**: Planning application relating to Turbotstown House for alterations to the existing return wing and associated south - east elevation as well as removal of later internal partition and the provision of a reversible enclosure of the basement stairwell to main house pantry including ancillary associated works to a building listed as a protected structure, No. 261. The planning authority granted planning permission on the 23rd September 2011 subject to 7 no. conditions.

- **Pl. Ref.81/699**: Planning application for erection of a 38kV sub-station at Tromra. The Planning Authority granted permission on the 29th October 1981.

7.1.3 Applications in the Vicinity of the Proposed Grid Connection Route

The grid connection route from the permitted Coole Wind Farm site is in the general vicinity of over 100 no. valid planning applications made to Westmeath County Council. The majority of these applications are for residential development and were lodged since the early 1980s. The proposed grid connection route is also immediately adjacent to and/or within the general vicinity of a range of consented commercial developments, particularly within Multyfarnham, and ancillary agricultural infrastructure. Of those applications submitted the following are of note:

Energy Infrastructure

- Planning Ref. 18/6063 - Planning Application for a ten-year permission for the construction of an energy storage facility, including an electrical substation building, battery modules, transformer/invertor station modules and ancillary infrastructure (Planning Ref. 186063), located c. 220m west of the proposed grid connection route. The development was granted planning permission by Westmeath County Council in February 2019. This decision was subsequently appealed to An Bord Pleanála. An Bord Pleanála granted permission for the development in July 2019.
- Planning Ref. 81/699: Planning application for erection of a 38 kV sub-station at Tromra. The Planning Authority granted permission on the 29th October 1981.

Peat Operations

- Planning Ref. 88/313: Planning application to retain peat moss processing plant and buildings at Doon, Castlepollard. The planning authority granted planning permission on 10th February 1989.

Residential

- Planning Ref. 16/6001 - Planning Application for the development of 28 no. houses to be constructed in three phases. The planning authority granted planning permission in January 2017.

Community Facilities

There are several applications for community facilities, e.g. education and recreational facilities, located adjacent to or within general proximity of the proposed grid connection, as listed below. The majority of these applications have been submitted within the last 5 no. years.

- Planning Ref. 06/2334 - To remove existing prefabricated classroom and to extend existing school to provide a replacement classroom with toilets, staff room, resource room, wheelchair toilet facilities and a P.E. room. The Planning Authority granted permission for the Proposed Development in January 2007.
- Planning Ref. 10/2021 - To alter & extend part of the existing agricultural training collage buildings to provide a Cancer counselling and retreat centre and a suicide and training centre. The Planning Authority granted permission for the Proposed Development in August 2010.
- Planning Ref. 13/6091 - New single storey classroom extension (45sqm) to the rear of the existing building and the provision of a staff carparking area. The Planning Authority granted permission for the Proposed Development in February 2014.
- Planning Ref. 17/6116 - Change of use of a former agricultural yard to a horticultural based sessional training centre. The Planning Authority granted permission for the Proposed Development in November 2017.
- Planning Ref. 17/6112 - New single storey side extension (42.65 sqm) to the existing building comprising of a new classroom/toilet, disabled toilet and lobby, car-parking. The Planning Authority granted permission for the Proposed Development in July 2017.
- Planning Ref. 18/6174 - The installation of a multi-purpose playground unit. The Planning Authority granted permission for the Proposed Development in August 2018.
- Planning Ref. 18/6233 - A proposed sports and recreational development adjacent to the existing Community Centre and playing filed. Permission is also sought to upgrade the existing car parking area and to construct a new car parking area with a total number of 224 spaces and 2 no. bus parking bays. The Planning Authority granted permission for the Proposed Development in December 2018.

7.1.4 Forestry and Replanting

The majority of the proposed wind farm site is occupied by commercial cutover peat, with some areas occupied by commercial forestry. As part of the Proposed Development, some tree felling is required within and around the development footprint to allow the construction of turbine bases, access roads and other ancillary infrastructure. There are two turbines within the Proposed Development that are located within an area of forestry; T5 and T14. It should be noted that all forestry on the site of the proposed wind farm was originally planted as a commercial crop and will be felled in the coming years should the proposed wind farm proceed or not.

In line with the Forest Service's published policy on granting felling licenses for wind farm developments, areas cleared of forestry for turbine bases, access roads, and any other wind farm-related uses will have to be replaced by replanting at an alternative location.

A total of 16.36 hectares of new forestry will be replanted as a condition of any felling licence that might issue in respect of the Proposed Development. Replanting is a requirement of the Forestry Act and is primarily a matter for the statutory licensing processes that are under the control of the Forest service.

The replacement replanting of forestry can occur anywhere in the State subject to licence. A potential replanting area has been identified in the townland of Maheraboy, approximately 1.4 kilometres east of

Ballaghdereen, Co. Roscommon. An area at this site measuring 16.53 hectares has been granted Forest Service Technical Approval for afforestation. If these replant lands become unavailable, other similarly approved lands will be acquired for replanting should the proposed wind farm receive planning permission. A description of the proposed replanting land and an assessment of the potential impacts including cumulative impacts associated with afforestation at this location are presented in Appendix 4-6 of the EIAR and have been taken into account as part of this assessment.

7.1.5 Other Wind Farm Sites

There is only 1 No. permitted wind turbine located within 20 kilometres of the proposed wind turbines, as shown in Figure 2-2 in Chapter 2 of the EIAR. The relevant planning history of wind farm applications within the wider area is summarised below. This record lists the main relevant application in relation to the wind turbine applications. It is not intended to be exhaustive and list every application associated with the sites.

7.1.5.1 County Westmeath

Dryderstown Wind Turbine

- **Pl Ref 12/2054**: Application by Reforce Energy Ltd. for a single electricity generating wind turbine of hub height up to 64m and rotor diameter up to 48m, a hardstanding, Control Building, Associated site roads, drainage & site works
- **Development Address:** Dryderstown, Delvin. The site is located approximately 21 kilometres southeast of the nearest proposed wind turbine.
- **Decision:** 1 no. turbine granted by the Planning Authority (Westmeath County Council) subject to 12 no. conditions.

Crowinstown Wind Farm

- **Pl. Ref. 08/2174:** Application by Gaelectric Developments Ltd.seeking to amend planning ref 03/2064 (An Bord Pleanála Ref 25C.205586) relating to the development of a wind farm comprising of 3 wind turbine generators, 1 control building, 1 control building compound, associated access roads and 1 meteorological tower. This amendment seeks to increase the height of the wind turbine generators from a hub height of 78m to 85m and the rotor diameter from 72m to 80m. This will result in a maximum rotor blade tip height of 125m previously 114m. In addition, this application seeks to amend condition 2 to allow the 20-year permission period to commence from the commissioning date of the wind farm rather than from the date of the grant which was 22nd of June 2004.
- **Development Address:** Townlands of Crowinstown Great, Delvin, Co. Westmeath
  The site is located approximately 24.9 kilometres southwest of the nearest proposed wind turbine.
- **Decision:** 3 no. turbines granted by the Planning Authority (Westmeath County Council) subject to 13 no. conditions.

Proposed Ballivor Wind Farm

- Bord na Móna is proposing to develop a wind farm within the Ballivor Bog Group located in Counties Meath and Westmeath. This project is currently undergoing pre-application consultation with An Bord Pleanála under the provisions of ABP 307471-20. The proposed development will be located on bogs within the Ballivor Bog Group in counties Meath and Westmeath, namely Ballivor, Bracklin, Carranstown, Lisclogher and

Lisclogher West bogs. The site is located approximately 25.6 kilometres southwest of the nearest proposed Coole wind turbine.

Proposed Bracklyn Wind Farm

- Gaeltech Energy Developments Ltd is proposing to develop a wind farm of approximately 11 no. turbines in the townland of Bracklin, Co. Westmeath. The project is at the early design and consultation stage. The site is located approximately 24.9 kilometres southwest of the nearest proposed wind turbine.

7.1.5.2 County Cavan

Existing Ballyjamesduff Wind Turbine

- **Pl Ref 14/103ABP Ref. PL 02.243776:** Application by Liffey Energy for a development consisting of the erection of a single turbine with a hub height of 100m and rotor diameter of 103m, overall height not exceeding 152m and all associated site development works, including foundations, crane hardstanding, access track and underground cabling. Also, the construction of 20kV switchroom building with a floor area 50sqm, and temporary alteration of existing factory entrance of the L30130.
- **Development Address:** Townlands of Cloggagh,Ballyjamesduff
  This site is located approximately 16.4 kilometres northeast of the the nearest proposed wind turbine.
- **Decision:** 1 no. turbines granted by the Planning Authority (Cavan County Council) subject to 11 no. conditions.

Proposed Ballyjamesduff Wind Turbine

- **Pl Ref 19/447 ABP Ref. PL 02.309478:** Application by Liffey Energy for a development consisting of the erection of a single turbine with a maximum height of 169m, associated access and reinstatement works including turbine foundation, hardstanding area, site access tracks, 1 no. temporary site entrance and underground electrical cabling.
- **Development Address:** Townlands of Kilquilly and Cloggagh, Ballyjamesduff
  This site is located approximately 16 kilometres northeast of the the nearest proposed wind turbine.
- **Decision:** Cavan County Council refused permission for the proposed on 22nd January 2021, the application was appealed to An Bord Pleanála and was refused permission by the Bord on 23rd June 2021.

7.2 Other Projects

7.2.1 Projects Considered in Cumulative Assessment

The projects considered in relation to the potential for cumulative impacts and for which all relevant data was reviewed include those listed below.

Peat Extraction

Commercial peat harvesting at the Proposed Development site, as described in Section 2.6.2 in Chapter 2 of the EIAR.

Whilst the future of peat harvesting on the areas surrounding the wind farm is uncertain, the precautionary principle has been applied when carrying out the ecological assessments of the effects of the proposed wind farm in combination with adjacent peat harvesting operations. It has been assessed on the basis of peat cutting being in operation. Proposed in the EIAR as submitted is the establishment of an 'Integrated Management Group' which will be made up of Coole Wind Farm Ltd. and all relevant landowners and tenants in relation to peat harvesting activities. All parties within this group will collaborate to ensure that any proposed repurposing of the site or rehabilitation will be considered and carried out appropriately. Should the peat cutting operations permanently cease, any rehabilitation or repurposing of the site will be the subject of ecological assessment, Screening for Appropriate Assessment or full Appropriate Assessment and any such assessment would take account of the potential cumulative effects of any permitted or proposed wind farm. It is likely that the ecological impacts of any rehabilitation would be of a lower significance than those associated with the ongoing peat cutting.

Forestry

Some areas within the site are planted with commercial forestry.

Road Scheme

Proposed upgrade to a 52km section of the N4 between Mullingar and Longford (Roosky). A second Public Consultation on the Route Corridor Options is currently underway.

Other Wind Turbines

There is only one turbine permitted within a 20-kilometre radius of the proposed development site, located near Ballyjamesduff, Co. Cavan, as detailed in Section 2.7.4 above. This turbine is located approximately 16.4 kilometres from the nearest proposed turbine location at Coole. An application for a single turbine approximately 10 kilometres North East of the proposed development site has been appealed to An Bord Pleanála (Pl Ref 20/105 / ABP-307863-20) and is due to be decided by 14th December 2020.

Where the potential for the Proposed Development to result in adverse effects on European Sites on its own was identified, there was potential for it to contribute to in combination effects when considered in combination with other plans and projects. In the absence of mitigation, the potential for the Proposed Development to contribute to in combination effects on water quality within downstream the following SACs and SPAs:

- Lough Owel SAC (000688)
- Lough Ennell SAC (000685)
- Lough Owel SPA (004047)
- Lough Ennell SPA (004044)
- Lough Derravaragh SPA (004043)
- Lough Iron SPA (004046)

In addition, and following the precautionary principle, the Proposed Development has the potential to contribute to disturbance and displacement effects on the following SPAs:

- Lough Owel SPA (004047)
- Lough Derravaragh SPA (004043)
- Garriskil Bog SPA (004102)

Following the implementation of the best practice measures outlined in section 5 of this report, in the hydrology chapter of the EIAR accompanying this application and in the CEMP (Appendix 2), all

potential impact pathways have been blocked. There is therefore no potential for the Proposed Development to contribute to any in-combination impact on EU Designated Sites in combination with other plans and projects.

7.3 Conclusion of Cumulative Assessment

Following an examination, evaluation and analysis, in light of best scientific knowledge and the conservation objectives of the site, and, on the basis of objective information, having taken into account the relevant mitigation measures, it can be concluded that the Proposed Development will not have an adverse impact on any European Site and cannot contribute to any cumulative or in-combination effect when considered alongside any other plan or project.

In the review of the projects that was undertaken, no connection, that could potentially result in additional or cumulative impacts was identified. Neither was there any potential for different (new) impacts resulting from the combination of the various projects and plans in association with the Proposed Development.

8. CONCLUDING STATEMENT

This NIS has provided an assessment of all potential direct or indirect adverse effects on European Sites.

Where the potential for any adverse effect on any European Site has been identified, the pathway by which any such effect may occur has been robustly blocked through the use of avoidance, appropriate design and mitigation measures as set out within this report and its appendices. The measures ensure that the construction, and operation of the Proposed Development does not adversely affect the integrity of any European sites.

Following an examination, evaluation and analysis, in light of best scientific knowledge and the conservation objectives of the site, and, on the basis of objective information, having taken into account the relevant mitigation measures, it can be concluded that the Proposed Development will not have an adverse impact on any European Sites, either alone or in combination with other plans or projects.

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APPENDIX 1

APPROPRIATE ASSESSMENT SCREENING REPORT

Revised Appropriate Assessment Screening Report

Coole Wind Farm, Co. Westmeath

DOCUMENT DETAILS

Client:	**Coole Wind Farm Ltd.**
Project Title:	**Coole Wind Farm Optimisation**
Project Number:	**200445**
Document Title:	**Appropriate Assessment Screening Report**
Document File Name:	**RAASR -F – 2022.09.09 – 200445g**
Prepared By:	**MKO** **Tuam Road** **Galway** **Ireland** **H91 VW84**

Planning and Environmental Consultants

Rev	Status	Date	Author(s)	Approved By
01	Final	09/09/2022	LK	PR

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1. INTRODUCTION

MKO has been appointed to provide the information necessary to allow the competent authority to conduct an Article 6(3) Screening for Appropriate Assessment of the proposed construction of a 15 No. turbine wind energy development including the grid connection, near Coole, in north Co. Westmeath. This Screening Assessment report has been revised to take account of the request for further information issued by An Bord Pleanála in relation to the project on the 21st April 2022 and the submissions from the Development Applications Unit of the Department of the Department of Housing, Local Government and Heritage on the 17th May 2021. This document supersedes the Appropriate Assessment Screening Report that was submitted with the Planning Application.

Screening for Appropriate Assessment is required under Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (the Habitats Directive) and Part XAB of the Planning and Development Act 2000, as amended. Where it cannot be excluded that a project or plan, either alone or in combination with other projects or plans, would have a significant effect on a European Site then same shall be subject to an appropriate assessment of its implications for the site in view of the site's conservation objectives. The current project is not directly connected with, or necessary for, the management of any European Site consequently the project has been subject to the Appropriate Assessment Screening process.

The data underpinning this revised AA Screening Report was obtained through a desk study and field surveys undertaken between 2015 and 2020. In addition, further surveys were undertaken in 2021 and 2022 to ensure that all baseline information was up to date and relevant. Using this data, MKO has assessed the potential for the Proposed Development to result in significant effects on European sites in the absence of any best practice, mitigation or preventative measures.

This revised Appropriate Assessment Screening Report has been prepared in accordance with the European Commission's Assessment of Plans and Projects Significantly affecting Natura 2000 Sites: Methodological Guidance on the provisions of Article 6(3) and 6(4) of the Habitats Directive 92/43/EEC (EC, 2021) and Managing Natura 2000 Sites: the provisions of Article 6 of the 'Habitats' Directive 92/43/EEC (EC, 2018) as well as the Department of the Environment's Appropriate Assessment of Plans and Projects in Ireland - Guidance for Planning Authorities (DoEHLG, 2010) and the Appropriate Assessment Screening for Development Management. Office of the Planning Regulator, Dublin 7, Ireland OPR (2021).

In addition to the guidelines referenced above, the following relevant documents were also considered in the preparation of this report:

1. *Council of the European Commission (1992) Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora. Official Journal of the European Communities. Series L 20, pp. 7-49.*
2. *EC (2007) Guidance document on Article 6(4) of the 'Habitats Directive' 92/43/EEC – Clarification of the concepts of: alternative solutions, imperative reasons of overriding public interest, compensatory measures, overall coherence. Opinion of the commission.*
3. *EC (2013) Interpretation Manual of European Union Habitats. Version EUR 28. European Commission.*
4. *EC (2020) Guidance document on wind energy developments and nature legislation*

1.1 Appropriate Assessment

1.1.1 Screening for Appropriate Assessment

Screening is the process of determining whether an Appropriate Assessment is required for a plan or project. Under Part XAB of the Planning and Development Act, 2000, as amended, screening must be carried out by the Competent Authority. As per Section 177U of the Planning and Development Act, 2000, as amended '*A screening for appropriate assessment shall be carried out by the competent authority to assess, in view of best scientific knowledge, if that Land use plan or Proposed Development, individually or in combination with another plan or project is likely to have a significant effect on the European site*'. The Competent Authority's determination as to whether an Appropriate Assessment is required must be made on the basis of objective information and should be recorded. The Competent Authority may request information to be supplied to enable it to carry out screening.

Consultants or project proponents may provide for the competent authority, the information necessary for them to determine whether an Appropriate Assessment is required and provide advice to assist them in the Article 6(3) Appropriate Assessment Screening decision.

Where it cannot be excluded beyond reasonable scientific doubt at the Screening stage, that a proposed plan or project, individually or in combination with other plans and projects, would have a significant effect on the conservation objectives of a European site, an Appropriate Assessment is required.

Where an Appropriate Assessment is required, the Competent Authority may require the applicant to prepare a Natura Impact Statement.

The term Natura Impact Statement (NIS) is defined in legislation[1]. An NIS, where required, should present the data, information and analysis necessary to reach a definitive determination as to 1) the implications of the plan or project, alone or in combination with other plans and projects, for a European site in view of its conservation objectives, and 2) whether there will be adverse effects on the integrity of a European site. The NIS should be underpinned by best scientific knowledge, objective information and by the precautionary principle.

This Article 6(3) Appropriate Assessment Screening Report has been prepared in compliance with the provisions of section 177U of the Planning and Development Act 2000 as amended.

1.1.2 Statement of Authority

This report has been prepared by John Hynes (BSc., MSc., MCIEEM) and Laoise Kelly (BSc., MCIEEM) and reviewed by Pat Roberts (B.Sc. Environmental Science, MCIEEM). Pat has over 17 years' experience in ecological management and assessment. John Hynes has over 10 years' professional ecological consultancy experience Laoise Kelly has over 6 years' professional ecological consultancy experience and both are full members of the Chartered Institute of Ecology and Environmental Management. The baseline ecological surveys were undertaken by John Hynes B.Sc. (Env.) M.Sc MCIEEM, Pamela Boyle (PhD), Una Nealon (PhD), Laoise Kelly B.Sc. (Env.), MCIEEM and Susan Doyle B.Sc. (Env.) M.Sc (Eco). All surveyors have relevant academic qualifications and are competent experts in undertaking habitat and ecological assessments to this level. The bird surveys are undertaken by Patrick Manley (B.Sc.) Project

[1] As defined in Section 177T of the Planning and Development Act, 2000 as amended, an NIS means a statement, for the purposes of Article 6 of the Habitats Directive, of the implications of a Proposed Development, on its own and in combination with other plans and projects, for a European site in view of its conservation objectives. It is required to include a report of a scientific examination of evidence and data, carried out by competent persons to identify and classify any implications for the European site in view of its conservation objectives

Ornithologist with MKO, Andrew O'Donoghue, Conor Rowland, Niall McHugh, Niamh Scanlon, Tom Rae, Zak O'Conor and Zuzana Erosova, all of whom are experienced, competent bird surveyors.

1.1.3 Data Collected to Carry Out Assessment

In preparation of the report, the following sources were used to gather information:

- Review of existing information obtained during the application made in 2017 as part of the permitted Coole Wind Farm.
- Review of NPWS Conservation Objectives supporting documents, site synopsis, standard data forms and supporting documents for EU Designated Sites,
- Review of online web-mappers: National Parks and Wildlife Service (NPWS), Environmental Protection Agency (EPA), EPA (Envision), Water Framework Directive (WFD), Geological Survey of Ireland (GSI) and Inland Fisheries Ireland (IFI)
- Review of the publicly available National Biodiversity Data Centre (NBDC) web-mapper,
- Inland Fisheries Ireland (IFI) reports, where relevant/available,
- Review of NPWS Article 17 metadata and GIS database.
- Review of NPWS Article 12 metadata and GIS database.
- Records from the NPWS web-mapper and review of specially requested records from the NPWS Rare and Protected Species Database for the hectads in which the Proposed Project is located.
- Review of OS maps and aerial photographs of the site of the Proposed Development
- Review of other plans and projects within the area.
- MKO field assessments and bird surveys carried out between 2015 and 2022 and as provided in full in the EIAR, NIS and associated appendices.

2. DESCRIPTION OF THE PROPOSED DEVELOPMENT

2.1 Site Location

The proposed wind farm site is located approximately 2.4 kilometres north of Coole village (i.e. distance from Coole village centre to the main wind farm site boundary). The town of Castlepollard is located approximately 6.7 kilometres southeast of the wind farm site boundary, at its nearest point. The Proposed Development will connect to the national electricity grid via Mullingar 110 kV substation. Mullingar Substation is located in the townland of Irishtown approximately 2 kilometres northwest of Mullingar town. The proposed grid connection route measures approximately 26m from the proposed wind farm site to the existing substation near Mullingar.

The townlands in which the proposed wind farm site, ancillary works, grid connection route and junction accommodation works are located include; Camagh, Carlanstown, Coole, Clonrobert, Clonsura, Doon, Monktown, Mullagh, and Newcastle, Mullagh, Boherquill, Coole, Corralanna, Culvin, Joanstown, Mayne, Fearmore (Fore by), Newtown (Fore by), Simonstown (fore by), Ballinealoe, Shrubbywood, Clonava, Lackan (Corkaree by), Soho, Ballynaclonagh, Abbeyland, Rathganny, Ballindurrow, Cullendarragh, Culleenabohoge, Ballynafid, Knightswood, Portnashangan, Culleen More, Farranistick, and Irishtown (Moyashel by).

The location of the proposed works is shown in Figure 2-1.

2.2 Characteristics of the Proposed Development

Project Description

A previous application for a wind farm development at this location was submitted by Coole Wind Farm Ltd. to Westmeath County Council on the 19th October 2017 and was considered under Pl. Ref. 17/6292. This application comprised of a wind farm consisting of up to 13 No. wind turbines with a tip-height of up to 175 metres, upgrade of existing internal access roads and provision of new internal access roads, an on-site substation, underground cabling, temporary construction compound and all ancillary infrastructure. Westmeath County Council issued their decision to refuse to grant permission on 12th December 2017 based on 1 no. refusal reason. This decision was appealed to An Bord Pleanála on 14th January 2018 and was considered under ABP-300686-18. An Bord Pleanála issued the decision to grant permission for the wind farm on 27th March 2019.

Map Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- Proposed Hardstand
- Proposed Borrow Pit
- Construction Compound
- Internal Roads (new)
- Internal Roads (Upgrades to existing)
- Proposed Junction Works
- External Roads (Upgrades to Existing)
- Proposed Onsite Substation
- Proposed Grid Connection Route
- Proposed Upgrade Works to Existing Mullingar Substation
- Turbine Delivery Route
- Temporary Hardcore Surfacing Areas

Site Location

Coole Wind Farm, Co. Westmeath

Drawn By	Checked By
HW	LK
Project No.	Drawing No.
200445	Figure 2-1
Scale	Date
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The Proposed Development will comprise the construction and operation of up to 15 No. wind turbines and all associated works. The proposed turbines will have a tip height of up to 175 metres. The full description of the Proposed Development, as per the public planning notices, is as follows:

i. Up to 15 No. wind turbines with a tip height of up to 175 metres and all associated foundations and hardstanding areas;
ii. 1 no. onsite electrical substation including a control building, associated electrical plant and equipment, welfare facilities and a wastewater holding tank;
iii. 1 no. temporary construction compound;
iv. Provision of new site access roads, upgrading of existing access roads and hardstand areas;
v. Excavation of 1 no. borrow pit;
vi. All associated underground electrical and communications cabling connecting the turbines to the proposed onsite substation;
vii. Laying of approximately 26 km of underground electricity cabling to facilitate the connection to the national grid from the proposed onsite substation located in the townland of Camagh to the existing 110kV Mullingar substation located in the townland of Irishtown;
viii. Upgrade works to the existing 110kV Mullingar substation consisting of the construction of an additional dedicated bay to facilitate connection of the cable;
ix. Construction of a link road between the R395 and R396 Regional Roads in the townland of Coole to facilitate turbine delivery;
x. Junction improvement works to facilitate turbine delivery, at the N4 junction with the L1927 in the townland of Joanstown, on land to the South East of railway line level crossing on the L1927 in the townland of Culvin, the L1927 and L5828 junction in the townland of Boherquill and the L5828 and R395 junction in the townland of Corralanna;
xi. Site Drainage;
xii. Forestry Felling;
xiii. Signage, and;
xiv. All associated site development works.

The application is seeking a 10-year planning permission, that is that the planning consent would remain valid for 10 years following a final grant of planning permission.

An Environmental Impact Assessment Report (EIAR) and Natura Impact Statement (NIS) were prepared for the project to accompany the planning application.

Project Location & Access

The Proposed Development site measures approximately 498 hectares and is located in north Co. Westmeath, approximately 2.4 kilometres north of Coole village. The town of Castlepollard is located approximately 6.7 kilometres southeast of the site, at its nearest point. The Grid Reference co-ordinates for the approximate centre of the site are E641172, N776072.

Access to the site is via regional and local roads. The site is accessed via the R396 Regional Road, which travels in a southeast-northwest direction between Coole and Granard. From the R396, the L5755 local road traverses the site, linking to the R394 Regional Road, east of the Proposed Development site.

Grid Connection

The planning application includes for the construction of underground electricity cabling from the proposed onsite substation located in the townland of Camagh. This connection is carried out via an underground cable which is almost entirely contained within the public road corridor to the existing 110kV Mullingar substation located in the townland of Irishtown. Proposed upgrade works at the

existing Mullingar substation will consist of the construction of an additional dedicated bay to facilitate connection of the cable. The total length of the proposed cable route is approximately 26 kilometres.

3. IDENTIFICATION OF RELEVANT EUROPEAN SITES

3.1 Identification of the European Sites within the Likely Zone of Impact

The following methodology was used to establish which European Sites are within the Likely Zone of Impact of the Proposed Development:

- Initially the most up to date GIS spatial datasets for European designated sites and water catchments were downloaded from the NPWS website (www.npws.ie) and the EPA website (www.epa.ie) on the 03/03/2021. The datasets were utilised to identify European Sites which could feasibly be affected by the Proposed Development.
- All European Sites that could potentially be affected were identified using a source-pathway - receptor model. To provide context for the assessment, European Sites within a distance of 15km surrounding the development site are shown on Figure 3.1. Information on these sites with regard to their conservation objectives is provided in Table 3-1[2]. Sites that were further away from the proposed development were also considered. Given the nature, scale and location of the Proposed Development no potential for significant effect on sites that are located outside the 15km buffer were identified. The nearest downstream site outside the 15km buffer is Lough Ree SAC and SPA located over 40km hydrological distance from the proposed works and buffered by the intervening waterbody of Lough Iron. Consequently, based on distance and the existing intervening waterbodies (e.g. Lough Iron and Lough Ennell) no pathway for significant effect on these or any other European sites outside the 15km buffer was identified.
- In relation to Special Protection Areas, in the absence of any specific European or Irish guidance in relation to such sites, the Scottish Natural Heritage (SNH) Guidance, '*Assessing Connectivity with Special Protection Areas* (SPA)' (2016) was consulted. This document provides guidance in relation to the identification of connectivity between proposed development and Special Protection Areas. The guidance takes into consideration the distances species may travel beyond the boundary of their SPAs and provides information on dispersal and foraging ranges of bird species which are frequently encountered when considering plans and projects.
- The site of the proposed development was not found to lie on any significant migration route for any species. The results of these surveys (including those submitted in response to the Further Information Request), provide the scientific evidence to support this conclusion.
- In addition, the results of the detailed bird surveys that were undertaken between 2015 and 2022 were taken into account during the assessment.
- The catchment mapping was used to establish or discount potential hydrological connectivity between the site of the Proposed Development and any European Sites. The hydrological catchments are also shown in Figure 3.1.
- The hydrological studies and analysis that was presented in the EIAR that supports the application were also taken into account in this AA Screening assessment, as was the hydrological information that is presented in response to the request for further information.
- Table 3.1 provides details of all relevant European Sites as identified in the preceding steps and assesses which are within the likely Zone of Impact.
- The results of the extensive bird surveys carried out between 2015 and 2022 were consulted in the course of this screening exercise and provided information on whether the birds recorded on the site could potentially be associated with any European Site.

[2] *Office of the Planning Regulator (2021) guidance; 'OPR Practice Note PN01 Appropriate Assessment Screening for Development Management', utilises the Source-Pathway-Receptor model. This Appropriate Assessment Screening Report follows this guidance as well as providing information on European sites located within 15km of the proposed development as recommended in guidance provided by DEHLG (2010).*

- The site synopses and conservation objectives of these sites, as per the NPWS website (www.npws.ie), were consulted and reviewed at the time of preparing this report. Figure 3.1 shows the location of the Proposed Development in relation to all European sites within 15km of the Proposed Development.
- Where potential pathways for Significant Effect such as habitat or hydrological connectivity are identified, the site is included within the Likely Zone of Impact.

3.2 Assessment of Potential for Significant Effects on European Sites

This Appropriate Assessment Screening Report considers any potential for likely direct or indirect impacts of the Proposed Development, both alone and in combination with other plans and projects, on European Sites by virtue of the following criteria: size and scale, land-take, distance from the European Site or key features of the site, resource requirements, emissions, excavation requirements, transportation requirements and duration of construction, operation and decommissioning were considered in this screening assessment.

Table 3.1 below identifies which European Sites are located within the Zone of Likely Impact and identifies pathways by which impacts may occur. All European Sites that are within the Zone of Likely Impact are Screened In following the precautionary principle and assessed within the Natura Impact Statement. In addition, the individual pathways by which effects may occur are identified in Table 3-1 below.

Map Legend

- EIAR Site Boundary
- 15km Buffer from Site
- Special Area of Conservation (SAC)
- Special Protection Area (SPA)
- WFD Catchments
- EPA Mapped Watercourses

Newry, Fane, Glyde and Dee

Erne

Upper Shannon

Boyne

Lower Shannon

Cooneen Bog SAC

Ballykenny-Fisherstown Bog SPA

Lough Forbes Complex SAC

Brown Bog SAC

Mount Jessop Bog SAC

Fortwilliam Turlough SAC

Lough Ree SAC

Carn Park Bog SAC

Crosswood Bog SAC

River Shannon Callows SAC

Middle Shannon Callows SPA

Ardagullion Bog SAC

Lough Sheelin SPA

Lough Kinale and Derragh Lough SPA

Derragh Bog SAC

Moneybeg And Clareisland Bogs SAC

Garriskil Bog SAC

Garriskil Bog SPA

Glen Lough SPA

Lough Iron SPA

Lough Derravaragh SPA

Lough Owel SAC

Lough Owel SPA

Scragh Bog SAC

Wooddown Bog SAC

Ballymore Fen SAC

Lough Ennell SPA

Lough Ennell SAC

Split Hills And Long Hill Esker SAC

White Lough, Ben Loughs And Lough Doo SAC

Lough Bane And Lough Glass SAC

Lough Lene SAC

Killyconny Bog (Cloghbally) SAC

River Boyne and River Blackwater SPA

River Boyne And River Blackwater SAC

Girley (Drewstown) Bog SAC

Mount Hevey Bog SAC

15km Buffer to EU Designated Sites

Coole Wind Farm, Co. Westmeath

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Table 3-1 Identification of Designated Sites within the Likely Zone of Impact and assessment of potential for significant effects

European Sites and distance from Proposed Development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 03/09/2021)	Conservation Objectives	Likely Zone of Impact Determination and assessment of potential for significant effect
Special Area of Conservation (SAC)			
Lough Owel SAC (000688) **Distance:** Grid connection route is located within the existing N4 corridor along the boundary of the European Site. 12.5km from the windfarm site.	› White-clawed crayfish *Austropotamobius pallipes* [1092] › Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp. [3140] › Transition mires and quaking bogs [7140] › Alkaline fens [7230]	Detailed conservation objectives for this site (Version 1, May 2018) were reviewed as part of the assessment and are available at www.npws.ie	There will be no direct effect on this SAC in relation to the windfarm site, which is separated from it by a distance of over 12km. There will be no direct effects associated with the grid connection route as where it runs along the SAC boundary is located entirely within the existing N4 road corridor. A watercourse flows under the N4 where the cable is to be laid and provides hydrological connectivity with this SAC. As a result, there is potential for indirect effects on the SAC, in the form of deterioration of water quality resulting from pollution associated with the construction phase of the development Consequently, the potential for significant effects on this European Site cannot be excluded at this stage of the Appropriate Assessment process. This site is therefore considered to be **within the Likely Zone of Impact**.
Garriskil Bog SAC (000679)	› Active raised bogs* [7110] › Degraded raised bogs still capable of natural regeneration [7120]	Detailed conservation objectives for this site (Version 1, November 2015) were reviewed as part of the assessment and are available at www.npws.ie	There will be no direct effects as the Proposed Development is located entirely outside the boundary of the designated site.

European Sites and distance from Proposed Development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 03/09/2021)	Conservation Objectives	Likely Zone of Impact Determination and assessment of potential for significant effect
Distance: 0.06km east of the proposed grid connection route. 4.5km from windfarm site.	› Depressions on peat substrates of the *Rhynchosporion* [7150]		The SAC is located approximately 60m east of the proposed grid connection route (at its closest point.) and 4.5km from the proposed windfarm site. Following a review of the detailed hydrological assessment that was undertaken and presented in the EIAR and in the response to the further information request, it is concluded that, in the absence of mitigation There are no direct/indirect hydrological pathways between the Grid Connection Route and Gariskil Bog SAC There is no connectivity pathway for pollution or drainage related impacts. No complete impact source-pathway-receptor chain was identified. **The site is not in the Likely Zone of Impact and no further assessment is required.**
Scragh Bog SAC (000692) **Distance:** 0.3km east of the proposed grid connection route. 14.4km from windfarm site.	› Slender green feather-moss *Drepanocladus vernicosus* [1393] › Transition mires and quaking bogs [7140] › Alkaline fens [7230] ›	Detailed conservation objectives for this site (Version 1, May 2018) were reviewed as part of the assessment and are available at www.npws.ie	There will be no direct effects as the Proposed Development is located entirely outside the boundary of the designated site. The SAC is located approximately 300m east of the proposed grid connection route and 14.4km from the proposed windfarm site. Following a review of the detailed hydrological assessment that was undertaken and presented in the EIAR and in the response to the further information request, it is concluded that, in the absence of mitigation There are no direct/indirect hydrological pathways between the Grid Connection Route and Scragh Bog SAC/pNHA. There is no connectivity pathway for pollution or drainage related impacts. No

European Sites and distance from Proposed Development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 03/09/2021)	Conservation Objectives	Likely Zone of Impact Determination and assessment of potential for significant effect
			complete impact source-pathway-receptor chain was identified. **The site is not in the Likely Zone of Impact and no further assessment is required.**
Derragh Bog SAC (002201) **Distance:** 2.4km north of the windfarm site. 4.9km from the proposed grid connection.	› Degraded raised bogs still capable of natural regeneration [7120] › Bog woodland* [91D0]	This site has the generic conservation objective: "To maintain or restore the favourable conservation condition of the Annex I habitat(s) and/or the Annex II species for which the SAC has been selected." (NPWS (2022) Conservation objectives for Derragh Bog SAC [002201]. Generic Version 9.0. Department of Housing, Local Government and Heritage.	There will be no direct effects as the Proposed Development is located entirely outside the boundary of the designated site. The SAC is located approximately 2.4km north of the proposed windfarm site and 4.9km from the proposed grid connection and is designated for terrestrial habitats. There is no connectivity pathway for pollution or drainage related impacts. No complete impact source-pathway-receptor chain was identified. **The site is not in the Likely Zone of Impact and no further assessment is required.**
Moneybeg and Clareisland Bogs SAC (002340) **Distance**: 3.1km from wind farm site 6.1km from the proposed grid connection route	› Active raised bogs* [7110] › Degraded raised bogs still capable of natural regeneration [7120] › Depressions on peat substrates of the Rhynchosporion [7150]	Detailed conservation objectives for this site (Version 1, February 2016) were reviewed as part of the assessment and are available at www.npws.ie	There will be no direct effects as the Proposed Development is located entirely outside the boundary of the designated site. The SAC is located approximately 3.1km north of the windfarm site 6.1km north of the proposed grid connection route and is designated for terrestrial habitats. There is no connectivity pathway for pollution or drainage related impacts. No complete impact source-pathway-receptor chain was identified. **The site is not in the Likely Zone of Impact and no further assessment is required.**

European Sites and distance from Proposed Development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 03/09/2021)	Conservation Objectives	Likely Zone of Impact Determination and assessment of potential for significant effect
Ardagullion Bog SAC (002341) **Distance**: 3.7km from the proposed junction works in Boherquill 7.4km from the windfarm site	› Active raised bogs* [7110] › Degraded raised bogs still capable of natural regeneration [7120] › Depressions on peat substrates of the Rhynchosporion [7150]	Detailed conservation objectives for this site (Version 1, November 2015) were reviewed as part of the assessment and are available at www.npws.ie	There will be no direct effects as the Proposed Development is located entirely outside the boundary of the designated site. The SAC is located approximately 3.7km west of the proposed junction works in Boherquill and 7.4km west of the proposed windfarm site and is designated for terrestrial habitat. There is no connectivity pathway for pollution or drainage related impacts. No complete impact source-pathway-receptor chain was identified. **The site is not in the Likely Zone of Impact and no further assessment is required.**
Lough Ennell SAC (000685) **Distance**: 4.2km the proposed gird connection route 24km from the wind farm site	› Alkaline fens [7230]	Detailed conservation objectives for this site (Version 1, January 2018) were reviewed as part of the assessment and are available at www.npws.ie	There will be no direct effects as the Proposed Development is located entirely outside the boundary of the designated site. The SAC is located approximately 4.2km south of the proposed grid connection route and 24km from the proposed wind farm site. There is hydrological connectivity between the proposed grid connection route and the SAC approximately 8.8km (hydrological distance) downstream. As a result, there is potential for indirect effects in the form of deterioration of water quality resulting from pollution on the aquatic QI Alkaline fens [7230]. Consequently, following the precautionary principle, the potential for significant effects on this European Site cannot be excluded at this stage of the Appropriate

European Sites and distance from Proposed Development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 03/09/2021)	Conservation Objectives	Likely Zone of Impact Determination and assessment of potential for significant effect
			Assessment process. **This site is therefore considered to be within the Likely Zone of Impact.**
Wooddown Bog SAC (002205) **Distance**: 5.8km from the proposed grid connection route 20.7km south east of the windfarm site	› Degraded raised bogs still capable of natural regeneration [7120]	This site has the generic conservation objective: "To maintain or restore the favourable conservation condition of the Annex I habitat(s) and/or the Annex II species for which the SAC has been selected." NPWS (2022) Conservation objectives for Wooddown Bog SAC [002205]. Generic Version 9.0. Department of Housing, Local Government and Heritage.	There will be no direct effects as the Proposed Development is located entirely outside the boundary of the designated site. The SAC is located approximately 5.8km east of the proposed grid connection route and 20.7km from the proposed windfarm site and is designated for terrestrial habitat. There is no connectivity pathway for pollution or drainage related impacts. No complete impact source-pathway-receptor chain was identified. **The site is not in the Likely Zone of Impact and no further assessment is required.**
Lough Lene SAC (002121) **Distance**: 7.5km from the proposed grid connection route 8.5km from the windfarm site	› White-clawed crayfish *Austropotamobius pallipes* [1092] › Hard oligo-mesotrophic waters with benthic vegetation of Chara spp. [3140]	Detailed conservation objectives for this site (Version 1, 21st October 2021) were reviewed as part of the assessment and are available at www.npws.ie	There will be no direct effects as the Proposed Development is located entirely outside the boundary of the designated site. The SAC is located approximately 7.5km east of the proposed grid connection route and 8.5km from the proposed wind farm site boundary. Lough Lene SAC is located in a separate hydrological catchment to the proposed works. No complete impact source-pathway-receptor chain was identified. **The site is not in the Likely Zone of Impact and no further assessment is required.**

European Sites and distance from Proposed Development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 03/09/2021)	Conservation Objectives	Likely Zone of Impact Determination and assessment of potential for significant effect
White Lough, Ben Loughs and Lough Doo SAC (001810) **Distance**: 8.0km from the proposed windfarm site 9.2km from the grid connection route	› White-clawed crayfish *Austropotamobius pallipes* [1092] › Hard oligo-mesotrophic waters with benthic vegetation of Chara spp. [3140]	Detailed conservation objectives for this site (Version 1, 21st October 2021) were reviewed as part of the assessment and are available at www.npws.ie	There will be no direct effects as the Proposed Development is located entirely outside the boundary of the designated site. The SAC is located approximately 8.0km east of the proposed wind farm site and 9.2km from the proposed grid connection route in a separate hydrological catchment. No complete impact source-pathway-receptor chain was identified. **The site is not in the Likely Zone of Impact and no further assessment is required.**
Lough Bane and Lough Glass SAC (002120) **Distance:** 10.7km from the proposed wind farm site 11.4km from the grid connection route	› White-clawed crayfish *Austropotamobius pallipes* [1092] › Hard oligo-mesotrophic waters with benthic vegetation of Chara spp. [3140] ›	Detailed conservation objectives for this site (Version 1, 21st October 2021) were reviewed as part of the assessment and are available at www.npws.ie	There will be no direct effects as the Proposed Development is located entirely outside the boundary of the designated site. The SAC is located approximately 10.7km east of the proposed windfarm site and 11.4km from the proposed grid connection route in a separate hydrological catchment. No complete impact source-pathway-receptor chain was identified. **The site is not in the Likely Zone of Impact and no further assessment is required.**
River Boyne and River Blackwater SAC (002299) **Distance:** 12.7km from the proposed grid connection route	› River lamprey *Lampetra fluviatilis* [1099] › Salmon *Salmon salar* [1106] › Otter *Lutra lutra* [1355] › Alkaline fens [7230] › Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*)*	Detailed conservation objectives for this site (Version 1, 03 Dec 2021) were reviewed as part of the assessment and are available at www.npws.ie	There will be no direct effects as the Proposed Development is located entirely outside the boundary of the designated site. The SAC is located approximately 12.7km east of the proposed grid connection route and 14.4km from the proposed windfarm site in a separate hydrological catchment. No complete impact source-pathway-receptor

European Sites and distance from Proposed Development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 03/09/2021)	Conservation Objectives	Likely Zone of Impact Determination and assessment of potential for significant effect
14.4km from the windfarm site boundary			chain was identified. **The site is not in the Likely Zone of Impact and no further assessment is required.**
Special Protection Area (SPA)			
Lough Owel SPA (004047) **Distance:** Grid connection route is located within the existing N4 corridor along the boundary of the European Site. 12.5km from the windfarm site	› Shoveler *Anas clypeata* [A056] › Coot *Fulica atra* › Wetland and Waterbirds [A999]	This site has the generic conservation objective: "To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests of this SPA." This site also has a second conservation objective: "To maintain or restore the favourable conservation condition of the wetland habitat at Lough Owel SPA as a resource for the regularly-occurring migratory waterbirds that utilise it." NPWS (2022) Conservation objectives for Lough Owel SPA [004047]. Generic Version 9.0. Department of Housing, Local Government and Heritage.	There will be no direct effects as the Proposed Development is located within the N4 road corridor along the boundary of the SPA at its closest point. A watercourse flows under the N4 where the cable is to be laid and provides hydrological connectivity with this SPA. Taking a precautionary approach, a potential pathway for indirect effects in the form of deterioration of water quality resulting from pollution, associated with the construction phase of the development was identified. Consequently, there is potential for deterioration of the wetland habitat of all SCI species. In addition, taking a precautionary approach, given that the proposed grid connection is located adjacent to the SPA boundary, there is potential for disturbance on the SCI species associated with the SPA. As a result, this site is considered to be **within the Likely Zone of Impact** and further assessment is required.
Lough Derravarragh SPA (004043)	› Whooper swan *Cygnus cygnus* [A038] › Pochard *Aythya farina* [A059] › Tufted duck *Aythya fuligula* [A061]	This site has the generic conservation objective:	The development is located within the potential core foraging range of Whooper Swan which is an SCI species associated with the SPA (SNH Guidelines (2016).

European Sites and distance from Proposed Development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 03/09/2021)	Conservation Objectives	Likely Zone of Impact Determination and assessment of potential for significant effect
Distance: 0.07km from the proposed grid connection route 4.8km from the windfarm site	› Coot *Fulica atra* [A125] › Wetland and Waterbirds [A999]	"To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests of this SPA." This site also has a second conservation objective: "To maintain or restore the favourable conservation condition of the wetland habitat at Lough Derravarragh SPA as a resource for the regularly-occurring migratory waterbirds that utilise it." NPWS (2022) Conservation objectives for Lough Derravarragh SPA [004043]. Generic Version 9.0. Department of Housing, Local Government and Heritage.	Consequently, and following the precautionary principle, the potential for direct and indirect impacts on the following the SPA requires further assessment. The proposed gird connection route is located approximately 70m west of the SPA. Therefore, potential for disturbance SCI bird species associated with the SPA has also been considered. There will be no direct effects on the supporting wetland habitat of waterbirds within the SPA. Given that the SPA is located hydrologically downstream of the development site there is potential for indirect effects with regard to surface water pollution. As a result, this site is considered to be **within the Likely Zone of Impact** and further assessment is required.
Garriskil Bog SPA (004102) **Distance**: 1.4km from the proposed grid connection route 7.2km from the wind farm site	› Greenland white-fronted goose *Anser albifrons flavirostris* [A395]	This site has the generic conservation objective: "To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests of this SPA." NPWS (2022) Conservation objectives for Garriskil Bog SPA [004102]. Generic	In accordance with SNH Guidelines (2016), the wind farm site is located within the potential core foraging range of SCI species associated with the SPA. However, as per the NPWS site synopsis, the last record of Greenland White-fronted Goose at the site was from *1986/87 (43 individuals).* The following is an extract from the NPWS site synopsis for the SPA "

European Sites and distance from Proposed Development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 03/09/2021)	Conservation Objectives	Likely Zone of Impact Determination and assessment of potential for significant effect
		Version 9.0. Department of Housing, Local Government and Heritage.	*At the time this site was designated as a Special Protection Area (SPA) it was known to be utilised by part of an internationally important population of Greenland White-fronted Goose centered around the midland lakes. The geese appear to have abandoned these peatland sites in favour of grassland sites elsewhere.* Given that lack of evidence to suggest that the SCI species utilise the SPA, and the lack of potential for the proposed development to result in significant effects thereon (following detailed bird surveys at the site and as presented in the bird survey report prepared in response to the request for further information), potential impacts on the populations of the SCI species for which the SPA was designated are considered highly unlikely. However, following an extremely precautionary principle and due to the fact that the wind farm site is within the core foraging range of the SCI species, **this SPA is within the likely zone of impact and further assessment is required**
Lough Kinale and Derragh Lough SPA **Distance:** 1.8km from the windfarm site 4.4km from the proposed grid connection route	› Pochard *Aythya farina* [A059] › Tufted duck *Aythya fuligula* [A061] › Wetland and Waterbirds [A999]	This site has the generic conservation objective: "To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests of this SPA."	SCI species associated with this SPA were not recorded on the site of the proposed development during the extensive and comprehensive ornithological surveys undertaken from 2015-2022. Given the distance and intervening natural buffers between the wind farm site and the SPA, displacement related impacts are not anticipated.

European Sites and distance from Proposed Development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 03/09/2021)	Conservation Objectives	Likely Zone of Impact Determination and assessment of potential for significant effect
		This site also has a second conservation objective: "To maintain or restore the favourable conservation condition of the wetland habitat at Lough Kinale and Derragh Lough SPA as a resource for the regularly-occurring migratory waterbirds that utilise it." NPWS (2022) Conservation objectives for Lough Kinale and Derragh Lough SPA [004061]. Generic Version 9.0. Department of Housing, Local Government and Heritage.	There will be no direct effects on the supporting wetland habitat of waterbirds within the SPA. There is no potential for indirect effects with regard to surface water pollution as the development site is located downstream of the SPA in the Shannon surface water catchment, with no identifiable pathway for impact. **The site is not in the Likely Zone of Impact and no further assessment is required.**
Lough Iron SPA **Distance**: 3km from the proposed junction works in Joanstown and 4.3km from the proposed grid connection route 11.4km from the windfarm site	› Whooper Swan *Cygnus cygnus* [A038] › Wigeon *Anas penelope* [A050] › Teal *Anas creca* [A052] › Shoveler *Anas clypeata* [A056] › Coot *Fulica atra* [A125] › Golden Plover *Pluvialis apricaria* [A140] › Greenland White-fronted Goose *Anser albifrons flavirostris* [A395] › Wetland and Waterbirds [A999]	This site has the generic conservation objective: "To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests of this SPA." This site also has a second conservation objective: "To maintain or restore the favourable conservation condition of the wetland habitat at Lough Iron SPA as a resource	Whilst the windfarm site is located outside the potential core foraging range of SCI species associated with the SPA (SNH Guidelines (2016) and is also located outside the zone of sensitivity of any species that is listed as particularly sensitive to wind energy development in Mc Guinness et.al 2015 a potential pathway for indirect effects on this SPA is considered on a highly precautionary basis and further assessment is required. The proposed junction works in Joanstown occur approximately 3km north west of the SPA.. The proposed works are confined to the existing road corridor and there is no potential for effect in relation to disturbance associated with the proposed works on any

European Sites and distance from Proposed Development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 03/09/2021)	Conservation Objectives	Likely Zone of Impact Determination and assessment of potential for significant effect
		for the regularly-occurring migratory waterbirds that utilise it." To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA: (2022) Conservation objectives for Lough Iron SPA [004046]. Generic Version 9.0. Department of Housing, Local Government and Heritage.	SCI species associated with the SPA. There will be no direct effects on the supporting wetland habitat of waterbirds within the SPA. Taking a precautionary approach, a potential pathway for indirect effects in the form of deterioration of water quality resulting from pollution, associated with the construction phase of the development was identified. Consequently, there is potential for deterioration of the wetland habitat of all SCI species. Impact on this wetland habitat is considered. As a result, this site is considered to be **within the Likely Zone of Impact** and further assessment is required.
Glen Lough SPA **Distance:** 3.3km from the proposed junction works in Joanstown and 9.7km from the proposed grid connection route. 13.5 from the windfarm site	› Whooper Swan *Cygnus cygnus* [A038]	This site has the generic conservation objective: "To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests of this SPA." (2022) Conservation objectives for Glen Lough SPA [004045]. Generic Version 9.0. Department of Housing, Local Government and Heritage.	The wind farm site is located in over 13.5 km from the SPA with no habitat or direct surface water connectivity. The development is located outside the identified foraging range of the SCI species associated with the SPA that are listed in SNH (2016). Bird activity surveys between 2015 and 2022 have not revealed the site of the Proposed Development to be located on an identifiable migration route for this species. In addition, the detailed survey work undertaken between 2015 and 2022 has not revealed any potential for significant effect on this species as a result of the proposed development.

European Sites and distance from Proposed Development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 03/09/2021)	Conservation Objectives	Likely Zone of Impact Determination and assessment of potential for significant effect
			Works in relation to the junction upgrade locations and grid connection will be restricted to the existing road corridor with no potential to impact on this species. Consequently, the potential for adverse impacts on populations of SCI species associated with the SPA can be discounted and no further assessment is required. **The site is not in the Likely Zone of Impact and no further assessment is required.**
Lough Sheelin SPA **Distance:** 3.9km from windfarm site 7.8km from the proposed grid connection route	› Great crested grebe *Podiceps cristatus* [A005] › Pochard *Aythya ferina* [A059] › Tufted duck *Aythya fuligula* [A061] › Goldeneye *Bucephala clangula* [A067]	This site has the generic conservation objective: "To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests of this SPA." This site also has a second conservation objective: "To maintain or restore the favourable conservation condition of the wetland habitat at Lough Sheelin SPA as a resource for the regularly-occurring migratory waterbirds that utilise it." (2022) Conservation objectives for Lough Sheelin SPA [004065]. Generic	SCI species associated with this SPA were not recorded on the wind farm site during the extensive and comprehensive ornithological surveys undertaken from 2015-2022. Given the distance and intervening natural buffers between the development site and the SPA, displacement related impacts are not anticipated. There will be no direct effects on the supporting wetland habitat of waterbirds within the SPA. There is no potential for indirect effects with regard to surface water pollution as the development site is located downstream of the SPA in the Shannon surface water catchment, with no identifiable pathway for impact. Consequently, the potential for adverse impacts on populations of SCI species associated with the SPA can be discounted and no further assessment is required. **The site is not in the Likely Zone of Impact and no further assessment is required.**

European Sites and distance from Proposed Development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 03/09/2021)	Conservation Objectives	Likely Zone of Impact Determination and assessment of potential for significant effect
		Version 9.0. Department of Housing, Local Government and Heritage.	
Lough Ennell SPA **Distance:** 4.5km from the proposed grid connection route 24.3km from the windfarm site	› Pochard *Aythya ferina* [A059] › Tufted duck *Aythya fuligula* [A061] › Coot *Fulica atra* [A125] › Wetland and Waterbirds [A999]	This site has the generic conservation objective: "To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests of this SPA." This site also has a second conservation objective: "To maintain or restore the favourable conservation condition of the wetland habitat at Lough Ennell SPA as a resource for the regularly-occurring migratory waterbirds that utilise it." (2022) Conservation objectives for Lough Ennell SPA [004044]. Generic Version 9.0. Department of Housing, Local Government and Heritage.	There will be no direct effects as the Proposed Development is located outside of the designated site. The SPA is located 4.5km south of the proposed grid connection route and 24.3km south of the windfarm site. Due to this distance, there is no potential for significant indirect effects as a result of disturbance. There is hydrological connectivity between the proposed grid connection route and the SPA approximately 9.2km (hydrological distance) downstream. Taking a precautionary approach, a potential pathway for indirect effects in the form of deterioration of water quality resulting from pollution, associated with the construction phase of the development was identified. Consequently, there is potential for deterioration of the wetland habitat of all SCI species. **This site is considered to be within the Likely Zone of Impact and further assessment is required.**

3.3 European Sites with the Potential to be Significantly Affected by the Proposed Development

The following European Sites have the potential to be significantly affected by the Proposed Development:

- Lough Owel SAC (000688)
- Lough Ennell SAC (000685)
- Lough Owel SPA (004047)
- Lough Ennell SPA (004044)
- Lough Derravaragh SPA (004043)
- Lough Iron SPA (004046)
- Garriskill Bog SPA (004102)

Lough Owel SAC

The SAC is located 12.5km south of the windfarm site and the grid connection is located within the N4 road corridor along the boundary of the SAC. There will be no direct effect on this SAC in relation to the windfarm site, which is separated from it by a distance of over 12km. There will be no direct effects associated with the grid connection route as where it runs along the SAC boundary is located entirely within the existing N4 road corridor. A watercourse flows under the N4 where the cable is to be laid and provides hydrological connectivity with this SAC. As a result, there is potential for indirect effects on the SAC, in the form of deterioration of water quality resulting from pollution associated with the construction phase of the development

Lough Ennell SAC

The SAC is located approximately 4.2km south of the proposed grid connection route and 24km from the proposed wind farm site. There is hydrological connectivity between the proposed grid connection route and the SAC approximately 8.8km (hydrological distance) downstream. As a result, there is potential for indirect effects in the form of deterioration of water quality resulting from pollution on the aquatic QI Alkaline fens [7230].

Lough Owel SPA

The SPA is located 12.5km south of the windfarm site and the grid connection is located within the N4 road corridor along the boundary of the SPA. A watercourse flows under the N4 where the cable is to be laid and provides hydrological connectivity with this SPA. Taking a precautionary approach, a potential pathway for indirect effects in the form of deterioration of water quality resulting from pollution, associated with the construction phase of the development was identified. Consequently, there is potential for deterioration of the wetland habitat of all SCI species.

In addition, taking a precautionary approach, given that the proposed grid connection is located adjacent to the SPA boundary, there is potential for disturbance on the SCI species associated with the SPA.

Lough Ennell SPA

The SPA is located 4.5km south of the proposed grid connection route and 24.3km south of the windfarm site. Due to this distance, there is no potential for significant indirect effects as a result of disturbance. There is hydrological connectivity between the proposed grid connection route and the SPA approximately 9.2km (hydrological distance) downstream. Taking a precautionary approach, a potential pathway for indirect effects in the form of deterioration of water quality resulting from pollution,

associated with the construction phase of the development was identified. Consequently, there is potential for deterioration of the wetland habitat of all SCI species.

Lough Derravaragh SPA

The development is located within the potential core foraging range of Whooper Swan which is an SCI species associated with the SPA (SNH Guidelines (2016). Consequently, and following the precautionary principle, the potential for direct and indirect impacts on the following the SPA requires further assessment. The proposed gird connection route is located approximately 70m west of the SPA. Therefore, potential for disturbance SCI bird species associated with the SPA has also been considered.

There will be no direct effects on the supporting wetland habitat of waterbirds within the SPA. Given that the SPA is located hydrologically downstream of the development site there is potential for indirect effects with regard to surface water pollution.

.Lough Iron SPA

Whilst the windfarm site is located outside the potential core foraging range of SCI species associated with the SPA (SNH Guidelines (2016) and is also located outside the zone of sensitivity of any species that is listed as particularly sensitive to wind energy development in Mc Guinness et.al 2015 a potential pathway for indirect effects on this SPA is considered on a highly precautionary basis and further assessment is required.

The proposed junction works in Joanstown occur approximately 3km north west of the SPA.. The proposed works are confined to the existing road corridor and there is no potential for effect in relation to disturbance associated with the proposed works on any SCI species associated with the SPA. There will be no direct effects on the supporting wetland habitat of waterbirds within the SPA. Taking a precautionary approach, a potential pathway for indirect effects in the form of deterioration of water quality resulting from pollution, associated with the construction phase of the development was identified. Consequently, there is potential for deterioration of the wetland habitat of all SCI species. Impact on this wetland habitat is considered.

Garriskil Bog SPA

This SPA is located 1.4km from the proposed grid connection route and 7.2km from the wind farm site. In accordance with SNH Guidelines (2016), the wind farm site is located within the potential core foraging range of SCI species associated with the SPA. However, as per the NPWS site synopsis, the last record of Greenland White-fronted Goose at the site was from *1986/87 (43 individuals).*

The following is an extract from the NPWS site synopsis for the SPA

"*At the time this site was designated as a Special Protection Area (SPA) it was known to be utilised by part of an internationally important population of Greenland White-fronted Goose centered around the midland lakes. The geese appear to have abandoned these peatland sites in favour of grassland sites elsewhere.*

Given that lack of evidence to suggest that the SCI species utilise the SPA, and the lack of potential for the proposed development to result in significant effects thereon (following detailed bird surveys at the site and as presented in the bird survey report prepared in response to the request for further information), potential impacts on the populations of the SCI species for which the SPA was designated are considered highly unlikely. However, following an extremely precautionary principle and due to the fact that the wind farm site is within the core foraging range of the SCI species, this SPA is within the likely zone of impact and further assessment is required.

3.4 Likely Cumulative Impact of the Proposed Works on European Sites, in-combination with other plans and projects

Where the potential for significant effects on European Sites has been identified in the preceding sections of this document, there is potential for the Proposed Development to result in cumulative effect. This potential is addressed in the NIS that accompanies this application.

Where no pathway for effect on a particular European Site was identified, there is no potential for cumulative effects on that site and no further assessment is required.

4. ARTICLE 6(3) APPROPRIATE ASSESSMENT SCREENING STATEMENT AND CONCLUSIONS

4.1 Concluding Statement

Following an examination, analysis and evaluation of the relevant data and information set out within this Screening Report, it cannot be excluded beyond reasonable scientific doubt, in view of best scientific knowledge, on the basis of objective information and in light of the conservation objectives of the relevant European sites, that the Proposed Development, individually or in combination with other plans and projects, would be likely to have a significant effect on the following sites:

- Lough Owel SAC (000688)
- Lough Ennell SAC (000685)
- Lough Owel SPA (004047)
- Lough Ennell SPA (004044)
- Lough Derravaragh SPA (004043)
- Lough Iron SPA (004046)

As a result, an Appropriate Assessment is required, and a Natura Impact Statement shall be prepared in respect of the Proposed Development in order to assess whether the Proposed Development will adversely impact the integrity of these European Sites.

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APPENDIX 2

CONSTRUCTION AND ENVIRONMENTAL MANAGEMENT PLAN (CEMP)

Construction and Environmental Management Plan

Coole Wind Farm Development, Co. Westmeath

DOCUMENT DETAILS

Client:	**Coole Wind Farm Ltd.**
Project Title:	**Coole Wind Farm Development, Co. Westmeath**
Project Number:	**200445**
Document Title:	**Construction and Environmental Management Plan**
Document File Name:	**CEMP F - 2021.03.16 - 200445**
Prepared By:	**MKO** **Tuam Road** **Galway** **Ireland** **H91 VW84**

Planning and Environmental Consultants

Rev	Status	Date	Author(s)	Approved By
01	Draft	10.02.2021	PH	MW/EOS
02	Draft	11.02.2021	PH	MW/EOS
03	Draft	08.03.2021	PH	MW/EOS
04	Draft	10.03.2021	PH	MW/EOS
05	Draft	11.03.2021	PH	MW/EC
06	Draft	11.03.2021	PH	MW/EC
07	Final	16.03.2021	PH	MW/EC

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1. INTRODUCTION

This Construction and Environmental Management Plan (CEMP) has been developed by MKO on behalf of Coole Wind Farm Ltd., who intend to apply to An Bord Pleanála for planning permission to construct a wind energy development and all associated infrastructure, as well as the provision of an underground grid connection (c. 26.km in length) suitable to link the proposed substation to the national electricity transmission network via the existing Mullingar substation at Irishtown, near Mullingar. The proposal also includes upgrade works to the existing 110kV Mullingar substation consisting of the construction of an additional dedicated bay to facilitate connection of the cable.

This CEMP has been prepared in conjunction with the Environmental Impact Assessment Report (EIAR) which will accompany the planning application for the proposed development to be submitted to An Bord Pleanála. This report is intended as a single, amalgamated document that can be used during the future phases of the project, as a single consolidated point of reference relating to all construction, environmental and drainage requirements for the Planning Authority, developer and contractors alike.

This report provides the environmental management framework to be adhered to during the pre-commencement, construction and operational phases of the proposed development and it incorporates the mitigating principles to ensure that the work is carried out in a way that minimises the potential for any environmental impacts to occur. This report has been prepared in accordance with the mitigation measures and commitments made in the EIAR, Appropriate Assessment Screening Report (AASR), Natura Impact Statement (NIS) and other planning documents for the development.

Should the project secure planning permission, the CEMP will be updated, in line with all conditions and obligations which apply to any grant of permission. The CEMP should be read in conjunction with the EIAR and planning drawings.

1.1 Potential Amendment Scenario's

The CEMP will also require updating by the selected contractor in order to identify, assess and satisfy the contract performance criteria as set out by the various stakeholders. The CEMP due to its structure and nature will also require constant updating and revision throughout the construction period as set out below. Therefore, this is a working document and will be developed further prior to and during construction.

Triggers for amendments to the CEMP will include:

- When there is a perceived need to improve performance in an area of environmental impact;
- As a result of changes in environmental legislation applicable and relevant to the project;
- Where the outcomes from auditing establish a need for change;
- Where Work Method Statements identify changes to a construction methodology to address high environmental risk; and
- As a result of an incident or complaint occurring that necessitates an amendment. Complaints will be documented in the site complaints log and the Environmental Manager will arrange to meet with those affected. The situation will be acted upon immediately and reviewed by the Project Manager. A copy of the complaints procedure is included in Appendix 1 of this document.

1.2 Scope of the Construction and Environmental Management Plan

This report is presented as a guidance document for the construction phase of the proposed Coole Wind Farm. It outlines clearly the mitigation measures and monitoring proposals that are required to be adhered to in order to construct the wind farm in an appropriate manner. The report is divided into nine sections, as outlined below.

- Section 1 provides a brief introduction as to the scope of the report and the planning conditions it is intended to satisfy.
- Section 2 outlines the site and project details, detailing the targets and objectives of this plan along with providing an overview of anticipated construction methodologies that will be adopted throughout the proposed project.
- Section 3 sets out an overview of the construction methodologies for all elements of the proposed development
- Section 4 sets out details of the environmental controls on site which looks at noise and dust controls. Site drainage measures, peat management, invasive species management, traffic management and a waste management plan are also included in this section.
- Section 5 sets out a fully detailed implementation plan for the environmental management of the proposed project outlining the roles and responsibilities of the project team.
- Section 6 outlines the Emergency Response Procedure to be adopted in the event of an emergency in terms of site health and safety and environmental protection.
- Section 7 provides a summary of the Safety and Health Plan for the proposed development outlining the responsibilities and inputs required from the project team
- Section 8 consists of a summary table of all mitigation proposals to be adhered to during the implementation of the proposed project, categorised into three separate headings, 1) pre-commencement measures; 2) construction-phase measures and 3) operational-phase measures.
- Section 9 consists of a summary table of all monitoring requirements and proposals to be adhered to during the implementation of the proposed project, categorised into three separate headings, 1) pre-commencement measures; 2) construction-phase measures and 3) operational-phase measures.
- Section 10 sets out an anticipated programme for the timing of the proposed works.
- Section 11 outlines the proposals for reviewing compliance with the provisions of this report.

1.3 Targets and Objectives

In so far as they have been completed to date, or are to be further completed in future, the construction phase works are designed to approved standards, which include specified materials, standards, specifications and codes of practice. The design of the project has considered environmental issues and this is enhanced by the works proposals.

The key site targets are as follows;

- Ensure construction works and activities are completed in accordance with mitigation and best practice approach presented in the EIAR, AASR, NIS and associated planning documentation;
- Ensure construction works and activities are completed in accordance with all planning conditions for the development and that the CEMP is updated as required;
- Ensure construction works and activities have minimal impact/disturbance to local landowners and the local community;

- Ensure construction works and activities have no adverse effect on the integrity of any European Site;
- Adopt a sustainable approach to construction; and,
- Provide adequate environmental training and awareness for all project personnel.

The key site objectives are as follows;

- Using recycled materials if possible, e.g. excavated stone, clay and peat material;
- Ensure sustainable sources for materials supply where possible;
- Avoidance of any pollution incident or near miss as a result of working around or close to existing watercourses and having emergency measures in place;
- Avoidance of vandalism;
- Keeping all watercourses free from obstruction and debris;
- Correct implementation of the SuDS drainage design principles;
- Keep impact of construction to a minimum on the local environment, watercourses, and wildlife;
- Correct fuel storage and refuelling procedures to be followed;
- Good waste management and house-keeping to be implemented;
- Air and noise pollution prevention to be implemented; and,
- Monitoring of the works and any adverse effects that it may have on the environment. Construction Methods and designs will be altered where it is found there is an adverse effect on the environment;
- Comply with all relevant water quality legislation;
- Ensure a properly designed, constructed and maintained drainage system appropriate to the requirements of the site is kept in place at all times.

2. SITE AND PROJECT DETAILS

2.1 Site Location

The site of the proposed wind farm development is located in north Co. Westmeath, approximately 2.4 kilometres north of Coole village. The town of Castlepollard is located approximately 6.7 kilometres southeast of the site, at its nearest point. Table 2-1 sets out the townlands in all elements of the wind farm, grid connection route and ancillary works are located.

The proposed permanent footprint of the Proposed Development measures approximately 26.4 hectares. The overall layout of the Proposed development is shown on Figure 2-1a and 2-1b. Land-use on the subject site is associated with commercial peat harvesting, commercial forestry and pastoral agriculture. Land-use in the wider landscape comprises a mix of large-scale peat extraction, pastoral agriculture, low density residential and commercial forestry.

The site is partially bound by the Inny River to the west, agricultural land to the south and east, and coniferous forestry and an active peat harvesting bog to the north. The River Glore intersects the northern section of the site as it flows from southeast to northwest.

It is proposed to deliver turbines to the site from the port of delivery (i.e. Dublin, Cork or Waterford) via the M4 motorway and then the N4 National Primary Road single-lane carriageway between Mullingar and Edgeworthstown. From the N4, the turbine delivery route turns northwards on the L1927 local road, then turns right onto the L5828 at Boherquill, and from here onto the R395 Regional Road at Corralanna. From the R395, the turbine delivery route will then connect to the R396 via a proposed new section of access road ("link road") in the townland of Coole, thereby avoiding the existing left-hand-turn in Coole village. A Traffic Management Plan is located in Section 4.12.3 of this CEMP with further information on traffic and transportation outlined in Chapter 14 of the EIAR.

The Proposed Development will connect to the national electricity grid via Mullingar 110 kV substation. The proposed grid connection route measures approximately 26km in length from the proposed wind farm site to the existing substation near Mullingar. The grid connection route would comprise underground cabling located primarily within the public road corridor, with a short section of underground cabling (approximately 700m) across private lands at the northernmost end.

It is proposed to upgrade the existing Mullingar 110kV substation to accommodate the connection of the Proposed Development consisting of the construction of an additional dedicated bay to facilitate connection of the cable.

Table 2-1 Townlands within which the Proposed Development is located

Development Works	Townland
Wind Farm, including Turbines and Access Roads, Substation, Construction Compound	Camagh, Carlanstown, Coole, Clonrobert, Clonsura, Doon, Monktown, Mullagh, and Newcastle.
Proposed Borrow Pit	Mullagh
Junction Accommodation Works	Boherquill, Coole, Corralanna, Culvin,Joanstown and Mayne
Grid Connection Route	Camagh, Monktown, Coole, Fearmore (Fore by), Newtown (Fore by), Mayne, Simonstown (fore by), Ballinealoe, Shrubbywood, Clonava,

Development Works	Townland
	Lackan (Corkaree by), Soho, Ballynaclonagh, Abbeyland, Rathganny, Ballindurrow, Cullendarragh, Culleenabohoge, Ballynafid, Knightswood, Portnashangan, Culleen More, Farranistick, and Irishtown (Moyashel by)

Map Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- Proposed Hardstand
- Internal Roads (new)
- Internal Roads (Upgrades to existing)
- External Roads (Upgrades to Existing)
- Proposed Temporary Construction Compound
- Proposed Borrow Pit
- Proposed Onsite Substation
- Proposed Grid Connection Route
- Proposed Upgrade Works to Existing Mullingar Substation
- Temporary Hardcore Surfacing Areas

Proposed Site Layout

Coole Wind Farm, Co. Westmeath

Drawn By	Checked By
EC	MW
Project No.	Drawing No.
200445	Figure 2-1a
Scale	Date
1:65000	11.02.2021

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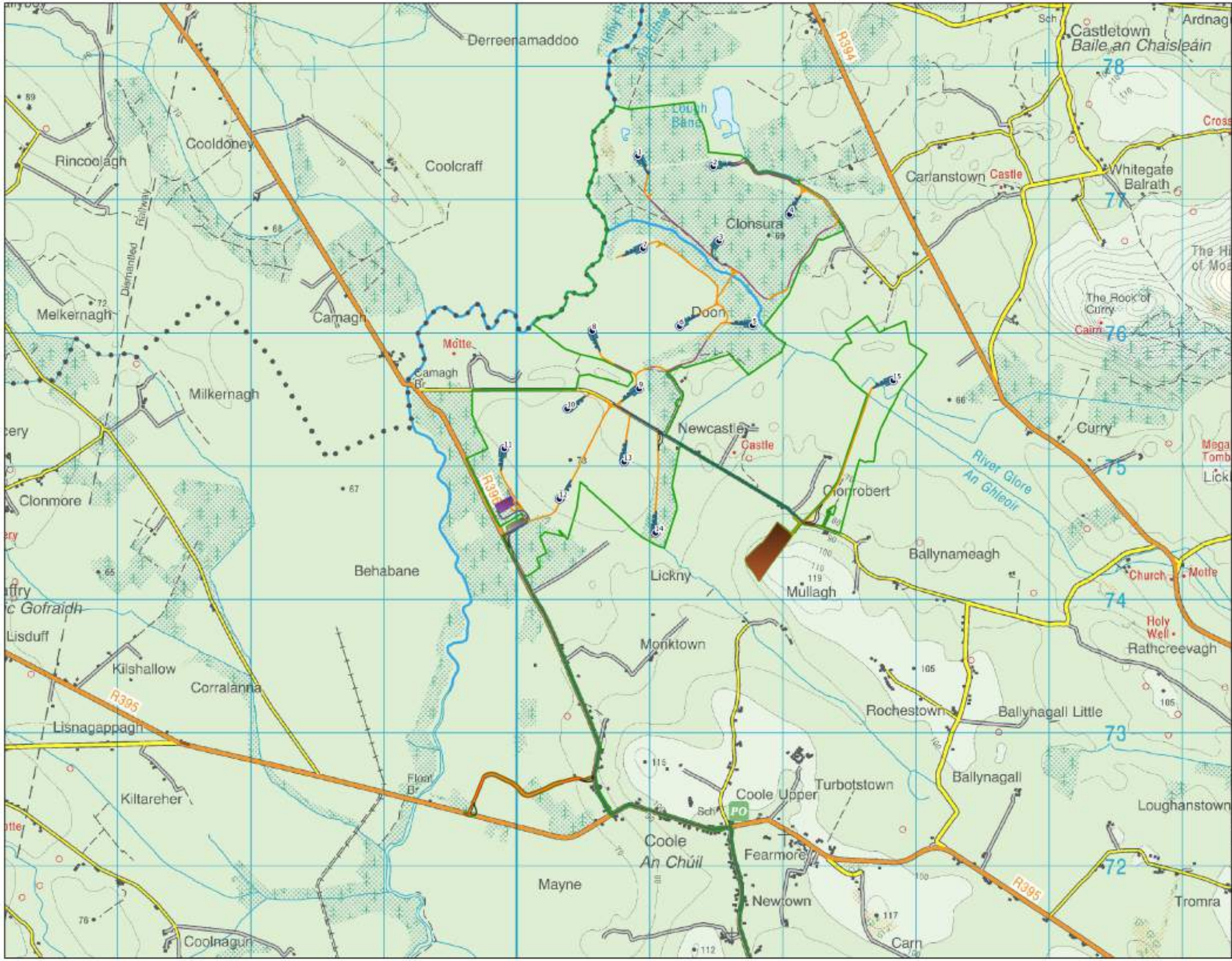

Proposed Site Layout

Coole Wind Farm, Co. Westmeath

Drawn By	Checked By
EC	MW
Project No.	Drawing No.
200445	Figure 2-1b
Scale	Date
1:25000	11.02.2021

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2.2 Geological Conditions

The ground conditions at the Wind Farm Site (including the link road area) can be categorised into the following deposits:

- Peat – Typically described as brown/dark brown fibrous and amorphous peat. Peat thicknesses from peat probing, window sampling and drilling ranged from 0 to 12.5m. The average peat depths recorded at infrastructure locations across the Wind Farm Site was 3.9m.
- Calcareous Mud/Shell Marl – Soft cream coloured mud with local deposits of shell fragments.
- Lacustrine Clay – Locally grey to dark grey soft to firm clay. The marl is considered to be a lacustrine deposit.
- Glacial Granular Soils – Locally loose to dense wet grey sandy clayey silty gravel. The glacial granular soils are likely to have a mixed strength/density.
- Weathered Bedrock – Possible weathered bedrock was only encountered in trial pit TP2-C. Arisings from the trial pit comprised of large angular cobbles and a matrix of sandy silt and angular gravel.
- Limestone bedrock – Limestone bedrock was encountered during the rotary core boreholes drilled at 13 no. locations. The bedrock is described as generally medium strong to strong, dark grey, fine grained, thinly to thickly bedded Limestone.

The ground conditions at the borrow pit can be typically categorised into the following deposits:

- Topsoil – Typically described as sandy gravelly clay.
- Glacial Till – Consisted of orange to brown slightly gravelly Clay.
- Weathered Bedrock – Typically consisting of angular gravels, cobbles and boulders of weathered limestone in a clay matrix.
- Bedrock – Bedrock comprises of strong intact limestone at typically 1.5 metres below ground level.

The published soils map (www.epa.ie) for the area indicates that the majority of the Grid Connection Route, north of Multyfarnham, including the area of the proposed onsite substation, is mapped as cut over peat, while the area around Coole village is mapped as basic, well drained mineral soil (BminDW). South of Multyfarnham, soils are mapped as being predominantly acidic, well drained mineral soil (AminDW) with some pockets of Fen Peat. The soils between the southern tip of Lough Owel and Mullingar town are mapped as BminDW. Subsoils in the area are mapped by the GSI as generally cut over raised peat and Tills derived from Limestone north of Multyfarnham, transitioning to Tills derived from chert, raised peat and minor areas of Tills derived from Limestone.

A peat stability assessment was carried out to determine the stability i.e. Factor of Safety (FoS), of the peat slopes where construction is proposed during the development of the wind farm. The findings, which involved analysis of over 200 no. locations, showed that the site has an acceptable margin of safety and is suitable for the proposed wind farm development. The findings include recommendations and control measures for construction work in peatlands to ensure that all works adhere to an acceptable standard of safety as set out in the Peat Stability Management Section 4.6 of this CEMP.

2.3 Hydrological Conditions

On a regional scale, the proposed wind farm is located in the Inny River surface water sub-catchment which is in the Upper Shannon catchment within Hydrometric Area 26 of the Shannon International River Basin District (SIRBD).

On a more local scale the site is located in the Inny River sub-catchment and two sub basins of the Inny River. The majority of the site is within the Inny_050 sub basin with a small section in the south of the

site near the R396 within the Inny_060 sub basin. The Inny River flows in a southerly direction along the western boundary of the site and discharges into Lough Derraverragh approximately 7.5km downstream of the site.

The western section of the site drains directly to the Inny River via a number of settlement ponds and outfall channels which are discussed further below in the site drainage section. The River Glore flows from across the northern section of the site from east to west and merges with the Inny River on the western boundary of the site.

A drain (henceforth known as drain D1), which divides the northern basin in two sections, discharges directly to the Inny River northwest of the Wind Farm Site. Lough Bane, proposed Natural Heritage Area (pNHA) is located adjacent to the northern boundary of the Proposed Development site; however, no part of the Proposed Development footprint is located within the pNHA. Lough Bane itself is located approximately 180 metres north of the internal access road between Turbines T2 and T4. An unnamed small dystrophic lake is located on the northwestern corner of the site.

The proposed link road is located within the Inny River catchment, and the junction improvement works are also located within sub-catchments to the Inny River. The Inny River flows south from the Wind Farm Site into Lough Derraverragh approximately 7.5km downstream of the site.

The Grid Connection Route is located within the Shannon International River Basin District. With respect to regional hydrology, the Grid Connection Route is located in 2 no. regional surface water catchments (the River Inny and the River Brosna) and 3 no. regional surface water sub-catchments. The southern section of the Grid Connection Route, along the eastern edge of Lough Owel and on to Mullingar (~8km long) is located within the Brosna sub-catchment (Brosna_SC_010) within the regional Lower Shannon catchment (25A). The area north of Lough Owel to the northern edge of Lough Derravargh is located within the Inny sub-catchment (Inny[Shannon]_SC_030). North of Lough Derravargh, towards Coole, falls within the boundary of the Inny sub-catchment (Inny[Shannon]_SC_020). Both of these subcatchments are located within the regional Upper Shannon Catchment (26F).

Drainage measures on the site will include swales, silt traps, settlement ponds, field drains and headland drains as discussed further in Section 4.2 below.

2.4 Ecological Conditions

The Coole Wind Farm Site study area is dominated by Cutover Bog (PB4). Much of Coole bog comprises milled peat and is divided up by drains, spaced approximately 15m apart, which separate long parallel peat production fields. The lands to the east of the site comprise agricultural land. The edge of the main wind farm site is bordered by Conifer Plantation (WD4) to the east and south while the lands surrounding T15 are predominantly agricultural in nature. The proposed Turbine 15 is located to the east of the site within agricultural grassland categorized as Improved Agricultural Grassland (GA1)/Wet Grassland (GS4). The proposed Turbine 5 and Turbine 14 are located within Conifer Plantation (WD4). The remaining turbines locations are situated in Cutover Bog (PB4).

The proposed grid connection route will be located within the carriageway/verge of existing public roads. There is no requirement to use habitats located outside the road carriageway except at the Northern and Southern ends where the connection points leave the public road for termination. All roads within/adjacent to the proposed cable route were classified as Building and Artificial Surfaces (BL3). Much of the cable route was bordered by a verge supporting Dry Meadows and Grassy Verges (GS2).

Third Schedule invasive species, Rhododendron (Rhododendron ponticum), Japanese Knotweed (Fallopia japonica) and Bohemian Knotweed (Fallopia bohemica) were recorded at 5 locations along the grid connection route in the townlands of Clonava, Multyfarnham and Ballinealoe. All works in

these areas will be confined to the existing road. Best practice measures are in place to ensure no Third Schedule invasive plants are spread as a result of the Proposed Development.

The assessment identifies a number of Key Ecological Receptors: Degraded Raised Bog, Dystrophic Lake, River Glore Corridor and River Inny, Bog Woodland, Otter, Badger and Bat species. Habitats listed in Annex I of the EU habitats Directive were not recorded within the development footprint or along the turbine delivery or grid connection routes. No Annex I habitats will be impacted as a result of the Proposed Development. Levels of faunal activity were extremely low and evidence recorded was associated with the periphery of the site.

2.5 Archaeological Conditions

Through a detailed examination of the baseline data available and a detailed site inspection, it was concluded that while the archaeological potential of the area is high, however no new sites were noted within the peatland areas of the Proposed Development, nor are any recorded archaeological or architectural assets located therein. One new potential archaeological monument was detected within the Wind Farm Site boundary at Clonrobert townland. It comprises an enclosed rectangular area in pasture c. 74m east of the proposed access road to T15. No direct impacts to this potential monument as a result of the proposed development have been identified. Furthermore, direct impacts to recorded archaeological and architectural assets as a result of the proposed turbines, substation, associated infrastructure and borrow pit have not been identified.

Where potential impacts are possible appropriate mitigation measures have been recommended in order to minimise any such impacts. Recommended mitigation includes re-assessment surveys due to the changing levels within the bog as a result of peat harvesting, pre-development archaeological testing where turbine bases, roads etc will be excavated and archaeological monitoring during the construction stage of the project. Indirect effects on the setting of National Monuments within 15km, RMPs within 5km and RPS/NIAH within 5km were included in order to assess impacts on setting in the wider landscape.

The proposed Grid Connection Route was subject to assessment. All cultural heritage assets within 100m of either side of the route were assessed for potential impacts to same as a result of the proposed Grid Connection Route. No direct impacts to the recorded or unrecorded archaeological, architectural or cultural heritage resource as a result of the proposed Grid Connection Route have been identified. Mitigation measures are recommended where deemed appropriate and include archaeological monitoring of ground works in specified areas along the proposed route. An assessment of potential impacts as a result of proposed Junction Accommodation Works along the proposed Turbine Delivery Route was also carried out. No direct or indirect impacts to the recorded archaeological or cultural heritage resource were identified.

An archaeological assessment will be completed in areas prior to the commencement of works. The details of the required assessment are summarised in Section 4.7 below.

3. CONSTRUCTION MANAGEMENT

3.1 Introduction

An experienced main contractor will be appointed for the civil works for the construction phase. The appointed contractor for the works will be required to comply with this CEMP and any revisions made to this document.

The proposed wind farm development will comprise of the following:

i. *Up to 15 No. wind turbines with a tip height of up to 175 metres and all associated foundations and hardstanding areas;*
ii. *1 no. onsite electrical substation including a control building, associated electrical plant and equipment, welfare facilities and a wastewater holding tank;*
iii. *1 no. temporary construction compound;*
iv. *Provision of new site access roads, upgrading of existing access roads and hardstand areas;*
v. *Excavation of 1 no. borrow pit;*
vi. *All associated underground electrical and communications cabling connecting the turbines to the proposed onsite substation;*
vii. *Laying of approximately 26 km of underground electricity cabling to facilitate the connection to the national grid from the proposed onsite substation located in the townland of Camagh to the existing 110kV Mullingar substation located in the townland of Irishtown;*
viii. *Upgrade works to the existing 110kV Mullingar substation consisting of the construction of an additional dedicated bay to facilitate connection of the cable;*
ix. *Construction of a link road between the R395 and R396 Regional Roads in the townland of Coole to facilitate turbine delivery;*
x. *Junction improvement works to facilitate turbine delivery, at the N4 junction with the L1927 in the townland of Joanstown, on land to the South East of railway line level crossing on the L1927 in the townland of Culvin, the L1927 and L5828 junction in the townland of Boherquill and the L5828 and R395 junction in the townland of Corralanna;*
xi. *Site Drainage;*
xii. *Forestry Felling;*
xiii. *Signage, and;*
xiv. *All associated site development works.*
xv. *This application is seeking a ten-year planning permission and 30-year operational life from the date of commissioning of the entire wind farm.*

The developer and/or contractor for the main construction works will liaise directly with Westmeath County Council and An Garda Síochána in relation to securing any necessary permits to allow the works to take place including for example:

- Commencement notice
- Special Permits in relation to oversized vehicles on public roads
- Temporary Road Closures (if required)
- Road Opening Licence (if required)

Complaints will be documented in the site complaints log and the Site Environmental Officer will arrange to meet with those affected. The situation will be acted upon immediately and reviewed by the Project Manager. A copy of the complaints procedure is included in Appendix 1 of this document.

An overview of the proposed anticipated Construction Methodologies is provided below.

3.1.1 Overview of Proposed Construction Methodology

The proposed anticipated construction methodology is summarised under the following main headings:

- Temporary Construction Compound;
- Tree Felling
- Borrow Pit;
- Road Construction
- Hard Standing Areas;
- Turbine Foundations;
- Electricity Substation and Control Buildings;
- Proposed upgrade works to the existing 110kV Mullingar substation;
- Peat and Spoil Management;
- Grid Connection Cable Trench
- Existing Underground Services
- Grid Connection Watercourse/Culvert Crossings and Irish Rail Level Crossing
- Link Road Junction Accommodation and Public Road Works

3.1.1.1 Temporary Construction Compound

A temporary construction compound is proposed, located inside the wind farm site entrance from the R396 Regional Road, as shown in Figure 2-1. The proposed compound area measures approximately 6,610m2. The layout of the proposed compound comprises of temporary site offices, staff facilities and car-parking areas.

A dedicated waste management area will be located within the compound, with waste to be sorted and collected from site by permitted collectors. Potable drinking water will be supplied via water coolers located within the staff facilities, which will be restocked on a regular basis as required during the construction phase. A supply contract will be set up with a water cooler supply company with water supplies delivered to site as required for the duration of the construction period.

Temporary port-a-loo toilets located within portacabins will be used during the construction phase. Wastewater from staff toilets will be directed to a sealed storage tank, with all wastewater being tankered off site by permitted waste collector to wastewater treatment plants. Power will be supplied by a diesel generator, located within the compound. The construction compound will be used for temporary storage of some construction materials, prior to their delivery to the required area of the site.

3.1.1.2 Tree Felling

The majority of the proposed wind farm site is occupied by cutover peat, with some areas occupied by commercial forestry and agricultural grassland. As part of the Proposed Development, some tree felling is required within and around the development footprint to allow the construction of turbine bases, access roads and other ancillary infrastructure. There are two turbines within the Proposed Development that are located within an area of forestry; T5 and T14. It should be noted that all forestry on the site of the proposed wind farm was originally planted as a commercial crop, and will be felled in the coming years should the proposed wind farm proceed or not.

A total of 16.36 hectares of forestry is required to be felled within and around the Proposed Development footprint.

The tree felling activities required as part of the Proposed Development will be the subject of a Felling Licence application to the Forest Service, as per the Forest Service's policy on granting felling licenses for wind farm developments. The policy requires that a copy of the planning permission for the wind farm be submitted with the felling licence applications; therefore the felling licenses cannot be applied for until such time as planning permission is obtained for the Proposed Development.

3.1.1.3 Borrow Pit

It is proposed to develop 1 No. borrow pit as part of the Proposed Development, the location of which is shown on Figure 2-1 and in the design drawings in Appendix 4-1 of the EIAR. The site of the proposed borrow pit is located on agricultural grassland, approximately 700 metres southeast of the nearest proposed turbine location (T14). The proposed borrow pit will be accessed from the L5755 local road, which will connect the borrow pit to the proposed wind farm site. The borrow pit access road is located less than 0.1 kilometre west of the access road to T15.

It is proposed to obtain the majority of all rock and hardcore material that will be required during the construction of the proposed development from the on-site borrow pit. Usable rock may also be won from other infrastructure construction including the substation and the turbine base excavations.

The borrow pit will, on removal of all necessary and useful rock, be reinstated and made safe from a health and safety perspective and the slopes will be graded using the subsoils and topsoil currently at this location. A gate will be in place at the borrow pit entrance location, set back from the local road.

3.1.1.4 Road Construction

3.1.1.4.1 *New Floating Roads*

New roadways will be required onsite for access to turbine locations, with the majority of these access roads floated unless ground conditions permit the use of excavated roads. New roadways will have a running width of approximately five metres, with wider section at corners and on the approaches to turbine locations. The proposed road layout also incorporates 2 No. passing bays to allow two trucks pass each other while travelling around the site.

All new roadways will be constructed with a camber to aid drainage and surface water runoff. The gradient and slope of the camber will depend on the site characteristics where the road is actually being constructed.

Construction of floating access roads across the peat is the proposed technique for the majority of the site access roads. Given the flat topography and deep nature of peat on site, floating access roads are deemed an appropriate construction technique.

The general construction methodology for floating access roads, as presented in FT's Peat and Spoil Management Plan in Appendix 4-2 of the EIAR, is summarised as follows:

- Prior to commencing floating road construction movement monitoring posts will be installed in areas where the peat depth is greater than 4m.
- Base geogrid to be laid directly onto the existing peat surface along the line of the road in accordance with geogrid provider's requirements.
- Construction of road to be in accordance with appropriate design from the designer.
- The typical make-up of the new floated access road is up to 1,000mm of selected granular fill with 2 no. layers of geogrid with possibly the inclusion of a geotextile separator.
- Granular fill to be placed and compacted in layers in accordance with the TII Specification for Road Works.
- Following the detailed design of the floated access roads it may be deemed necessary to include pressure berms either side of the access road in some of the deeper peat areas. The inclusion of a 2 to 5m wide pressure berm (typically 0.5m in height) either side of the access road will reduce the likelihood of potential bearing failures beneath the access road.
- The finished road width will be approximately 5m, with wider sections on bends and corners.

- Stone delivered to the floating road construction shall be end-tipped onto the constructed floating road. Direct tipping of stone onto the peat shall not be carried out.
- To avoid excessive impact loading on the peat due to concentrated end-tipping all stone delivered to the floating road shall be tipped over at least a 10m length of constructed floating road.
- Where it is not possible to end-tip over a 10m length of constructed floating road then dumpers delivering stone to the floating road shall carry a reduced stone load (not greater than half full) until such time as end-tipping can be carried out over a 10m length of constructed floating road.
- Following end-tipping a suitable bulldozer shall be employed to spread and place the tipped stone over the base geogrid along the line of the road.
- A final surface layer shall be placed over the full width of the floating road, as per design requirements, to provide a road profile and graded to accommodate wind turbine construction and delivery traffic.

3.1.1.4.2 *Upgrade of Existing Access Roads or Tracks*

Upgrading of existing tracks through peat is proposed for limited sections of access track across the site. Given the flat topography and deep nature of peat on site, upgrading of existing excavated access roads is deemed appropriate only where specified.

The general construction methodology for upgrading of existing sections of onsite roads or tracks, as presented in FT's Peat and Spoil Management Plan in Appendix 4-2 of the EIAR, is summarised below.

- This methodology includes procedures that are to be included in the construction to minimise any adverse impact on peat stability. The methodology is not intended to cover all aspects of construction such as drainage and environmental considerations. Access road construction shall be to the line and level requirements as per design/planning conditions.
- For upgrading of existing excavated access roads the following guidelines apply:
    - Excavation of the widened section of access road should take place to a competent stratum beneath the peat and backfilled with suitable granular fill.
    - Benching of the excavation may be required between the existing section of access road and the widened section of access road depending on the depth of excavation required.
    - The surface of the existing access road should be overlaid with up to 500mm of selected granular fill.
    - Access roads to be finished with a layer of capping across the full width of the track
    - A layer of geogrid/geotextile may be required at the surface of the existing access road and at the base of the widened section of access road
    - For excavations in peat, side slopes shall be not greater than 1 (v): 3 (h). This slope inclination should be reviewed during construction, as appropriate. Where areas of weaker peat are encountered then slacker slopes will be required to ensure stability.

- For upgrading of existing floated access tracks (Type B – Figure 4-6) the following guidelines apply:
    - The make-up of the existing floating access roads on site is generally locally tree brash/trunks laid directly onto the peat surface and/or geotextile overlain by up to 500mm of coarse granular fill/till type (fine granular/cohesive) site won material. It should be noted that there are

localised variations in the make-up of the existing floated access tracks on site, frequently no tree brash/trunks were used in the make-up and the presence of a geogrid was also noted in localised sections of the existing track.
    - The surface of the existing access track should be levelled prior to the placement of any geogrid/geotextile, where necessary (to prevent damaging the geogrid/geotextile).
    - Where coarse granular fill has been used in the existing floated access road make-up, a layer of geogrid should be placed on top of the existing floated access track.
    - Where fine granular/cohesive type material has been used in the existing floated access road make-up (as is the case on some of the existing access roads in the southeast of the site), a layer of geotextile is likely to be required as a separator layer with a layer of geogrid.
    - The geogrid will be overlaid with up to 500mm of selected granular fill. Granular fill to be placed and compacted in layers.

- The finished road width will have a running width of 5m, with wider sections on bends and corners.
- On side long sloping ground any road widening works required will be done on the upslope side of the existing access road, where possible.
- At transitions between new floating and existing excavated roads a length of about 10 to 20m shall have all peat excavated and replaced with suitable fill. The surface of this fill shall be graded to accommodate wind turbine construction and delivery traffic.

Where possible, internal cabling may be placed within the internal road corridor, subject to ESB/Eirgrid specifications.

3.1.1.4.3 *Excavated Road Construction Methodology*

The excavation of peat and spoil and founding of access roads on competent stratum (below the peat) for new access roads will be carried out at various locations on the site.

Excavate and replace type access roads are the conventional method for construction of access roads on peatland sites and the preferred construction technique in shallow peat provided sufficient placement/reinstatement capacity is available on site for the excavated peat.

This methodology includes procedures that are to be included in the construction to minimise any adverse impact on peat stability. The methodology is not intended to cover all aspects of construction such as drainage and environmental considerations.

- Prior to commencing the construction of the excavated roads movement monitoring posts will be installed in areas where the peat depth is greater than 2.0m.
- Interceptor drains will be installed upslope of the access road alignment to divert any surface water away from the construction area.
- Excavation of roads swill be to the line and level given in the design requirements. Excavation will take place to a competent stratum beneath the peat.
- Road construction will be carried out in sections of approximately 50m lengths i.e. no more than 50m of access road should be excavated without re-placement with stone fill.
- Excavation of materials with respect to control of peat stability:

- Acrotelm (to about 0.3 to 0.4m of peat) is generally required for landscaping and will be stripped and temporarily stockpiled for re-use as required. Acrotelm stripping will be undertaken prior to main excavations.
- Where possible, the acrotelm shall be placed with the vegetation part of the sod facing the right way up to encourage growth of plants and vegetation.
- All catotelm peat (peat below about 0.3 to 0.4m depth) shall be transported immediately on excavation to the designated placement areas.

- Side slopes in peat shall be not greater than 1 (v): 3 (h). This slope inclination will be reviewed during construction, as appropriate. Where areas of weaker peat are encountered then slacker slopes will be required. Battering of the side slopes of the excavations will be carried out as the excavation progresses.
- The excavated access road will be constructed with up to 1000mm of selected granular fill. Granular fill to be placed and compacted in layers in accordance with the TII Specification for Road Works.
- Access roads to be finished with a layer of capping across the full width of the road.
- A layer of geogrid/geotextile may be required at the surface of the competent stratum.
- At transitions between floating and excavated roads a length of road of about 10 to 20m shall have all peat excavated and replaced with suitable fill. The surface of this fill shall be graded so that the road surface transitions smoothly from floating to excavated road.
- Where slopes of greater than 5 degrees are encountered along with relatively deep peat (i.e. greater than 1.5m) and where it is proposed to construct the access road perpendicular to the slope contours it is best practice to start construction at the bottom of the slope and work towards the top, where possible. This method avoids any unnecessary loading to the adjacent peat and greatly reduces any risk of peat instability.
- A final surface layer shall be placed over the excavated road and graded to accommodate wind turbine construction and delivery traffic.

3.1.1.4.4 *Hardstanding Areas*

Hard standing areas consisting of levelled and compacted hardcore are required around each turbine base to facilitate access, turbine assembly and turbine erection. The hard-standing areas are typically used to accommodate cranes used in the assembly and erection of the turbine, offloading and storage of turbine components, and generally provide a safe, level working area around each turbine position. The hard-standing areas are extended to cover the turbine foundations once the turbine foundation and tower is in place. The sizes, arrangement and positioning of hard standing areas are dictated by turbine suppliers. The hard-standing area is intended to accommodate a crane during turbine assembly and erection. The proposed hard standing areas shown on the detailed layout drawings included in Appendix 4-1 of the EIAR are indicative of the sizes required, but the extent of the required areas at each turbine location may be optimised on-site depending on topography, position of the site access road, the proposed turbine position and the turbine supplier's exact requirements.

3.1.1.5 Turbine Foundations

Each wind turbine is secured to a reinforced concrete foundation that is installed below the finished ground level. The size of the foundation will be dictated by the turbine manufacturer, and the final turbine selection will be the subject of a competitive tender process. Different turbine manufacturers use different shaped turbines foundations, ranging from circular to hexagonal and square, depending on the requirements of the final turbine supplier. The turbine foundation transmits any load on the wind turbine into the ground.

After the foundation level of each turbine has been formed using piling methods or on competent strata, the bottom section of the turbine tower or the "Anchor Cage" is levelled and reinforcing steel is then built up around and through the anchor cage. The outside of the foundation is shuttered with demountable formwork to allow the pouring of concrete and is backfilled accordingly with appropriate granular fill to finished surface level.

3.1.1.6 Electricity Substation and Control Buildings

It is proposed to construct one on site electricity substation within the Proposed Development site, as shown in Figure 2-1. The proposed substation site is located within an area of forestry, which will screen it from view from the R396 Regional Road, located approximately 40 metres west of the substation at its nearest point.

The footprint of the proposed electricity substation compound measures approximately 142 metres by 72 metres, and will include a wind farm control building and the electrical components necessary to consolidate the electrical energy generated by each wind turbine and export that electricity from the wind farm to the national grid.

The substation compound will be surrounded by a 2.65-metre high steel palisade fence (or as otherwise required by ESB/Eirgrid), and internal fences will also segregate different areas within the main substation. The construction and exact layout of electrical equipment in the electricity substation will be to ESB/Eirgrid networks specifications.

A wind farm control building will be located within the substation compound. The building will measure approximately 25.6 metres by 15 metres, and approximately 7.8 metres in height. The layout and elevation of the proposed wind farm control building are shown on Figure 4-14a of the EIAR. The wind farm control building will include a small office space and staff welfare facilities for the staff that will work on the operational phase of the proposed project. Toilet facilities will be installed with a low-flush cistern and low-flow wash basin.

An IPP (independent power producer) building and ESB control rooms will also be located withing the substation compound. The building will measure approximately 20.37 metres by 5.83 metres, and approximately 5.5 metres in height. The layout and elevation of the proposed IPP control building are shown on Figure 14-14b of the EIAR. The IPP building will include a small office space and staff welfare facilities for the staff that will work on the operational phase of the Proposed Development.

It is proposed to install a rainwater harvesting tank adjacent to the control building. During the operational phase, potable drinking water will be supplied by a water cooler at the control building. A supply contract will be set up with a water cooler supply company with water supplies delivered to site as required on a regular basis.

It is proposed to manage wastewater from the staff welfare facilities in the control building by means of a sealed storage tank located adjacent to the building, with all wastewater being tankered off site by a permitted waste collector to a wastewater treatment plant. Detailed measures to address surface water management based upon the design criteria and philosophy will be implemented. The drainage system will be excavated and constructed in conjunction with the road and hard standing construction. Drains will be excavated and settlement ponds constructed to eliminate any material level of suspended solids within surface water running off the site. The drainage regime will be installed in accordance with details submitted in the EIAR.

3.1.1.7 Proposed Upgrade works at Existing Electricity Substation

It is proposed to upgrade the existing Mullingar 110kV substation to accommodate the connection of the proposed wind farm development. The upgrade works at the substation will consist of the construction of an additional dedicated bay. Three potential connection points have been identified for

this connection in consultation with ESB and EirGrid with the exact location to be identified at detail design stage, as indicated on the planning drawings in Appendix 4-1 of the EIAR.

3.1.1.8 Proposed Watercourse Crossings

It is proposed to replace the existing timber bridge over the River Glore within the proposed wind farm site with a 5-metre clear span bridge. The proposed bridge crossing will form part of the internal site road network, connecting Turbines T5-T12 to Turbines T1-T4. The crossing location is at Grid Reference E 641,560 N 776,452, as shown in Figure 4-23 of the EIAR and the design avoids the need for in-stream works.

A second crossing will be required to provide access to Turbine T1 located to the north of an OPW drain. This will require a 3-metre clear span bridge as shown on Figure 4-24 of the EIAR which shows the typical clear span bridge design.

A third crossing will be required to provide access to Turbine T15 over the River Glore. This will require a 5-metre clear span bridge as shown in Figure 4-25 which shows the typical clear span bridge design. The clear span bridge's will be constructed to the specifications of the OPW bridge design guidelines 'Construction, Replacement or Alteration of Bridges and Culverts - A Guide to Applying for Consent under Section 50 of the Arterial Drainage Act, 1945', and in consultation with Inland Fisheries Ireland. Abutments will be constructed from precast units combined with in-situ foundations, placed within an acceptable backfill material.

The typical construction methodology for the installation of clear span bridges is presented below:

- The access road on the approach to the watercourse will be completed to a formation level which is suitable for the passing of plant and equipment required for the installation of the watercourse crossing.
- All drainage measures along the proposed road will be installed in advance of the works.
- The abutment will consist of concrete panels which will be installed on a concrete lean mix foundation to provide a suitable base. The base will be excavated to rock or competent ground with a mechanical excavator with the foundation formed in-situ using a semi-dry concrete lean mix. The base will be excavated along the stream bank with no instream works required.
- Access to the north or opposite side of the river for excavation and foundation installation will require the installation of pre-cast concrete slab across the river to provide temporary access for the excavator.
- All pre-cast concrete panels and slabs/beams will be installed using a crane which will be set up on the southern side of the stream and will be lifted into place from the stream back with no contact with the watercourse.
- A concrete deck will be poured over the beams/slabs which span across the river. This will be shuttered, sealed and water tested before concrete pouring can commence.

3.1.1.9 Peat and Spoil Management

The management of excavated peat and spoil, and the methods of storage are described in FT's Peat and Spoil Management Plan in Appendix 4-2 of the EIAR and summarised below.

The peatland areas of the Proposed Development site have been extensively harvested using mechanical harvesting equipment, resulting in a well-drained and extensively trafficked peat. Experience has shown that the most environmentally sensitive and stable way of handling and moving peat is its placement across the site and at locations as close as possible to the excavation areas. The peat and overburden that is excavated as part of the construction works will be placed/spread locally alongside the excavations for the infrastructure elements.

The proposed methodology for the placement and storage of peat, as described in the FT's Peat and Spoil Management Plan, is summarised below.

- The peat and overburden that is excavated as part of the construction works will be locally placed/spread alongside the excavations for the infrastructure elements. Given the flat topography/nature of the site, this approach for the placement of excavated spoil is deemed appropriate.
- During the construction process, the spoil will be relayed locally to the side of the excavation by an excavator and spread on the bog on one or both sides of the excavations.
- The spoil will be spread to a depth not exceeding 1.0m in height over a typical width of 5m. The placed peat shall be tracked in to ensure it is adequately compacted and stable and graded to complement the topography and drainage system on the site.
- Where practical, it will be ensured that the surface of the placed material is shaped to allow efficient run-off of surface water. Where possible, shaping of the surface of the spread material shall be carried out as placement of material progresses. This will reduce the likelihood of debris run-off and ensure stability of the spread material.
- The placement of excavated material will be avoided without first establishing the adequacy of the ground to support the load. This may involve a visual inspection by competent personnel. The placement of material may require the use of long reach excavators and low ground pressure machinery in localised areas.
- Where there is any doubt as to the stability of the peat surface then no material shall be placed on to the peat surface.
- Finished/shaped side slopes in the placed material is likely to be in the region of 1 (v): to 3 (h). This slope inclination will be reviewed during construction, as appropriate. Where areas of weaker material are encountered then slacker slopes may be required.
- All placed/spread material will be allowed to revegetate naturally from the extensive seed source of the plants that have already colonised in the area. Alternatively, and possibly in addition, seeding of the placed material could be carried out which would aid in stabilising the placed material in the long term.

3.1.1.10 Grid Connection Cable Trench

Underground electrical cables will connect the proposed wind turbines to the proposed onsite substation. From here, the proposed wind farm will connect to the national grid via an underground cable connection between the site and the existing Mullingar 110 kV substation. The grid connection route follows the public road network and the exact location of the cable within the road curtilage will be subject to ESB/Eirgrid specifications and agreement with Westmeath County Council. The specifications for cables and cable installation will be in accordance with Eirgrid/ESB requirements.

What is provided below are the grid connection methodologies for:

- Cable Trench Installation in non-peatland environments
- Cable Trench Installation through peatland
  - Trench Type A (Through Floating Road Trench in Road with >2.5m to base of peat)
  - Trench Type B (Through Floating Road Trench in Verge with >2.5m to base of peat)
  - Trench Type C (Through Raised Floating Road Trench in Verge with <2.5m to base of peat)
  - Trench Type D (Through Floating Road Trench in Verge with <2.5m to base of peat)
  - Trench Type E1 (Through Floating Grid Route Track with >2.5m to base of peat)

- Trench Type E2 (Through Solid Grid Route Track with <2.5m to base of peat)

3.1.1.10.1 *Typical Cable Trench Installation in Non-Peatland Environments*

The underground cable required to facilitate grid connection will be laid beneath the surface of the site and/or public road using the following typical methodology:

- The area where excavations are planned will be surveyed, prior to the commencement of works, to identify all existing underground services.
- Two teams consisting of tracked excavators, dumpers and a tractor and stone cart with side-shoot or similar will dig the trench and lay approximately 300m of the underground cable ducting between them per day.
- One team will start at one end of the grid route with the other team starting approximately half way along the grid connection route. Both teams will be constructing in the same direction.
- The excavators will open a trench at the edge of the road surface, the trench will be a maximum of approximately 600mm wide and 1,250mm deep.
- The excavated material will be loaded into the dumpers to be transported to a designated temporary stockpiling area to be reused as backfilling material where appropriate.
- Clay plugs will be installed at 50m intervals to prevent the trench becoming a conduit for surface water runoff.
- Once the trench has been excavated, a level 65mm blinding layer with semi-dry lean-mix concrete will be placed at the base of the trench;
- The cable trefoil 160mm HDPE power ducts will be placed in the trench and tied at 3m intervals to keep the trefoil formation;
- Lean-mix concrete (CBM4 or similar) will be compacted around the ducts and to 75mm above the top trefoil duct where a red cable marker strip will be placed;
- Two 125mm HPDE comms cable ducts will be laid, spaced a clear 200mm apart using appropriate spacers;
- Lean-mix concrete (CBM4 or similar) will be compacted around the ducts and to 75mm above the comms duct where a red cable marker strip will be placed
- Final backfill layer to include a 500mm wide yellow warning tape 300mm below the finished surface.
- The trench will be surfaced as per the road surface specifications of the national, regional or local public road.
- Cable joint pits will be located at approximately 500m intervals or as otherwise required by ESB/Eirgrid requirements along the proposed cable route, each joint pit will be approximately 2.5m x 6m in size and contain a communications chamber, an earth link box and a cable joint bay, all of which will be located in the road edge and accessible for cable pulling and future maintenance.

3.1.1.10.2 *Cable Trench Installation through peatland*

The following are a list of typical general requirements for the ducting work in peat:

- The ducting shall be placed in the trench as per the specific cable design drawings to ESB / Eirgrid specifications, generally following the sequence outlined below.
- Appropriate traffic management would be implemented on site. This will involve road closures.
- Suitable drainage and environmental mitigation measures would be established along the section of road.
- Detailed method statement regarding the ducting works will be provided by the contractor.

- An assessment of all areas of natural drainage from the area of works will be carried out, and measures put in place to prevent any material draining from the trenching works into adjacent drainage ditches or streams.
- Spill kits shall be available during trenching. A spill mat will be used by the fuel tanker while refuelling.
- Following the trench excavation, ducts will generally be installed and surrounded with concrete. The placement of the concrete will be controlled in such a manner as to prevent any concrete entering adjacent drainage ditches or streams.
- Upon completion of trenching works the site shall be cleaned and any waste will be disposed of at a licenced facility.
- Note that monitoring of floating road settlement may be required before, during and after construction to ensure the stability of the trench and the floating road.
- Where the road surface is to be sealed, a suitable road surfacing build-up/reinforcement will be agreed with the road authorities.
- Where the depth of the peat is greater than 2.5m, generally roads and grid route infrastructure would be constructed at the surface of the existing road or verge, in order to limit excavation of the underlying peat for the trench.

3.1.1.10.3 *Trench Type A (Through Floating Road Trench in Road with >2.5m to base of peat)*

The typical general trench installation sequence is as follows and is shown in drawing COLE d005.2.1 in Appendix 4-3 of the EIAR:

- Existing road build-up will be planed off/excavated as required.
- The trench will be excavated within the road build-up.
- The lower combi-grid layer (or geotextile separating layer plus geogrid) will be placed within the trench and adequately supported along the shoulders of the trench excavation.
- Place a level 65mm blinding layer with semi-dry lean-mix concrete at the base of the trench.
- Place and joint the cable trefoil 160mm HDPE power ducts using cable ties at 3m intervals.
- Lay in and compact the layer of lean-mix concrete (CBM4 or similar) around the ducts to the top of the trefoil.
- Place an additional 90mm of CBM4 or similar from the top of the trefoil and install the 400mm wide red marker strips.
- Install two 125mm HPDE comms cable duct, spaced a clear 200mm apart using appropriate spacers.
- Lay in and compact an additional 185mm of CBM4 or similar around the comms ducts, and place another 400mm wide red marker strip above.
- Lay the second geogrid layer across the road and trench.
- Final backfill layer to include a 500mm wide yellow warning tape 300mm below the finished surface.
- Lay in and compact a 300mm (approximately) layer of Cl 804 material or similar above the geogrid. This material will form part of the road build-up and act to anchor the geogrid supporting the cable trench.
- Lay the road surfacing layers, including any surfacing reinforcement as required. Road surfacing will be agreed with the relevant road authorities prior to obtaining a road opening licence.
- Reinstate the road verges and any grassed areas or berms.

3.1.1.10.4 *Trench Type B (Through Floating Road Trench in Verge with >2.5 to base of peat)*

The typical general trench installation sequence is as follows and is shown in drawing COLE d005.2.2 in Appendix 4-3 of the EIAR:

- Existing road build-up and verge will be planed off/excavated as required.
- The trench will be excavated within the verge.
- The lower combi-grid layer (or geotextile separating layer plus geogrid) will be placed within the trench and adequately supported along the shoulders of the trench excavation.
- Place a level 65mm blinding layer with semi-dry lean-mix concrete at the base of the trench.
- Place and joint the cable trefoil 160mm HDPE power ducts using cable ties at 3m intervals.
- Lay in and compact the layer of lean-mix concrete (CBM4 or similar) around the ducts to the top of the trefoil.
- Place an additional 90mm of CBM4 or similar from the top of the trefoil and install the 400mm wide red marker strips.
- Install a two 125mm HPDE comms cable duct, spaced a clear 200mm apart using appropriate spacers.
- Lay in and compact an additional 185mm of CBM4 or similar around the comms ducts, and place another 400mm wide red marker strip above.
- Lay the second geogrid layer across the road and trench.
- Final backfill layer to include a 500mm wide yellow warning tape 300mm below the finished surface.
- Lay in and compact a 300mm (approximately) layer of Cl 804 material or similar above the geogrid. This material will form part of the road build-up and act to anchor the geogrid supporting the cable trench.
- Lay the road surfacing layers, including any surfacing reinforcement as required. Road surfacing will be agreed with the relevant road authorities prior to obtaining a road opening licence.
- Reinstate the road verges and any grassed areas or berms.

3.1.1.10.5 *Trench Type C (Through Raised Floating Road Trench in Verge with <2.5m to base of peat)*

The typical general trench installation sequence is as follows and is shown in drawing COLE d005.2.3 in Appendix 4-3 of the EIAR:

- Existing verge will be excavated to the trench width.
- The lower section of the excavation, beneath the trench, will be filled with CBM or similar to support the trench. Note, provision will be made within this lower section to ensure continuity of groundwater flow underneath the trench (e.g. intermittent sections with permeable stone surrounded with a geotextile and/or sections of pipe).
- The lower combi-grid layer (or geotextile separating layer plus geogrid) will be placed within the trench and adequately supported along the shoulders of the trench excavation.
- Place a level 65mm blinding layer with semi-dry lean-mix concrete at the base of the trench.
- Place and joint the cable trefoil 160mm HDPE power ducts using cable ties at 3m intervals.
- Lay in and compact the layer of lean-mix concrete (CBM4 or similar) around the ducts to the top of the trefoil.
- Place an additional 90mm of CBM4 or similar from the top of the trefoil and install the 400mm wide red marker strips.
- Install two 125mm HPDE comms cable duct, spaced a clear 200mm apart using appropriate spacers.
- Lay in and compact an additional 185mm of CBM4 or similar around the comms ducts, and place another 400mm wide red marker strip above.
- Layer the second geogrid layer across the road and trench.

- Final backfill layer to include a 500mm wide yellow warning tape 300mm below the finished surface.
- Lay in and compact a 300mm (approximately) layer of Cl 804 material or similar above the geogrid. This material will form part of the road build-up and act to anchor the geogrid supporting the cable trench.
- Lay the road surfacing layers, including any surfacing reinforcement as required. Road surfacing will be agreed with the relevant road authorities prior to obtaining a road opening licence.
- Reinstate the road verges and any grassed areas or berms.

3.1.1.10.6 *Trench Type D (Through Floating Road Trench in Verge with <2.5m to base of peat)*

The typical general trench installation sequence is as follows and is shown in drawing COLE d005.2.4 in Appendix 4-3 of the EIAR:

- Existing road build-up and verge will be planed off/excavated as required.
- The trench will be excavated within the verge.
- The lower section of the excavation, beneath the trench, will be filled with CBM or similar to support the trench. Note, provision will be made within this lower section to ensure continuity of groundwater flow underneath the trench (e.g. intermittent sections with permeable stone surrounded with a geotextile and/or sections of pipe).
- The lower combi-grid layer (or geotextile separating layer plus geogrid) will be placed within the trench and adequately supported along the shoulders of the trench excavation. A layer of brash or timber logs may be required on the verge side beneath the geogrid layer.
- Place a level 65mm blinding layer with semi-dry lean-mix concrete at the base of the trench.
- Place and joint the cable trefoil 160mm HDPE power ducts using cable ties at 3m intervals.
- Lay in and compact the layer of lean-mix concrete (CBM4 or similar) around the ducts to the top of the trefoil.
- Place an additional 90mm of CBM4 or similar from the top of the trefoil and install the 400mm wide red marker strips.
- Install two 125mm HPDE comms cable duct, spaced a clear 200mm apart using appropriate spacers.
- Lay in and compact an additional 185mm of CBM4 or similar around the comms ducts, and place another 400mm wide red marker strip above.
- Lay the second geogrid layer across the road and trench.
- Final backfill layer to include a 500mm wide yellow warning tape 300mm below the finished surface.
- Lay in and compact a 300mm (approximately) layer of Cl 804 material or similar above the geogrid. This material will form part of the road build-up and act to anchor the geogrid supporting the cable trench.
- Lay the road surfacing layers, including any surfacing reinforcement as required. Road surfacing will be agreed with the relevant road authorities.
- Reinstate the road verges and any grassed areas or berms.

3.1.1.10.7 *Trench Type E1 (Through Floating Grid Route Track with >2.5 to base of peat)*

The typical general trench installation sequence is as follows and is shown in drawing COLE d005.2.5 in Appendix 4-3 of the EIAR:

- Fell trees within the construction corridor.

- Where required, turn the tree stumps over to create a starting platform for the access track and/or lay a layer of brash or timber logs.
- Lay the combigrid and construct the lower section of the road to act as a construction access track. Install drainage crossings along the route as it progresses (usually corrugated pipes slung down beneath the road into the existing drains or incorporated into the road itself).
- The trench will be excavated within the track build-up.
- Place a level 65mm blinding layer with semi-dry lean-mix concrete at the base of the trench.
- Place and joint the cable trefoil 160mm HDPE power ducts using cable ties at 3m intervals.
- Lay in and compact the layer of lean-mix concrete (CBM4 or similar) around the ducts to the top of the trefoil.
- Place an additional 90mm of CBM4 or similar from the top of the trefoil and install the 400mm wide red marker strips.
- Install two 125mm HPDE comms cable ducts, spaced a clear 200mm apart using appropriate spacers.
- Lay in and compact an additional 185mm of CBM4 or similar around the comms ducts, and place another 400mm wide red marker strip above.
- Lay the second geogrid layer across the road and trench.
- Final backfill layer to include a 500mm wide yellow warning tape 300mm below the finished surface. An additional geogrid layer may be required in the upper section of the road.
- A layer of Cl 804 material or similar will form part of the final access track running surface.
- Install any reflective posts or fencing and cable identification marker posts.

3.1.1.10.8 *Trench Type E2 (Through Solid Grid Route Track with <2.5m to base of peat)*

The typical general trench installation sequence is as follows and is shown in drawing COLE d005.2.6 in Appendix 4-3 of the EIAR:

- Fell trees within the construction corridor.
- Peat would be excavated to subgrade, with stone placed to build up the lower sections of the road.
- Install drainage crossings along the route as it progresses (usually corrugated pipes incorporated into the road build up).
- Lay a layer of combigrid and construct the lower section of the road to act as a construction access track.
- The trench would be excavated within the track build-up.
- Place a level 65mm blinding layer with semi-dry lean-mix concrete at the base of the trench.
- Place and joint the cable trefoil 160mm HDPE power ducts using cable ties at 3m intervals.
- Lay in and compact the layer of lean-mix concrete (CBM4 or similar) around the ducts to the top of the trefoil.
- Place an additional 90mm of CBM4 or similar from the top of the trefoil and install the 400mm wide red marker strips.
- Install two 125mm HPDE comms cable duct, spaced a clear 200mm apart using appropriate spacers.
- Lay in and compact an additional 185mm of CBM4 or similar around the comms ducts, and place another 400mm wide red marker strip above.
- Layer the second geogrid layer across the road and trench.

- Final backfill layer to include a 500mm wide yellow warning tape 300mm below the finished surface. An additional geogrid layer may be required in the upper section of the road.
- A layer of Cl 804 material or similar will form part of the final access track running surface.
- Install any reflective posts or fencing and cable identification marker posts.

3.1.1.11 Existing Underground Services

Any underground services encountered along the route will be surveyed for level and the ducting will pass over the service provided adequate cover is available. A minimum clearance of 300mm will be required between the bottom of the ducts and the service in question. If the clearance cannot be achieved the ducting will pass under the service and again 300 mm clearance between the top of the communications duct and bottom of the service will be achieved. In deeper excavations, an additional layer of marker tape will be installed between the communications layer and yellow top level marker tape. If the required separation distances cannot be achieved then a number of alternative options are available such as using steel plates laid across the width of the trench and using 35N concrete surrounding the ESB ducts where adjacent services are within 600mm, with marker tape on the side of the trench. Back fill around any utility services will be with dead sand/pea shingle where appropriate. All excavations will be kept within the roadway boundaries, i.e. in road or grass margin.

3.1.1.11.1 *Joint Bays*

Joint bays are pre-cast concrete chambers where lengths of cable ducting will be connected. They will be located at various points along the ducting route approximately every 500 meters or as otherwise required by ESB requirements along the proposed cable route. Where possible joint bays will be located in areas where there is a natural widening/wide grass margin on the road in order to accommodate easier construction, cable installation and create less traffic congestion. During construction, the joint bay locations will be completely fenced off and will be incorporated into the traffic management system. Once they have been constructed they will be backfilled temporarily until cables are being installed.

3.1.1.12 Grid Connection Watercourse/Culvert Crossings and Irish Rail Level Crossing

There is a total of 16 no. watercourse crossings along the proposed grid connection, the locations of which are shown in Figure 3-1. There are 7 no. river/stream crossings (Locations No. 2, 3, 4, 10, 14, 15 & 16), with the remaining crossings being classified as culverts.

The proposed grid connection route will traverse one Irish Rail level crossing in the townlands of Farranistick and Culleen More adjacent to water course crossing No 16. Any such works on properties of Córas Iompair Éireann (CIE) who are the authority for such properties requires a license agreement to be put in place between the developer and CIE.

The preferred methodologies for the provision of the grid connection at these locations is set out in Appendix 2, which provides a summary of the watercourse crossing/culvert survey and description of works for all crossings. Should an alternative methodology option be required for individual crossings during the construction process this will be agreed with the relevant authorities including Westmeath County Council prior to works commencing. A description of each crossing option is provided below. Instream works are not required at any watercourse crossing along the proposed grid connection.

3.1.1.12.1 *Crossings over Culverts – Option1*

The watercourse at any of the crossings will not be disturbed because no instream works or bridge/culvert alterations are proposed. Watercourses will not be directly impacted upon since no

instream works or bridge/culvert alterations are proposed. Where adequate cover exists above a culvert, the ESB/Eirgrid specified flat formation ducting arrangement will be used where the cable ducts pass over a culvert maintaining 300mm minimum clearance to the top of the culvert . A heavy duty steel plate will be placed over the ducts as distance between the road surface and the ducts will have been reduced. The cable trench will pass over the culvert in a standard trench as outlined in Figure 3-2.

3.1.1.12.2 *Crossing under Piped Culverts – Option 2*

Where the watercourse crossing is a piped culvert consisting of either a socketed concrete or sealed plastic pipe where there is inadequate cover above the culvert to excavate, a trench will then be excavated beneath the culvert and cable ducts will be passed under the sealed pipe as outlined in Figure 3.3. If this duct installation method cannot be achieved due to the invert level of the existing culvert or due to the composition of the culvert e.g. stone culverts, the ducts will be installed by alternative means as set out in the following sections as outlined in Figure 3-3.

3.1.1.12.3 *Flatbed formation over Culverts – Option3*

Where sufficient cover and road width isn't available to place the ducting in the bridge decking, the cable can be placed in a stainless steel conduit with a minimum wall thickness of 4mm secured to the outside of the bridge deck supported by cleats at 1m intervals as per ESB/Eirgrid specifications. This method of crossing a bridge structure is detailed in Figure 3-4.

3.1.1.12.4 *Outside of Bridge Decking – Option 4*

Where sufficient cover and road width isn't available to place the ducting in the bridge decking, the cable can be placed in a stainless steel conduit with a minimum wall thickness of 4mm secured to the outside of the bridge deck supported by cleats at 1m intervals as per ESB/Eirgrid specifications. This method of crossing a bridge structure is detailed in Figure 3-5

3.1.1.12.5 *Directional Drilling – Option 5*

In the event that none of the above methods are appropriate, directional drilling will be utilised. The directional drilling method of duct installation will be carried out using Vermeer D36 x 50 Directional Drill (approximately 22 tonnes) or similar. The launch and reception pits will be excavated with a suitably sized excavator. The drilling rig will be securely anchored to the ground by means of anchor pins which will be attached to the front of the machine. The drill head will then be secured to the first drill rod and the operator shall commence to drill into the launch pit to a suitable angle which will enable him to obtain the depths and pitch required to the line and level of the required profile. Drilling of the pilot bore shall continue with the addition of 3.0m long drill rods, mechanically loaded and connected into position.

During the drilling process, a mixture of a natural, inert and fully biodegradable drilling fluid such as Clear Bore™ and water is pumped through the centre of the drill rods to the reamer head and is forced into void and enables the annulus which has been created to support the surrounding sub soil and thus prevent collapse of the reamed length. Depending on the prevalent ground conditions, it may be necessary to repeat the drilling process by incrementally increasing the size of the reamers. When the reamer enters the launch pit, it is removed from the drill rods which are then passed back up the bore to the reception pit and the next size reamer is attached to the drill rods and the process is repeated until the required bore with the allowable tolerance is achieved.

The use of a natural, inert and biodegradable drilling fluid such as Clear Bore™ is intended to negate any potential adverse impacts arising from the use of other, traditional polymer-based drilling fluids and will be used sparingly as part of the drilling operations. It will be appropriately stored prior to use and deployed in the required amounts to avoid surplus. Should any excess drilling fluid accumulate in the

reception or drilling pits, it will be contained and removed from the site in the same manner as other subsoil materials associated with the drilling process to an approved disposal site.

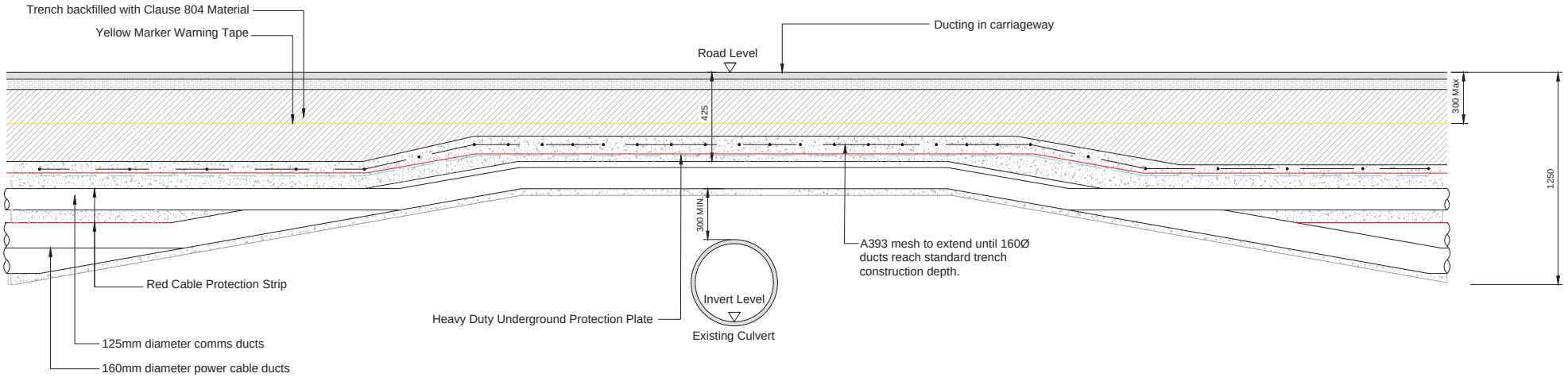
Backfilling of launch and reception pits will be conducted in accordance with the normal specification for backfilling excavated trenches. The directional drilling methodology is further detailed in Figure 3-6.

Drawing Title: Grid Connection Route Watercourse Crossing Locations

Project Title: Coole Wind Farm, Co. Westmeath

Drawn By	Checked By
EC	MW
Project No.	Drawing No.
200445	Figure 3-1
Scale	Date
1:100000	11/02/2021

MKO
Planning and Environmental Consultants



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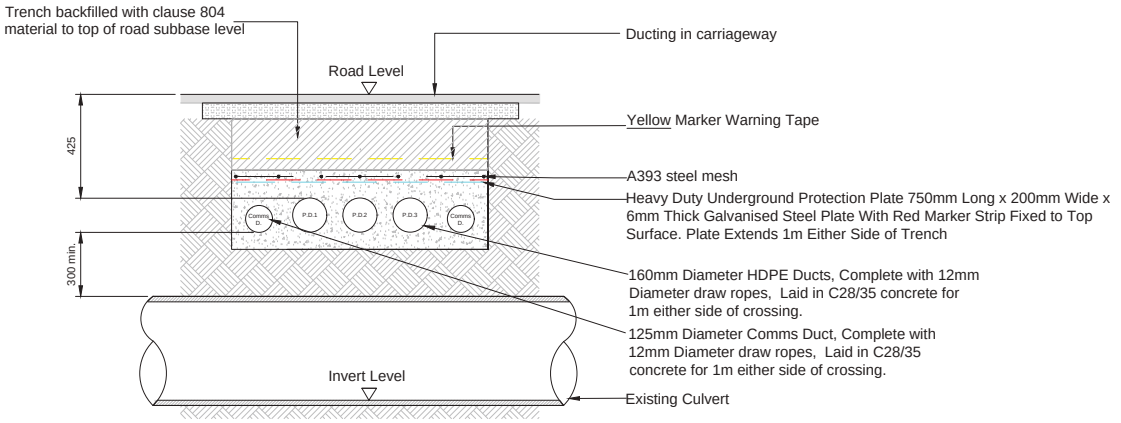

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Figure 3-2

Option 1 - Crossing over Culvert

NOTES

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A	17.01.2020	M.B.	J.S.	FIRST ISSUE

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PROJECT: COOLE WIND FARM GRID ROUTE

TITLE: WATER CROSSINGS TYPICAL DETAIL - OVER

REVISION: A

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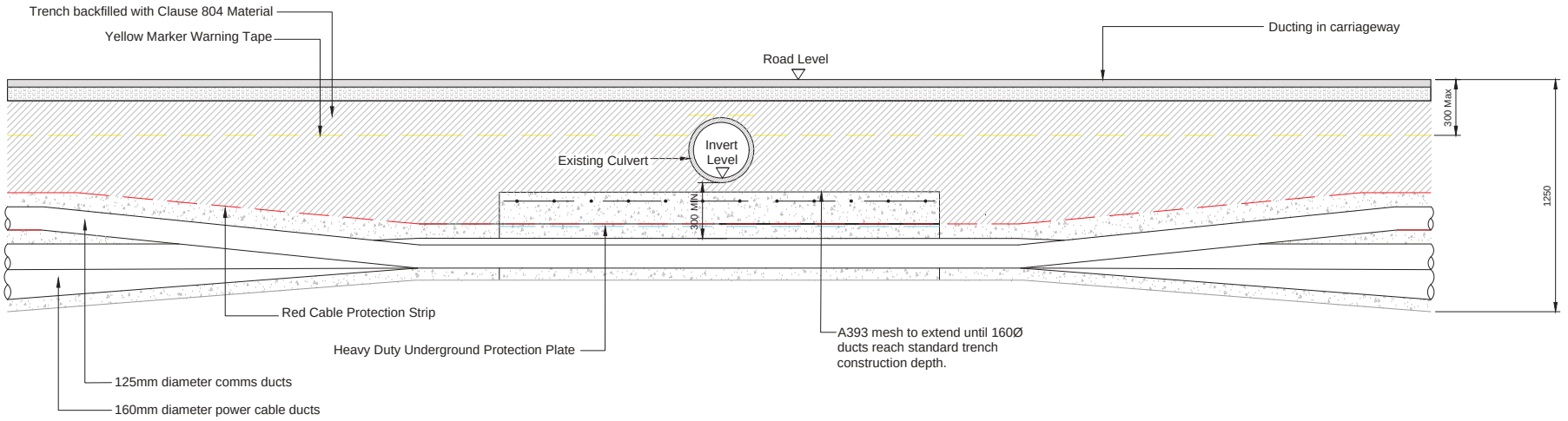

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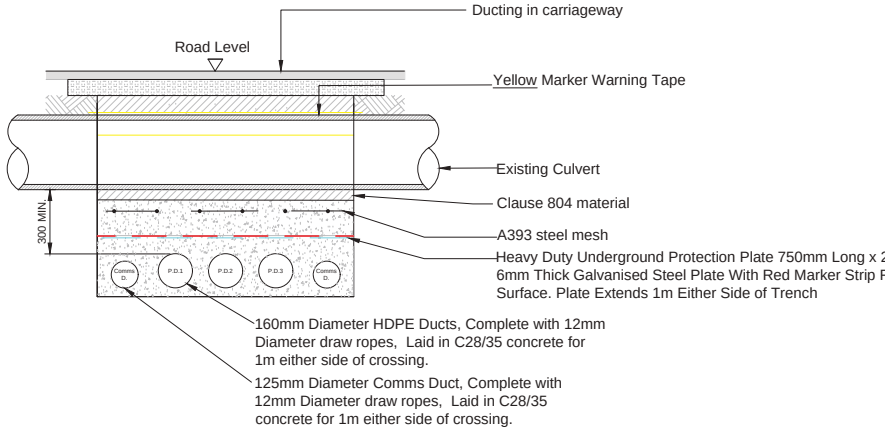

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Figure 3-3

Option 2 - Crossing under Piped Culvert

NOTES

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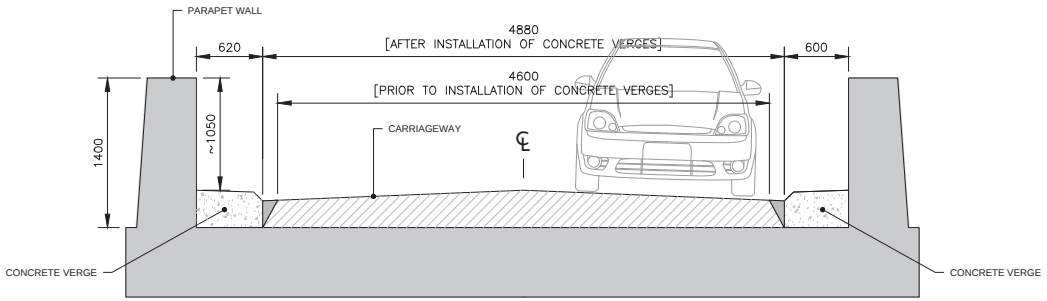

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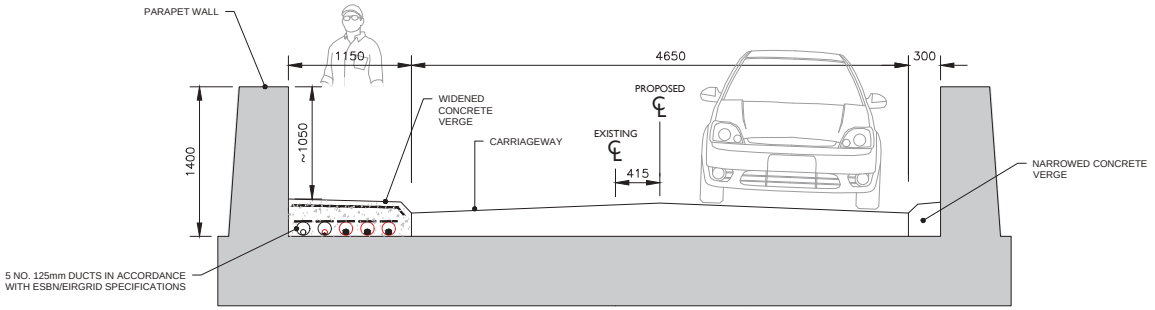

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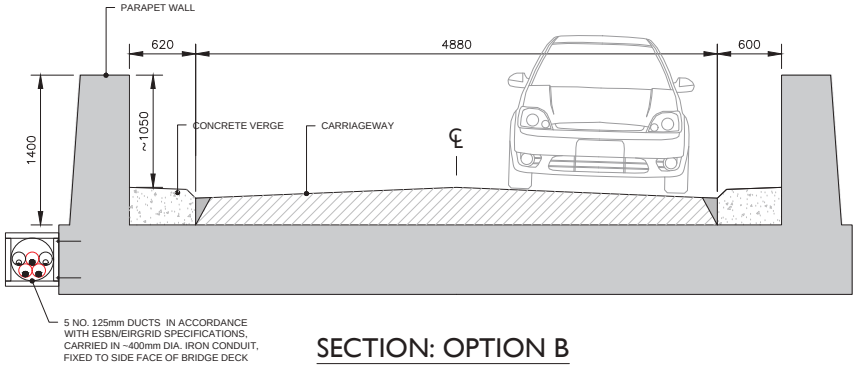

SECTION: OPTION B

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Figure 3-4

Option 3 - Flatbed Formation over Culverts

NOTES

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A	10.12.2019	M.B.	J.S.	FIRST ISSUE

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PROJECT: COOLE WIND FARM GRID ROUTE

TITLE: BRIDGE CROSSINGS WH-L1825-001.00

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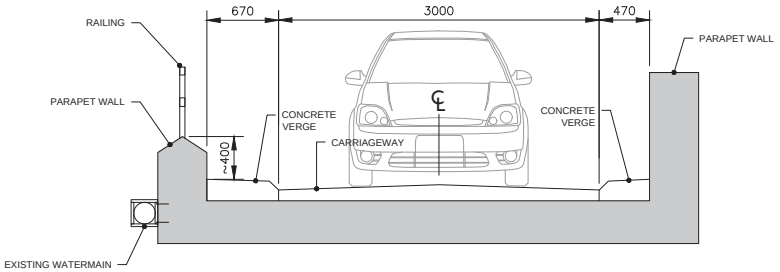

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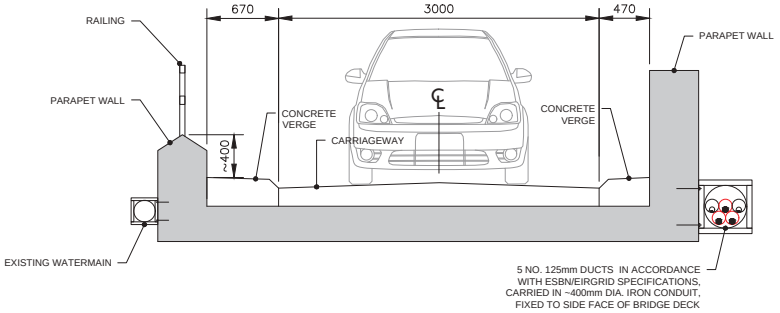

SECTION: OPTION A

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Figure 3-5

Option 4 - Outside of Bridge Decking

NOTES

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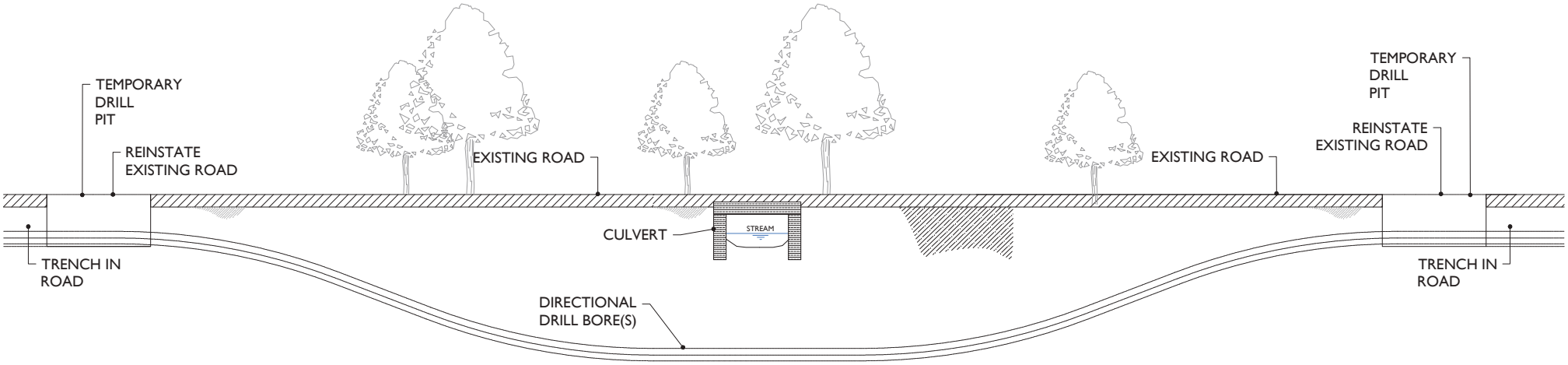

SECTION

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SECTION

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NOTE: No. and diameter of bores to be confirmed at detailed design.

Figure 3-6

Option 5 - Directional Drilling

NOTES

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3.1.1.13 Link Road, Junction Accommodation and Public Road Works

Improvements and modifications to the existing public road network to facilitate turbine delivery will be required as part of the Proposed Development works. This will include construction of a link road between the R395 and R396 Regional Roads and junction improvement works, including providing hardsurfacing at eleven locations; along the public road corridor at: the N4 junction with the L1927 in the townland of Joanstown, clearing of existing verge and vegetation to the south east of the railway line level crossing on the L1927, hardsurfacing and widening of the L1927 and L5828 junction in the townland of Boherquill, clearing of existing verge and vegetation and hardsurfacing at the gentle right turn from the L5828 onto the R395; hardsurfacing including clearance of vegetation and road verge to provide access and egress at proposed link road; hardsurfacing including clearance of vegetation and road verge at site access points off the R396, and at four points contained within the proposed wind farm site at junctions along the L5755.

The proposed link road between the R395 and R396 measures approximately 1.2 kilometres in length with a running width of approximately 5m. The road will traverse areas of cutover peat and improved agricultural grassland. The construction methodology for the link road is summarised as follows:

- Overburden within the required areas for the accommodation works will be excavated and temporarily stockpiled adjacent to the works area, where possible, until a competent stratum is reached.
- A layer of geogrid/geotextile may be required at the surface of the competent stratum to provide further structural formation.
- The competent stratum will be overlain with granular fill.
- A final surface running layer will be placed over the granular fill to provide a suitable surface to accommodate the turbine delivery/abnormal load vehicles.
- The accommodation works when not in use during the construction phase will be cordoned off from the public road, using bollards/fencing as required.
- Upon completion of the turbine delivery phase of the proposed wind farm the granular fill and final surface running layer will be left in situ, within the works areas.
- A barrier/ gate will be put in place at the entrance to the link road and a gate will be installed at the exit. An existing stone wall at the exit will be reinstated either side of the gate.
- Gates/barriers will be left in situ post construction to prevent access.

Leaving the granular fill and final surface running layer in place within the link road will allow these to be used again in the future should it become necessary (i.e. at decommissioning stage for turbine removal, or in the unlikely event of having to swap out a blade component during the operational phase).

The minor junction improvement works will require clearing back the existing road verge and field vegetation at the junctions, and excavation of material to allow the placing of stone/hard surfacing within the proposed areas. A series of removable bollards and/or temporary fencing will be placed along the existing road edge in order to preserve the structure of the junctions outside of those periods when deliveries of turbine components are underway. Once deliveries are completed the areas and boundaries will be reinstated restoring the junctions to their original configurations except as stated otherwise.

A Method Statement for the junction improvement works along the turbine delivery route is included in Appendix 3. All accommodation and link road works will be the subject of a method statement and traffic management plan prepared by the appointed contractor with the approval of Westmeath County Council, prior to the commencement of construction works.

4. ENVIRONMENTAL MANAGEMENT

4.1 Introduction

This CEMP includes all best practice measures required to construct the Proposed Development. It sets out the drainage proposals that will be developed further prior to the commencement of construction however, any such improvements will be in line with the principles set out here and will also be in full compliance with the planning consent and mitigation measures as presented in the EIAR, NIS and all other relevant planning documents. The following sections give an overview of the drainage design proposals, tree felling, refuelling, dust and noise control measures. An outline of the management of invasive species, waste materials, archaeological features, traffic, site reinstatement and decommissioning is also provided.

4.2 Protecting Water Quality

4.2.1 Introduction

The drainage design for the Proposed Development has been prepared by Hydro Environmental Services Ltd. (HES). The drainage design has been prepared based on experience of the project team of other wind farm sites in peat-dominated environments, and the number of best practice guidance documents referred to in the References section of the EIAR.

The protection of the watercourses within and surrounding the site, and downstream catchments that they feed is of utmost importance in considering the most appropriate drainage proposals for the site of the Proposed Development. There is an existing drainage system and surface water discharges from the site. The Proposed Development's drainage design has been proposed specifically with the intention of having no negative impact on the water quality of the site and discharges from the site and its associated rivers and lakes, and consequently no impact on downstream catchments and ecological ecosystems.

No routes of any natural drainage features will be altered as part of the Proposed Development and turbine locations and associated new roadways were originally selected to avoid natural watercourses in so far as possible. One existing water crossing within the proposed wind farm site will be upgraded as part of the Proposed Development, with the construction of two clear span bridges over the River Glore in the northern sections of the site – see Section 4.8.3 of the EIAR for further details.

There will be no direct discharges to any natural watercourses, with all drainage waters being dispersed as overland flows. All discharges from the proposed works areas will be made via settlement ponds, and over vegetation filters at a significant distance from natural watercourses.

Section 1.4.1 in Chapter 1 of the EIAR provides detail on the coordinated management of site activities, including drainage, between peat harvesting operations on the site should they continue and the construction and operation of the Proposed Development.

4.2.2 Existing Drainage Features

On a regional scale, the proposed wind farm site is located in the Inny River surface water sub-catchment, which is in the Upper Shannon catchment within Hydrometric Area 26 of the Shannon International River Basin District (SIRBD). On a more local scale, the proposed wind farm site is located in the Inny River sub-catchment and two sub-basins of the Inny River. The majority of the site is within the Inny_050 sub basin with a small section in the south of the site near the R396 Regional Road within the Inny_060 sub basin. The Inny River flows in a southerly direction along the western boundary of the site and discharges into Lough Derraverragh approximately 7.5km downstream of the site.

The elevation of the proposed wind farm site ranges between approximately 60m OD and 66m OD. The vast majority of the site is situated on cutover peatland The site comprises three separate peat basins, the northern, central and southern basins, each with its own separate drainage system. Further details on outfall drainage directions in each area of the site are provided in Section 9.3.5 of the EIAR:

A drain, which divides the northern basin in two sections, discharges directly to the Inny River northwest of the site. Lough Bane proposed Natural Heritage Area(pNHA) is located adjacent to the northern boundary of the Proposed Development site; however, no part of the Proposed Development footprint is located within the pNHA. Lough Bane itself is located approximately 180 metres north of the internal access road between Turbines T2 and T4. An unnamed small dystrophic lake is located on the north western corner of the site. The presence of perimeter boundary drains and intermediate high banks (uncut sections of high bog) means that there is no runoff from the peat harvesting area into Lough Bane or the dystrophic lake.

The western section of the proposed wind farm site drains directly to the Inny River via a number of settlement ponds and outfall channels. The River Glore flows from across the northern section of the site from east to west and merges with the Inny River on the western boundary of the site.

The proposed wind farm site has parallel-running peat drains that are spaced approximately every 12-15 metres on the bog surface for surface water runoff removal. Surface water runoff collected in these drains is conveyed to a headland silt trap, from where it flows into a larger boundary drain and then onto a sedimentation basin for retention and controlled discharge. The parallel running bog surface drains are only approximately 1.5m deep and therefore do not intercept the mineral subsoil underlying the peat. These internal field drains are deepened as harvesting progresses. The larger boundary drains are generally deeper and regularly intercept the mineral subsoils.

The proposed underground grid connection route is located within the Shannon International River Basin District. With respect to regional hydrology, the grid route is located in 2 no. regional surface water catchments (the River Inny and the River Brosna) and 3 no. regional surface water sub-catchments. The southern section of the proposed grid route, along the eastern edge of Lough Owel and on to Mullingar (~8km long) is located within the Brosna sub-catchment (Brosna_SC_010) within the regional Lower Shannon catchment (25A). The area north of Lough Owel to the northern edge of Lough Derravargh is located within the Inny sub-catchment (Inny[Shannon]_SC_030). North of Lough Derravargh, towards Coole, falls within the boundary of the Inny sub-catchment (Inny[Shannon]_SC_020). Both of these subcatchments are located within the regional Upper Shannon Catchment (26F).

4.2.3 Drainage Design Principles

Drainage water from any works areas of the site will not be directed to any natural watercourses within the site. Two distinct methods will be employed to manage drainage water within the site. The first method involves keeping clean water clean by avoiding disturbance to natural drainage features, minimising any works in or around artificial drainage features, and diverting clean surface water flow around excavations and construction areas. The second method involves collecting any drainage waters from works areas within the site that might carry silt or sediment, to allow attenuation and settlement prior to controlled diffuse release.

The drainage design is intended to maximise erosion control, which is more effective than having to control sediment during high rainfall. Such a system also requires less maintenance. The area of exposed ground will be minimised. The drainage measures will prevent runoff from entering the works areas of the site from adjacent ground, to minimise the volume of sediment-laden water that has to be managed. Discoloured run-off from any construction area will be isolated from natural clean run-off.

A schematic line drawing of the proposed drainage design is presented in Figure 4-1 below.

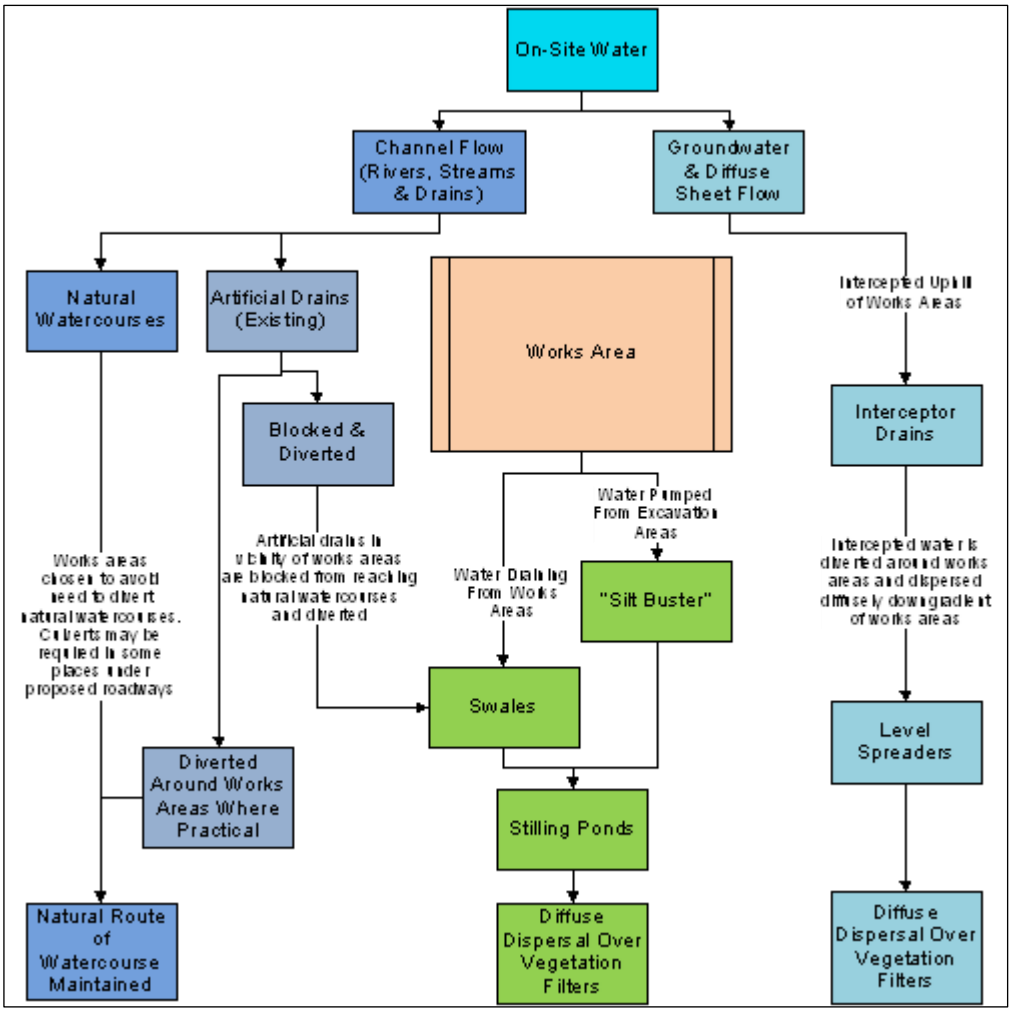

Figure 4-1 Schematic drawing of proposed drainage design

4.2.4 Drainage Design

A preliminary drainage design for the Proposed Development, incorporating all principles and measures outlined in this drainage design description, has been prepared, and is included in the drainage design drawings in Appendix 4-9 to the EIAR and Appendix 4 of this document. The drainage design employs the various measures further described and is cognisant of the following guidance documents:

- Environmental Requirements for Afforestation (Forest Service, 2016a);
- Forestry Commission (2004): Forests and Water Guidelines, Fourth Edition. Publ. Forestry Commission, Edinburgh;
- Coillte (2009): Forest Operations & Water Protection Guidelines;
- Forest Services (Draft) Forestry and Freshwater Pearl Mussel Requirements – Site Assessment and Mitigation Measures;
- Forest Service (2000): Forestry and Water Quality Guidelines. Forest Service, DAF, Johnstown Castle Estate, Co. Wexford;
- COFORD (2004): Forest Road Manual – Guidelines for the Design, Construction and Management of Forest Roads;
- Inland Fisheries Ireland (2016): Guidelines on Protection of Fisheries during Construction Works in and Adjacent to Watercourses;
- Good Practice During Wind Farm Construction (Scottish Natural Heritage, 2010);
- PPG1 - General Guide to Prevention of Pollution (UK Guidance Note);
- PPG5 – Works or Maintenance in or Near Watercourses (UK Guidance Note);

- CIRIA (Construction Industry Research and Information Association) 2006: Guidance on 'Control of Water Pollution from Linear Construction Projects' (CIRIA Report No. C648, 2006); and,
- CIRIA 2006: Control of Water Pollution from Construction Sites - Guidance for Consultants and Contractors. CIRIA C532. London, 2006.

4.2.4.1 Interceptor Drains

Interceptor drains will be installed up gradient of any works areas to collect surface flow runoff and prevent it reaching excavations and construction areas of the site where it might otherwise have come into contact with exposed surfaces and picked up silt and sediment. The drains will be used to divert upslope runoff around the works area to a location where it can be redistributed over the ground surface as sheet flow. This will minimise the volume of potentially silty runoff to be managed within the construction area.

The interceptor drains will be installed in advance of any main construction works commencing. The material excavated to make the drain will be compacted on the downslope edge of the drain to form a diversion dike. On completion of the construction phase works, it is envisaged that the majority of the interceptor drains could be removed. At that stage, there will be no open excavations or large areas of exposed ground that are likely to give rise to large volumes of potentially silt-laden run off. Any areas in which works were carried out to construct roads, turbine bases or hardstands, will have been built up with large grade hardcore, which even when compacted in place, will retain sufficient void space to allow water infiltrate the subsurface of these constructed areas. It is not anticipated that roadways or other installed site infrastructure will intercept ground-conveyed surface water runoff to any significant extent that would result in scouring or over-topping or spill over. Where the drains are to be removed, they will be backfilled with the material from the diversion dike. Interceptor drains may have to be retained in certain locations, for example where roadways are to be installed on slopes, to prevent the roadways acting as conduits for water that might infiltrate the roadway sub-base. In these cases, interceptor drains would be maintained in localised areas along the roadway with culverts under the roadway, which would allow the intercepted water to be discharged to vegetation filters downgradient of the roadway. Similarly, in localised hollows where water is likely to be funnelled at greater concentrations than on broader slopes, interceptor drains and culverts may be left in situ following construction.

The velocity of flow in the interceptor will be controlled by check dams (see Section 4.2.4.3 below), which will be installed at regular intervals along the drains to ensure flow in the channel is non-erosive. On steeper sections where erosion risks are greater, a geotextile membrane will be added to the channel.

Interceptor drains will be installed horizontally across slopes to run in parallel with the natural contour line of the slope. Intercepted water will travel along the interceptor drains to areas downgradient of works areas, where the drain will terminate at a level spreader. Across the entire length of the interceptor drains, the design elevation of the water surface along the route of the drains will not be lower than the design elevation of the water surface in the outlet at the level spreader.

4.2.4.2 Collector Drains/Swales

Collector drains or swales are shallow drains that will be used to intercept and collect run off from construction areas of the site during the construction phase. Drainage swales will remain in place to collect runoff from roads and hardstanding areas of the proposed development during the operational phase. A swale is an excavated drainage channel located along the downgradient perimeter of construction areas, used to collect and carry any sediment-laden runoff to a sediment-trapping facility and stabilised outlet. Swales are proven to be most effective when a dike is installed on the downhill side. They are similar in design to interceptor drains and collector drains described above.

Collector drains will be installed downgradient of any works areas to collect surface flow runoff where it might have come into contact with exposed surfaces and picked up silt and sediment. Swales will intercept the potentially silt-laden water from the excavations and construction areas of the site and prevent it reaching natural watercourses.

Collector drains will be installed in advance of any main construction works commencing. The material excavated to make the swale will be compacted on the downslope edge of the drain to form a diversion dike.

4.2.4.3 Check Dams

The velocity of flow in the interceptor drains and collector drains, particularly on sloped sections of the channel, will be controlled by check dams, which will be installed at regular intervals along the drains to ensure flow in the collector drain is non-erosive. Check dams will also be installed in some existing artificial drainage channels that will receive waters from works areas of the site.

Check dams will restrict flow velocity, minimise channel erosion and promote sedimentation behind the dam. The check dams will be installed as the interceptor drains are being excavated. Check dams may also be installed in some of the existing artificial drainage channels on the site, downstream of where collector drains connect in.

The proposed check dams will be made up of 4/40mm non-friable crushed stone. The check dams will be installed at regular intervals along the interceptor drains to ensure the bottom elevation of the upper check dam is at the same level as the top elevation of the next down-gradient check dam in the drain. The centre of the check dam will be approximately 150mm lower than the edges to allow excess water to overtop the dam in flood conditions rather than cause upstream flooding or scouring around the dams.

The check dams will be installed at regular intervals along the interceptor drains to ensure the bottom elevation of the upper check dam is at the same level as the top elevation of the next down-gradient check dam in the drain. The centre of the check dam will be approximately 150 mm lower than the edges to allow excess water to overtop the dam in flood conditions rather than cause upstream flooding or scouring around the dams.

Check dams will not be used in any natural watercourses, only artificial drainage channels and interceptor drains. The check dams will be left in place where required at the end of the construction phase to limit erosive linear flow in the collector drain during extreme rainfall events.

Check dams are designed to reduce velocity and control erosion and are not specifically designed or intended to trap sediment, although sediment is likely to build up. If necessary, any excess sediment build up behind the dams will be removed. For this reason, check dams will be inspected and maintained regularly to insure adequate performance. Maintenance checks will also ensure the centre elevation of the dam remains lower than the sides of the dam.

4.2.4.4 Level Spreaders

A level spreader will be constructed at the end of each interceptor drain to convert concentrated flows in the drain, into diffuse sheet flow on areas of vegetated ground. The levels spreaders will be located downgradient of any proposed works areas in locations where they are not likely to contribute further to water ingress to construction areas of the site, or areas where they are not likely to give rise to peat stability issues.

The water carried in interceptor drains will not have come in contact with works areas of the site, and therefore should be free of silt and sediment. The level spreaders will distribute clean drainage water onto vegetated areas where the water will not be re-concentrated into a flow channel immediately

below the point of discharge. The discharge point will be on level or only very gently sloping ground rather than on a steep slope so as to prevent erosion.

The slope in the channel leading into the spreader will be less than or equal to 1%. The slope downgradient of the spreader onto which the water will dissipate will have a grade of less than 6%. The availability of slopes with a grade of 6% or less will determine the locations of level spreaders. If a slope grade of less than 6% is not available in the immediate area downgradient of a works area at the end of a diversion drain, a piped slope drain will be used to transfer the water to a suitable location.

The spreader lip over which the water will spill will be made of a concrete kerb, wooden board, pipe, or other similar piece of material that can create a level edge similar in effect to a weir. The spreader will be level across the top and bottom to prevent channelised flow leaving the spreader or ponding occurring behind the spreader. The top of the spreader lip will be 150mm above the ground behind it. The length of the spreader will be a minimum of four metres and a maximum length of 25 metres, with the actual length of each spreader to be determined by the size of the contributing catchment, slope and ground conditions.

Clean four-inch stone can be placed on the outside of the spreader lip, and pressed into the ground mechanically to further dissipate the flow leaving the level spreader over a larger area.

4.2.4.5 Vegetation Filters

Vegetation filters are the existing vegetated areas of land that will be used to accept surface water runoff from upgradient areas. The selection of suitable areas to use as vegetation filters will be determined by the size of the contributing catchment, slope and ground conditions.

Vegetation filters will carry outflow from the level spreaders as overland sheet flow, removing any suspended solids and discharging to the groundwater system by diffuse infiltration.

Vegetation filters will not be used in isolation for waters that are likely to have higher silt loadings. In such cases, silt-bearing water will already have passed through stilling (settlement) ponds prior to diffuse discharge to the vegetation filters via a level spreader.

4.2.4.6 Silting Ponds/Settlement Ponds

Stilling ponds will be used to attenuate runoff from works areas of the site during the construction phase, and will remain in place to handle runoff from roads and hardstanding areas of the proposed development during the operational phase. The purpose of the stilling ponds is to intercept runoff potentially laden with sediment and to reduce the amount of sediment leaving the disturbed area by reducing runoff velocity. Reducing runoff velocity will allow larger particles to settle out in the stilling ponds, before the run-off water is redistributed as diffuse sheet flow in filter strips downgradient of any works areas.

Stilling ponds will be excavated/constructed at each required location as two separate ponds in sequence, a primary pond and a secondary pond. The points at which water enters and exits the stilling ponds will be stabilised with rock aprons, which will trap sediment, dissipate the energy of the water flowing through the stilling pond system, and prevent erosion. The primary stilling pond will reduce the velocity of flows to less than 0.5 metres per second to allow settlement of silt to occur. Water will then pass from the primary pond to the secondary pond via another rock apron. The secondary stilling pond will reduce the velocity of flows to less than 0.3 metres per second. Water will flow out of the secondary stilling pond through a stone dam, partially wrapped in geo-textile membrane, which will control flow velocities and trap any sediment that has not settled out.

Water will flow by gravity through the stilling pond system. The stilling ponds will be sized according to the size of the area they will be receiving water from, but will be sufficiently large to accommodate peak

flows storm events. The stilling ponds will be dimensioned so that the length to width ratio will be greater than 2:1, where the length is the distance between the inlet and the outlet. Where ground conditions allow, stilling ponds will be constructed in a wedge shape, with the inlet located at the narrow end of the wedge. Each stilling pond will be a minimum of 1-1.5 metres in depth. Deeper ponds will be used to minimise the excavation area needed for the required volume.

The embankment that forms the sloped sides of the stilling ponds will be stabilised with vegetated turves, which will have been removed during the excavation of the stilling ponds area. All material excavated during pond construction will be used locally for landscaping and berm construction around these ponds.

Stilling ponds will be located towards the end of collector drains, close to where the water will be reconverted to diffuse sheet flow. Upon exiting the stilling pond system, water will be immediately reconverted to diffuse flow via a fan-shaped rock apron if there is adequate space and ground conditions allow. Otherwise, a collector drain will be used to carry water exiting the stilling pond system to a level spreader to reconvert the flow to diffuse sheet flow.

Stilling ponds will be inspected weekly and following rainfall events with sediment cleaned out as required. Inlet and outlets will be checked for sediment accumulation and anything else that might interfere with flows.

4.2.4.7 Siltbuster

A “siltbuster” or similar equivalent piece of equipment will be available to filter any water pumped out of excavation areas if necessary, prior to its discharge to stilling ponds or swales.

Siltbusters are mobile silt traps that can remove fine particles from water using a proven technology and hydraulic design in a rugged unit. The mobile units are specifically designed for use on construction sites.

The unit stills the incoming water/solids mix and routes it upwards between a set of inclined plates for separation. Fine particles settle onto the plates and slide down to the base for collection, whilst treated water flows to an outlet weir after passing below a scum board to retain any floating material. The inclined plates dramatically increase the effective settling area of the unit giving it a very small footprint on site and making it highly mobile. Figure 4-2 below shows an illustrative diagram of the Siltbuster.

The Siltbuster units are now considered best practice for the management of dirty water pumped from construction sites. The UK Environment Agency and the Scottish Environmental Protection Agency have all recommended/specified the use of Siltbuster units on construction projects.

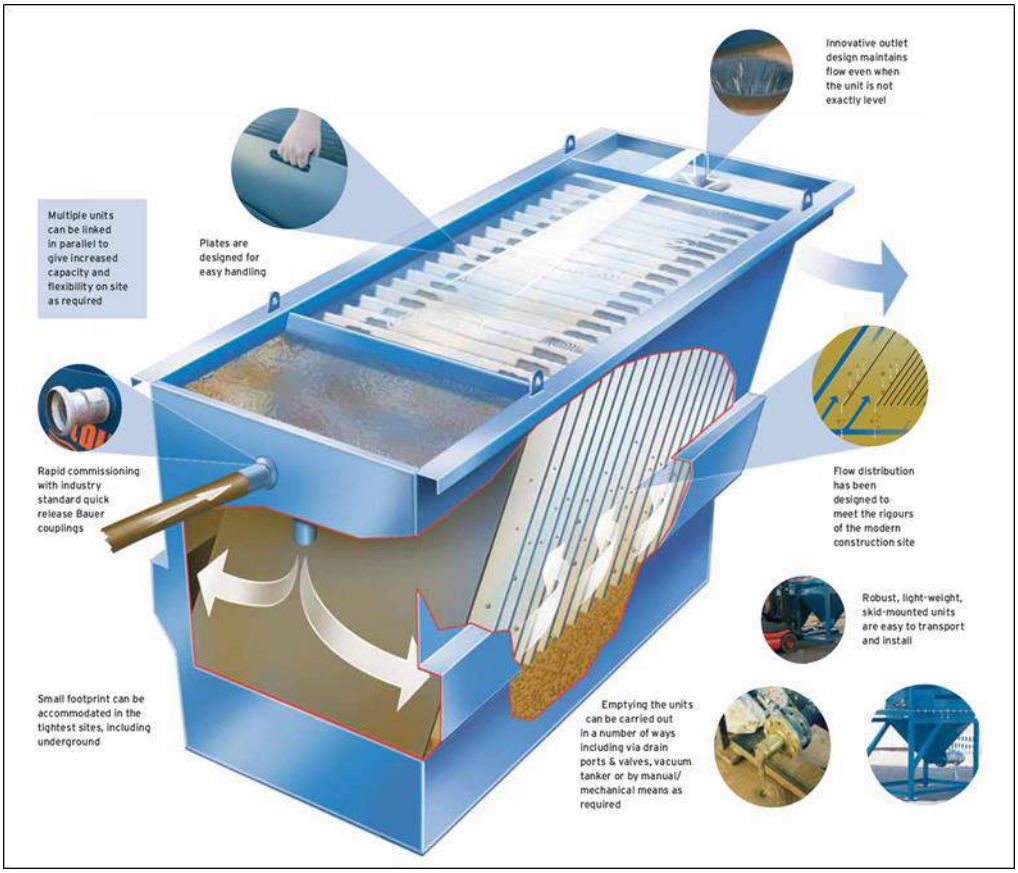

Figure 4-2 Siltbuster (Source: https://www.siltbuster.co.uk/sb_prod/siltbuster-fb50-settlement-unit/)

4.2.4.8 Silt Bags

Dewatering silt bags allow the flow of water through them while trapping any silt or sediment suspended in the water. The silt bags provide a passive non-mechanical method of removing any remaining silt contained in the potentially silt-laden water collected from works areas within the site.

Dewatering silt bags are an additional drainage measure that can be used downgradient of the stilling ponds at the end of the collector drain and will be located, wherever it is deemed appropriate, throughout the site. The water will flow, via a pipe, from the stilling ponds into the silt bag. The silt bag will allow the water to flow through the geotextile fabric and will trap any of the finer silt and sediment remaining in the water after it has gone through the previous drainage measures. The dewatering silt bags will ensure that there will be no loss of peaty silt into any stream.

The dewatering silt bag that will be used will be approximately 3 metres in width by 4.5 metres (see Plates 4-1 4-2 below) in length and will be capable of trapping approximately four tonnes of silt. The dewatering silt bag, when full, will be removed from site by a waste contractor with the necessary waste collection permit, who will then transport the silt bag to an appropriate, fully licensed waste facility.

Plate 4-1 Silt Bag with water being pumped through

Plate 4-2 Silt bag under inspection

4.2.4.9 Silt Fences

Silt fences will be installed as an additional water protection measure around existing watercourses in certain locations, particularly where watercourse crossings take place.

Silt fences can be installed as single, double or a series of triple silt fences, depending on the space available and the anticipated sediment loading. The silt fence designs follow the technical guidance document 'Control of Water Pollution from Linear Construction Projects' published by CIRIA (Ciria, No. C648, 1996). Up to three silt fences may be deployed in series.

Silt fences will be emplaced along drains and parallel to access roads edges as required, down-gradient of all new roads and turbine locations. Silt fences are effective at removing heavy settleable solids. This will act to prevent entry to watercourses of sand and gravel sized sediment, released from excavation of mineral subsoils of glacial and glacio-fluvial origin, and entrained in surface water runoff.

Inspection and maintenance of these structures during the construction phase is critical to their functioning to stated purpose. They will remain in place throughout the entire construction phase. Site fence material will be Terra Stop Premium as per the specifications provided at https://www.hy-tex.co.uk/products/geotextiles/terrastop-premium-silt-fence or equivalent manufacturer certified CE mark for erosion control of EN13253 or similar.

The most suitable type, number or combination of silt fences will be determined on a location specific basis for the various parts of the site. Although they may be indicated in the drainage designs shown in Appendix 4-1 of the EIAR to be just a single line, silt fences may be installed in series on the ground.

Site fences will be inspected regularly to ensure water is continuing to flow through and the fence is not coming under strain from water backing up behind it.

4.2.4.10 Sedimats

Sediment entrapment mats, consisting of coir or jute matting, will be placed at the outlet of the silt bag to provide further treatment of the water outfall from the silt bag. Sedimats will be secured to the ground surface using stakes/pegs. The sedimat will extend to the full width of the outfall to ensure all water passes through this additional treatment measure.

4.2.4.11 Culverts

All new proposed culverts and proposed culvert upgrades will be suitably sized for the expected peak flows in the watercourse.

Some culverts may be installed to manage drainage waters from works areas of the Proposed Development, particularly where the waters have to be taken from one side of an existing roadway to the other for discharge. The size of culverts will be influenced by the depth of the track or road sub-base. In some cases, two or more smaller diameter culverts may be used where this depth is limited, though this will be avoided as they will have a higher associated risk of blockage than a single, larger pipe. In all cases, culverts will be oversized to allow mammals to pass through the culvert.

Culverts will be installed with a minimum internal gradient of 1% (1 in 100). Smaller culverts will have a smooth internal surface. Larger culverts may have corrugated surfaces which will trap silt and contribute to the stream ecosystem. Depending on the management of water on the downstream side of the culvert, large stone may be used to interrupt the flow of water. This will help dissipate its energy and help prevent problems of erosion. Smaller water crossings will simply consist of an appropriately sized pipe buried in the sub-base of the road at the necessary invert level to ensure ponding or pooling doesn't occur above or below the culvert and water can continue to flow as necessary.

All culverts will be inspected regularly to ensure they are not blocked by debris, vegetation or any other material that may impede conveyance.

4.2.5 Borrow Pit Drainage

The proposed borrow pit will extract bedrock below the local groundwater table and therefore there is some moderate potential to impact on local groundwater levels. The proposed borrow pit is located on an elevated area of ground and drainage by gravity will ensue after reinstatement. The pit will be relatively shallow (5m), and therefore the potential for groundwater level impacts to extend significant distances from the pit is negligible. Relevant environmental management guidelines from the EPA quarry 2006 guidance document – "Environmental Management in the Extractive Industry" in relation to groundwater issues will be implemented during the construction phase.

The following guidelines will be implemented the construction and reinstatement of borrow pits outlined by Fehily Timoney as part of the Peat and Spoil Management Plan presented in Appendix 4-2 of this EIAR:

- Where possible, the surface of the placed spoil should be shaped to allow efficient run-off of surface water from the placed arisings.
- An interceptor drain should also be installed upslope of the borrow pit, where necessary. This drain will divert any surface water away from the borrow pit and hence prevent water from ponding and lodging during construction and also when reinstated.
- Control of groundwater within the borrow pit may be required and measures will be determined as part of the confirmatory ground investigation programme. A temporary pump and suitable outfall locations are likely to be required during construction.
- A silting pond may be required at the lower side/outfall location of the borrow pit.
- Where possible, the topsoil shall be placed with the vegetation part of the sod facing the right way up to encourage growth of plants and vegetation at the surface of the spoil within the borrow pits.

4.2.6 Floating Road Drainage

Where sections of floating road are to be installed instead of excavated roads, cross drains will be installed beneath the road construction corridor to maintain existing clean water drainage paths. Large surface water drainage pipes will be placed at these locations below the level of the proposed road sub-base. These drainage pipes will be extended each side of the proposed road and cable trench construction corridor, along the paths of the existing drains.

With the exception of the installation of cross drains under the floating road corridor, minimal additional drainage will be installed to run parallel to the roads, in order to maintain the natural hydrology of the peatland areas over which the roads will be floated.

4.2.7 Cable Trench Drainage

Cable trenches are typically developed in short sections, thereby minimising the amount of ground disturbed at any one time, and minimising the potential for drainage runoff to pick up silt or suspended solids. Each short section of trench is excavated, ducting installed and bedded, and backfilled with the appropriate materials, before work on the next section commences.

To efficiently control drainage runoff from cable trench works areas, excavated material is stored on the upgradient side of the trench. Should rainfall generate runoff from the excavated material, the material is contained in the downgradient cable trench. Excess subsoil will be removed from the cable trench works area immediately upon excavation, and used for landscaping and reinstatements of other areas elsewhere on site.

On steeper slopes, silt fences, as detailed in Section 4.6.4.9 of the EIAR will be installed temporarily downgradient of the cable trench works area, or on the downhill slope below where excavated material is being temporarily stored to control run-off.

4.2.8 Site Drainage Management

4.2.8.1 Preparative Site Drainage Management

All materials and equipment necessary to implement the drainage measures outlined above, will be brought on-site in advance of any works commencing. An adequate amount of clean stone, silt fencing, stakes, etc will be kept on site at all times to implement the drainage design measures as necessary. The drainage measures outlined in the above will be installed prior to, or at the same time as the works they are intended to drain.

4.2.8.2 Pre-emptive Site Drainage Management

The works programme for the groundworks part of the construction phase of the project will also take account of weather forecasts, and predicted rainfall in particular. Large excavations, large movements of overburden or large scale overburden or soil stripping will be suspended or scaled back if heavy rain is forecast. The extent to which works will be scaled back or suspended will relate directly to the amount of rainfall forecast.

4.2.8.3 Reactive Site Drainage Management

The final drainage design prepared for the proposed development prior to commencement of construction will have to provide for reactive management of drainage measures. The effectiveness of drainage measures designed to minimise runoff entering works areas and capture and treat silt-laden water from the works areas, will be monitored continuously by the Environmental Clerk of Works (ECoW) or supervising hydrologist on-site. The ECoW or supervising hydrologist will respond to changing weather, ground or drainage conditions on the ground as the project proceeds, to ensure the effectiveness of the drainage design is maintained in so far as is possible. This may require the installation of additional check dams, interceptor or collector drains as deemed necessary on-site. The drainage design may have to be modified on the ground as necessary, and the modifications will draw on the various features outlined above in whatever combinations are deemed to be most appropriate to situation on the ground at the particular time.

In the event that works are giving rise to siltation of watercourses, the ECoW or supervising hydrologist will stop all works in the immediate area around where the siltation is evident. The source of the siltation will be identified and additional drainage measures such as those outlined above will be installed in advance of works recommencing.

4.2.8.4 Drainage Maintenance

An inspection and maintenance plan for the drainage system onsite will be prepared in advance of commencement of any works. Regular inspections of all installed drainage features will be necessary, especially after heavy rainfall, to check for blockages, and ensure there is no build-up of standing water at parts of the systems where it is not intended. The inspection of the drainage system will be the responsibility of the ECoW or the Supervising Hydrologist.

If necessary, any excess sediment build up behind check dams will be removed. For this reason, check dams will be inspected and maintained weekly during the construction phase of the project to insure adequate performance. Maintenance checks will also ensure the centre elevation of the dam remains lower than the sides of the dam.

Check dams will also be inspected weekly during the construction phase of the project and following rainfall events to ensure the structure of the dam is still effective in controlling flow. Any scouring around the edges of the check dams or overtopping of the dam in normal flow conditions will be rectified by reinforcement of the check dam.

Drainage swales will be regularly inspected for evidence of erosion along the length of the swale. If any evidence of erosion is detected, additional check dams will be installed to limit the velocity of flow in the channel and reduce the likelihood of erosion occurring in the future.

An adequate amount of clean stone, Terra Stop (or similar silt fencing material), stakes, straw bales (rectangular bales, to be used in emergency only), etc. will be kept on site at all times to ensure the drainage system can be fully maintained throughout the construction phase of the wind farm and ensure that personnel are fully equipped to provide an emergency facility to control the discharge from settlement ponds and react to any accidental silt discharges.

Silt traps will be inspected weekly during the construction phase of the project and following rainfall events with sediment build-up removed as required. Inlet and outlets will be checked for sediment accumulation and anything else that might interfere with flows.

The frequency of drainage system inspections will be reduced following completion of the construction phase of the project. Weekly inspections during the construction phase will be reduced to monthly, bi-monthly and eventually quarterly inspections during the operational phase. The frequency will be increased or decreased depending on the effectiveness of the measures in place and the amount of remedial action required in any given period.

4.3 Tree Felling Management Plan

Tree felling to facilitate the Proposed Development will not be undertaken simultaneously with construction groundworks. Felling will take place prior to groundworks commencing.

Before the commencement of any felling works, an Environmental Clerk of Works (ECoW) shall be appointed to oversee the keyhole and extraction works. The ECoW shall be experienced and competent, and shall have the following functions:

- Attend the site for the setup period when drainage protection works are being installed, and be present on site during the remainder of the forestry keyhole felling works.

- Prior to the commencement of works, review and agree the positioning by the Operator of the required Aquatic Buffer Zones (ABZs), silt traps, silt fencing (see below), water crossings and onsite storage facilities for fuel, oil and chemicals (see further below).
- Be responsible for preparing and delivering the Environmental Tool Box Talk (TBT) to all relevant parties involved in site operations, prior to the commencement of the works.
- Conduct daily and weekly inspections of all water protection measures and visually assess their integrity and effectiveness in accordance with Section 3.4 (Monitoring and Recording) and Appendix 3 (Site Monitoring Form (Visual Inspections)) of the *Forestry & Freshwater Pearl Mussel Requirements*.
- Take representative photographs showing the progress of operation onsite, and the integrity and effectiveness of the water protection measures.
- Collect water samples for analysis by a 3rd party accredited laboratory, adhering to the following requirements:
    - Surface water samples shall be collected upstream and downstream of the keyhole felling site at suitable sampling locations.
    - Sampling shall be taken from the stream / river bank, with no in-stream access permitted.
    - The following minimum analytical suite shall be used: pH, EC, TSS, BOD, Total P, Ortho-P, Total N, and Ammonia.
- Review of operator's records for plant inspections, evidence of contamination and leaks, and drainage checks made after extreme weather conditions.
- Prepare and maintain a contingency plan.
- Suspend work where potential risk to water from siltation and pollution is identified, or where operational methods and mitigation measures are not specified or agreed.
- Prepare and maintain a Water Protection Measure Register. This document is to be updated weekly by the ECoW.

All relevant measures set out in the *Forestry & Freshwater Pearl Mussel Requirements, Forestry & Water Quality Guidelines, Forest Harvesting & the Environment Guidelines and the Forest Protection Guidelines* will apply. To protect watercourses, the following measures will be adhered to during all keyhole/tree felling activities.

- Works will be overseen by an ECoW as described above.
- The extent of all necessary tree felling will be identified and demarcated with markings on the ground in advance of any felling commencing.
- All roads and culverts will be inspected prior to any machinery being brought on site to commence the felling operation. No tracking of vehicles through watercourses will occur. Vehicles will only use existing road infrastructure and established watercourse crossings.
- Existing drains that drain an area to be felled towards surface watercourses will be blocked, and temporary silt traps will be constructed to ensure collection of all silt within felling areas. These temporary silt traps will be cleaned out and backfilled once felling works are complete. This ensures there is no residual collected silt remaining in blocked drains after felling works are completed. No direct discharge of such drains to watercourses will occur from within felling areas.
- New collector drains and sediment traps will be installed during ground preparation to intercept water upgradient of felling areas and divert it away. Collector drains will be excavated at an acute angle to the contour (0.3%-3% gradient), to minimise flow velocities.
- All silt traps will be sited outside of buffer zones and have no direct outflow into the aquatic zone. Machine access will be maintained to enable the accumulated sediment to be excavated. Sediment will be carefully disposed of away from all aquatic zones.

- All new collector drains will taper out before entering the aquatic buffer zone to ensures the discharging water gently fans out over the buffer zone before entering the aquatic zone.
- Machine combinations, such as mechanical harvesters or chainsaw felling will be chosen which are most suitable for ground conditions at the time of felling, and which will minimise soils disturbance;
- Mechanised operations will be suspended during and immediately after heavy rainfall.
- Where brash is required to form brash mats, it is to be laid out at harvesting stage to prevent soil disturbance by machine movement.
- Brash which has not been pushed into the soil may be moved within the site to facilitate the creation of mats in more demanding locations.
- Felling of trees will be pointed directionally away from watercourses.
- Felling will be planned to minimise the number of machine passes in any one area.
- Extraction routes, and hence brash mats, will be aligned parallel to the ground contours where possible.
- Harvested timber will be stacked in dry areas, and outside any 50-metre watercourse buffer zone. Straw bales and check dams to be emplaced on the down gradient side of timber storage sites.
- Branches, logs or debris will not be allowed to build up in aquatic zones. All such material will be removed when harvesting operations have been completed, but removing of natural debris deflectors will be avoided.

Table 4-1 Minimum Buffer Zone Widths (Forest Service, 2000)

Average slope leading to the aquatic zone		Buffer zone width on either side of the aquatic zone	Buffer zone width for highly erodible soils
Moderate	(0 – 15%)	10 m	15 m
Steep	(15 – 30%)	15 m	20 m
Very steep	(>30%)	20 m	25 m

4.4 Cement Based Products Control Measures

Only ready-mixed concrete will be used during the construction phase, with all concrete being delivered from local batching plants in sealed concrete delivery trucks. The use of ready-mixed concrete deliveries will eliminate any potential environmental risks of on-site batching. When concrete is delivered to site, only the chute of the delivery truck will be cleaned, using the smallest volume of water necessary, before leaving the site. Concrete trucks will be washed out fully at the batching plant, where facilities are already in place.

The small volume of water that will be generated from washing of the concrete lorry's chute will be directed into a temporary lined impermeable containment area. Alternatively, a Siltbuster-type concrete wash unit or equivalent (https://www.siltbuster.co.uk/sb_prod/siltbuster-roadside-concrete-washout-rcw/) may be used. This type of Siltbuster unit catches the solid concrete and filters and holds wash liquid for pH adjustment and further solids separation. The residual liquids and solids can be disposed of off-site at an appropriate waste facility. Where temporary lined impermeable containment areas are used, such containment areas are typically built using straw bales and lined with an impermeable membrane. Two examples are shown in Plate 4-3 and Plate 4-4 below.

Plate 4-3 Concrete Wash Out Area

Plate 4-4 Concrete Wash Out Area

The areas are generally covered when not in use to prevent rainwater collecting. In periods of dry weather, the areas can be uncovered to allow much of the water to be lost to evaporation. At the end of the concrete pours, any of the remaining liquid contents will be tankered off-site. Any solid contents that will have been cleaned down from the chute will have solidified and can be broken up and disposed of along with other construction waste.

Due to the volume of concrete required for each turbine foundation, and the requirement for the concrete pours to be continuous, deliveries are often carried out outside normal working hours in order to limit the traffic impact on other road users, particularly peak period school and work commuter traffic. Such activities are limited to the day of turbine foundation concrete pours, which are normally complete in a single day per turbine.

The risks of pollution arising from concrete deliveries will be further reduced by the following:

- Concrete trucks will not be washed out on the site, but will be directed back to their batching plant for washout.
- Site roads will initially be constructed with a subgrade and compacted with the use of a roller to allow concrete delivery trucks access all areas where the concrete will be needed. The final wearing course for the site roads will not be provided until all bases have been poured. No concrete will be transported around the site in open trailers or dumpers so as to avoid spillage while in transport. All concrete used in the construction of turbine bases will be pumped directly into the shuttered formwork from the delivery truck. If this is not practical, the concrete will be pumped from the delivery truck into a hydraulic concrete pump or into the bucket of an excavator, which will transfer the concrete to the location where it is needed.
- The arrangements for concrete deliveries to the site will be discussed with suppliers before work starts, agreeing routes, prohibiting on-site washout and discussing emergency procedures.
- Clearly visible signage will be placed in prominent locations close to concrete pour areas specifically stating washout of concrete lorries is not permitted on the site.

4.4.1 Concrete Pouring

Because of the scale of the main concrete pours that will be required to construct the Proposed Development, the main pours will be planned days or weeks in advance. Special procedures will be adopted in advance of and during all concrete pours to minimise the risk of pollution. These may include:

- Using weather forecasting to assist in planning large concrete pours, and avoiding large pours where prolonged periods of heavy rain is forecast.
- Restricting concrete pumps and machine buckets from slewing over watercourses while placing concrete.

- Ensuring that excavations are sufficiently dewatered before concreting begins and that dewatering continues while concrete sets.
- Ensuring that covers are available for freshly placed concrete to avoid the surface washing away in heavy rain.
- The small volume of water that will be generated from washing of the concrete lorry's chute will be directed into a temporary lined impermeable containment area, or a Siltbuster-type concrete wash unit (https://www.siltbuster.co.uk/sb_prod/siltbuster-roadside-concrete-washout-rcw/) or equivalent.
- Disposing of surplus concrete after completion of a pour in agreed suitable locations away from any watercourse or sensitive habitats.

4.5 Refuelling, Fuel and Hazardous Materials Storage

Mitigation measures proposed to avoid release of hydrocarbons at the site are as follows:

- Wherever possible, vehicles will be refuelled off-site. This will be the case for regular, road-going vehicles. However, for construction machinery that will be based on-site continuously, a limited amount of fuel will have to be stored on site in bunded areas.
- On-site refuelling of machinery will be carried out at dedicated refuelling locations 100m from watercourses using a mobile double skinned fuel bowser. The fuel bowser, a double-axle custom-built refuelling trailer or similar will be re-filled off site, and will be towed around the site by a 4x4 jeep to where machinery is located. It is not practical for all vehicles to travel back to a single refuelling point, given the size of the cranes, excavators, etc. that will be used during the construction of the proposed wind farm. The 4x4 jeep will also carry fuel absorbent material and pads in the event of any accidental spillages. The fuel bowser will be parked on a level area in the construction compound when not in use.
- Only designated trained and competent operatives will be authorised to refuel plant on site. Mobile measures such as drip trays, spill kits and fuel absorbent mats will be used during all refuelling operations.
- Fuels volumes stored on site should be minimised. Any fuel storage areas will be bunded appropriately for the fuel storage volume for the time period of the construction and fitted with a storm drainage system and an appropriate oil interceptor;
- The electrical control building should be bunded appropriately to the volume of oils likely to be stored, and to prevent leakage of any associated chemicals and to groundwater or surface water. The bunded area will be fitted with a storm drainage system and an appropriate oil interceptor;
- The plant used should be regularly inspected for leaks and fitness for purpose; and,
- An emergency plan for the construction phase to deal with accidental spillages will be contained within Emergency Response Plan (Section 6). Spill kits will be available to deal with an accidental spillage.

4.6 Outline Peat Stability Management Plan

Minimal peat excavation is likely to be required on site due to the proposed construction techniques for the site. With the exception of Turbine T5 and T15, all turbines and their associated crane hardstands are likely to require a piled foundation as a result of the depth of peat and soft lacustrine deposits present. In addition, piled foundations may be required for the substation building. It is anticipated that the substation platform and construction compound platform will likely be constructed using floating techniques. The proposed construction method for all the new proposed access roads is a floated technique.

Quantities of peat and overburden to be excavated during the construction phase of the proposed development were calculated by FT as part of the Peat and Spoil Management Plan presented in Appendix 4-2 of this EIAR.

Peat instability or failure refers to a significant mass movement of a body of peat that would have an adverse impact on proposed wind farm development and the surrounding environment. Peat failure excludes localised movement of peat that could occur below an access road, creep movement or erosion type events. In the absence of appropriate mitigation, the consequence of peat failure at the study area may result in:

- Death or injury to site personnel;
- Damage to machinery;
- Damage or loss of access tracks;
- Drainage disrupted;
- Site works damaged or unstable;
- Contamination of watercourses, water supplies by sediment particulates; and,
- Degradation of the environment.

A Geotechnical & Peat Stability Assessment Report has been prepared by AGEC which provides a Geotechnical Risk Register for the site and includes details of the required mitigation/control measures. These mitigation measures are summarised below and in Appendix 8-1 of the EIAR.

4.6.1 General recommendations for Good Construction Practice

The peat stability assessment indicates that there is insignificant risk of peat failure. The following mitigation measures are recommended and should be taken into account when preparing Construction Method Statements for the proposed development:

- Avoidance of uncontrolled concentrated water discharge onto peat slopes identified as being unsuitable for such discharge.
- Avoidance of unstable excavations. All excavations shall be suitably supported to prevent collapse and development of tension cracks.
- Avoidance of placing fill and excavations in the vicinity of steeper peat slopes, that is at the crest or toe of the slope.
- Installation and regular monitoring of geotechnical instrumentation, as appropriate, during construction in areas of possible poor ground, such as deeper peat deposits.
- Site reporting procedures to ensure that working practices are suitable for the encountered ground conditions. Ground conditions to be assessed by suitably experienced geotechnical engineer.
- Regular briefing of all site staff (e.g. toolbox talks) to provide feedback on construction and ground performance and to promote reporting of any observed change in ground conditions.
- Routine inspection of wind farm site by contractor to include an assessment of ground stability conditions (e.g. cracking, excessive floating road settlement, disrupted surface, closed-up drains) and drainage conditions (e.g. blocked drains, absence of water in previously flowing drains, springs, etc).
- Peat movement monitoring posts will be installed upslope and downslope of access roads and at locations where peat depths are greater than 2.0m.

4.7 Outline Archaeological Management Plan

Archaeological monuments are safeguarded through national and international policy, which is designed to secure the protection of the cultural heritage resource.

Through a detailed examination of the baseline data available and a detailed site inspection, it was concluded that while the archaeological potential of the area is high no new sites were noted within the peatland areas of the areas proposed development, nor are any recorded archaeological or architectural assets located therein. One new potential archaeological monument was detected within the Wind Farm Site boundary at Clonrobert townland. It comprises an enclosed rectangular area in pasture c. 74m east of the proposed access road to T15. No direct impacts to this potential monument as a result of the proposed development have been identified. Furthermore, direct impacts to recorded archaeological and architectural assets as a result of the proposed turbines, substation, associated infrastructure and borrow pit have not been identified. Therefore, the following mitigation proposed is the protection and preservation of potentially new and previously undiscovered sites:

- A pre-construction walkover survey / inspection of areas proposed for excavation will be undertaken to re-assess the bog for new sites that may be exposed.
- If present, the sites shall be archaeologically excavated under licence prior to construction. The archaeologist will liaise with the Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs regarding the methods being proposed for excavation.
- Pre-construction archaeological testing of turbine bases and hardstands proposed for excavation will be carried out. A report setting out the findings will be submitted to the relevant authorities.
- Archaeological monitoring of ground works and metal detection of spoil during construction. A report on the results of the monitoring shall be compiled and submitted to the relevant authorities on completion of the project.

In the event of the discovery of archaeological finds or remains, the National Monuments Service and the National Museum of Ireland shall be notified immediately. If features are revealed, the archaeological finds or remains will need to be investigated, and no further development will take place in that area until the site is fully identified, recorded and excavated or alternatively avoided to the satisfaction of the statutory authorities.

4.8 Dust Control & Air Quality

Construction dust can be generated from many on-site activities such as excavation and backfilling. The extent of dust generation will depend on the type of activity undertaken, the location, the nature of the dust, i.e. soil, sand, peat, etc and the weather. In addition, dust dispersion is influenced by external factors such as wind speed and direction and/or, periods of dry weather. Construction traffic movements also have the potential to generate dust as they travel along the haul route.

Proposed measures to control dust include:

- Any site roads with the potential to give rise to dust will be regularly watered, as appropriate, during dry and/or windy conditions;
- The designated public roads outside the site and along the main transport routes to the site will be regularly inspected by the Site Environmental manager for cleanliness, and cleaned as necessary;
- Material handling systems and material storage areas will be designed and laid out to minimise exposure to wind;
- Water misting or sprays will be used as required if particularly dusty activities are necessary during dry or windy periods;
- Water misting or bowsers will operate on-site as required to mitigate dust in dry weather conditions;
- The transport of soils or other material, which has significant potential to generate dust, will be undertaken in tarpaulin-covered vehicles where necessary;
- All construction related traffic will have speed restrictions on un-surfaced roads to 15 kph;

- Daily inspection of construction sites to examine dust measures and their effectiveness.
- When necessary, sections of the haul route will be swept using a truck mounted vacuum sweeper.
- If necessary, water will be taken from stilling ponds in the site's drainage system, and will be pumped into a bowser or water spreader to dampen down haul roads and site compounds to prevent the generation of dust.
- Silty or oily water will not be used for dust suppression, because this would transfer the pollutants to the haul roads and generate polluted runoff or more dust.
- Water bowser movements will be carefully monitored, as the application of too much water may lead to increased runoff.
- A road sweeper will be available if any section of the public roads requires cleaning due to construction traffic associated with the Proposed Development.

4.9 Noise & Vibration Control

Regarding construction activities, reference will be made to BS 5228-1:2009+A1:2014 *Code of practice for noise and vibration control on construction and open sites – Noise*, which offers detailed guidance on the control of noise & vibration from demolition and construction activities. It is proposed that various practices be adopted during construction, including:

- managing the hours during which site activities likely to create high levels of noise or vibration are permitted as detailed below;
- establishing channels of communication between the contractor/developer, Local Authority and residents;
- appointing a site representative responsible for matters relating to noise and vibration;
- monitoring typical levels of noise and vibration during critical periods and at sensitive locations;
- keeping site access roads even to mitigate the potential for vibration from lorries.

Furthermore, a variety of practicable noise control measures will be employed. These include:

- selection of plant with low inherent potential for generation of noise and/ or vibration;
- placing of noisy / vibratory plant as far away from sensitive properties as permitted by site constraints, and;
- regular maintenance and servicing of plant items.

It is recommended that vibration from construction activities be limited to the values set out in Table 11-3 in Chapter 11 of this EIAR. It should be noted that these limits are not absolute, but provide guidance as to magnitudes of vibration that are very unlikely to cause cosmetic damage. Magnitudes of vibration slightly greater than those in the table are normally unlikely to cause cosmetic damage, but construction work creating such magnitudes should proceed with caution. Where there is existing damage these limits may need to be reduced by up to 50%.

The operation of plant and machinery, including construction vehicles, is a source of potential impact that will require mitigation at all locations within the wind farm. Proposed measures to control noise include:

- No plant used on site will be permitted to cause an on-going public nuisance due to noise.
- The best means practicable, including proper maintenance of plant, will be employed to minimise the noise produced by on site operations.
- All vehicles and mechanical plant will be fitted with effective exhaust silencers and maintained in good working order for the duration of the contract.

- Compressors will be attenuated models fitted with properly lined and sealed acoustic covers which will be kept closed whenever the machines are in use and all ancillary pneumatic tools shall be fitted with suitable silencers.
- Machinery that is used intermittently will be shut down or throttled back to a minimum during periods when not in use.
- Any plant, such as generators or pumps, which is required to operate outside of general construction hours will be surrounded by an acoustic enclosure or portable screen.
- During the course of the construction programme, supervision of the works will include ensuring compliance with the limits detailed in Chapter 11 using methods outlined in British Standard BS 5228-1:2014+A1:2019 Code of practice for noise and vibration control on construction and open sites – Noise.
- The hours of construction activity will be limited to avoid unsociable hours where possible. Construction operations shall generally be restricted to between 7:00hrs and 19:00hrs Monday to Saturday. However, to ensure that optimal use is made of good weather periods or at critical periods within the programme (i.e. concrete pours, large turbine component delivery, rotor/blade lifting) it could occasionally be necessary to work outside of these hours which will be agreed with the local authority where required.

Where rock breaking is employed in relation to the proposed borrow pit location, the following are examples of measures that will be employed, where necessary, to mitigate noise emissions from these activities:

- Fit suitably designed muffler or sound reduction equipment to the rock breaking tool to reduce noise without impairing machine efficiency.
- Ensure all leaks in air lines are sealed.
- Use a dampened bit to eliminate ringing.
- Erect acoustic screen between compressor or generator and noise sensitive area. When possible, line of sight between top of machine and reception point needs to be obscured.
- Enclose breaker or rock drill in portable or fixed acoustic enclosure with suitable ventilation.

4.9.1 Vibration

While it was concluded above that there will be no significant vibration impacts associated with the construction of the Proposed Development and that no specific mitigation measures were required, it is recommended that vibration from construction activities will be limited to the values set out in Section 11.3.2.1.3. It should be noted that these limits are not absolute but provide guidance as to magnitudes of vibration that are very unlikely to cause cosmetic damage. Magnitudes of vibration slightly greater than those in the table are normally unlikely to cause cosmetic damage, but construction work creating such magnitudes should proceed with caution. Where there is existing damage these limits may need to be reduced by up to 50%.

4.9.2 Operational Phase Mitigation

An assessment of the operational noise levels has been undertaken in accordance with best practice guidelines and procedures as outlined in Section 11.3.2.2 in Chapter 11 of this EIAR. The findings of the assessment identified that there are two NSLs where potential exceedances are predicted. If confirmed during post-construction monitoring, a curtailment strategy will be implemented to reduce noise levels due to the wind farm to within the criteria at all NSLs.

In the unlikely event that an issue with low frequency noise is associated with the Proposed Development, it is recommended that an appropriate detailed investigation be undertaken. Due consideration should be given to guidance on conducting such an investigation which is outlined in Appendix VI of the EPA document entitled *Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities* (NG4) (EPA, 2016). This guidance is based on the

threshold values outlined in the Salford University document *Procedure for the assessment of low frequency noise complaints, Revision 1, December 2011.*

The following programme of measures would be implemented in the event of an issue of aerodynamic modulation being identified and associated with the site:

- A detailed noise survey conducted by an appropriately qualified acoustic consultant will be commissioned in order to confirm the presence or not of the issue, the extent of the issue (i.e. number of locations, wind speeds and environmental conditions in which it is occurring);
- Based on the findings of this work and where aerodynamic modulation is identified a schedule of measures will be formulated and agreed with the planning authority, which would typically be envisaged to focus on control and regulation of the operation of turbine unit(s) in certain atmospheric and meteorological conditions.

4.9.3 Monitoring

Commissioning noise surveys are recommended to ensure compliance with any noise conditions applied to the Proposed Development. In the unlikely instance that an exceedance of these noise criteria is identified, the assessment guidance outlined in the IoA GPG and Supplementary Guidance Note 5: Post Completion Measurements (July 2014) should be followed and relevant corrective actions undertaken.

4.10 Invasive Species Management

Third Schedule invasive species Bohemian Knotweed, Japanese Knotweed, Himalayan Knotweed and Rhododendron were recorded along the proposed grid connection route (see Table 6-14 of the EIAR). The following mitigation will be adhered to in relation to these species:

- All earthworks machinery will be thoroughly pressure-washed prior to arrival on site and prior to their further use elsewhere.
- Care will be taken not to disturb or cause the movement of invasive species fragments, either intentionally or accidentally.
- Stands of Knotweed will be clearly demarcated by temporary fencing and tracking within them will be strictly avoided. A minimum buffer of seven metres will be applied to avoid disturbance of lateral Knotweed rhizomes.
- Where works occur within 7m of a Knotweed stand these will be carried out under the supervision of a suitably qualified ecologist.
- Where a Knotweed stand is encountered along the road the grid connection will be laid on the opposite side of the road to avoid excavation of potential Knotweed root material insofar as possible.
- Should removal of Knotweed off site be required this will be done so under the supervision of an ecologist in line with NPWS licencing.
- The machinery must be thoroughly cleaned down under supervision of an ecologist prior to moving away from the Knotweed contaminated area.
- All contractors and staff will be briefed about the presence, identification and significance of Knotweed before commencement of works.
- Good construction site hygiene will be employed to prevent the spread of these species with vehicles thoroughly cleaned down prior to leaving any site with the potential to have supported invasive species. All plant and equipment employed on the construction site (e.g. excavator, footwear, etc.) will be thoroughly cleaned down on site to prevent the spread of invasive plant species such as Knotweed and Rhododendron. All clean down must be undertaken in areas with no potential to result in the spread of invasive species.

- When working at locations in proximity to natural watercourses, a suitable barrier will be erected between the watercourse and the stand of invasive species. This will assist in preventing the spread of any invasive species into the watercourse during their removal.
- Any soils or subsoils contaminated with invasive species will sent for disposal to an appropriately licenced facility.

The treatment and control of invasive alien species will follow guidelines issued by the National Roads Authority - *The Management of Noxious Weeds and Non-native Invasive Plant Species on National Roads* (NRA 2010) and Irish Water (2016) *Information and Guidance Document on Japanese Knotweed*.

The bio security requirements in relation to all plant and equipment as set out in the Inland Fisheries Ireland (IFI) Bio-Security Protocol (copy provided in Appendix 6) will be implemented as required.

4.10.1 Good Practice on Site Management

Careful preparation of the site and planning of the works is crucial to successful treatment of invasive species. The following list of guidelines, which is not exhaustive, shall be followed by all on-site personnel. Only those who have been inducted into biosecurity measures on-site may enter the contaminated zones within the works areas. Should any risk of contaminated material escaping be observed by the site supervisor, the management plan for the site must be amended by an appropriately qualified person to mitigate against the risk. The Best Practice Management Guidelines produced by Invasive Species Ireland (Maguire et al, 2008) and is included in Appendix 5 of this document.

4.10.2 Establishing Good Site Hygiene

- A risk assessment and method statement must be provided by the Contractor prior to commencing works.
- A series of test pits will be dug within the footprint of the proposed cable route in order to confirm presence or absence of parent plant rhizomes. This will be completed under the supervision of a suitably qualified ecologist.
- Fences will be erected around areas of infestation, as confirmed by test pits, and warning signs shall be erected.
- A designated wash-down area will be created, where power-washed material from machinery can be contained, collected and disposed of with other contaminated material. This area will contain a washable membrane or hard surface.
- Stockpile areas will be chosen to minimise movement of contaminated soil.
- Stockpiles will be marked and isolated.
- Contaminated areas which will not be excavated will be protected by a root barrier membrane if they are likely to be disturbed by machinery. Root barrier membranes will be protected by a layer of sand above and below and topped with a layer of hardcore.
- The use of vehicles with caterpillar tracks within contaminated areas will be avoided to minimise the risk of spreading contaminated material.
- An environmental manager/suitably qualified ecologist will be on site to monitor and oversee the implementation of invasive species management plans.

4.10.3 Decontamination of Vehicles

- Personnel may only clean down if they are familiar with the plant and rhizome material, and can readily identify it.
- Decontamination will only occur within designated wash-down areas.

- Vehicles will be cleaned using stiff-haired brush and pressure washers, paying special attention to any areas that might retain rhizomes e.g. wheel treads and arches.
- All run-off will be isolated and treated as contaminated material. This will be disposed of in already contaminated areas.

4.11 Waste Management Plan

This section of the CEMP provides a Waste Management Plan (WMP) which outlines the best practice procedures during the excavation and construction phases of the project. The WMP will outline the methods of waste prevention and minimisation by recycling, recovery and reuse at each stage. Disposal of waste will be seen as a last resort.

- This WMP has a number of key objectives as outlined below:
- To set out management prescriptions that adhere to a waste management hierarchy
- To outline the roles and responsibilities of the Waste Manager
- Prevention and minimisation of waste at the construction stage of the proposed development.

4.11.1.1 Legislation

The Waste Management Act 1996 and its subsequent amendments provide for measures to improve performance in relation to waste management, recycling and recovery. The Act also provides a regulatory framework for meeting higher environmental standards set out by other national and EU legislation.

The Act requires that any waste related activity has to have all necessary licenses and authorisations. It will be the duty of the Waste Manager on the site of the proposed development to ensure that all contractors hired to remove waste from the site have valid Waste Collection Permits. It will then be necessary to ensure that the waste is delivered to a licensed or permitted waste facility. The hired waste contractors and subsequent receiving facilities must adhere to the conditions set out in their respective permits and authorisations.

The Department of the Environment provides a document entitled, '*Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Projects*'.

4.11.2 Preliminary Plan

The Department of the Environment guidelines state that, at the design stage of the project, only a preliminary WMP is required,

> "Formal production and presentation of the Plan may be at a later stage but a clear 'waste management philosophy' needs to be adopted...at the initial conceptual stage of the Project..."

This preliminary WMP has a number of key objectives as outlined below:

- To set out management prescriptions that adhere to a waste management hierarchy
- To outline the roles and responsibilities of the Waste Manager
- Prevention and minimisation of waste at the construction stage of the proposed development.

4.11.3 Waste Management Hierarchy

The waste management hierarchy sets out the most efficient way of managing in the following order:

Prevention and Minimisation:

The primary aim of the WMP will be to prevent and thereby reduce the amount of waste generated at each stage of the project.

Reuse of Waste:

Reusing as much of the waste generated on site as possible will reduce the quantities of waste that will have to be transported off site to recovery facilities or landfill.

Recycling of Waste:

There are a number of established markets available for the beneficial use of Construction and Demolition waste such as using waste concrete as fill for new roads.

At all times during the implementation of the WMP, disposal of waste to landfill will be considered only as a last resort.

4.11.4 Construction Phase waste Management

4.11.4.1 Description of the Works

The construction of the proposed development will involve the construction of up to 15 no. turbines, new site access tracks & upgrade of existing tracks, internal cabling and grid connection, substation & control buildings, borrow pit, junction upgrade along the turbine haul and the provision of a link road for turbine delivery and upgrade works to the existing 110kV Mullingar substation.

The proposed turbines will be manufactured off site and delivered to site where on site erection will occur.

After the foundation level of each turbine has been formed using piling methods or on competent strata, the bottom section of the turbine tower or the "Anchor Cage" is levelled and reinforcing steel is then built up around and through the anchor cage. The outside of the foundation is shuttered with demountable formwork to allow the pouring of concrete and is backfilled accordingly with appropriate granular fill to finished surface level.

The construction of the substation will comprise of piled concrete foundations, the piles will most likely be constructed by coring and inserting a steel sleeve which will be filled with reinforced concrete prior to sleeve removal. The reminder of the substation will consist of concrete masonry blocks and a timber roof structure with roof tile or slate covering. The roof structure will be made up of prefabricated roof trusses manufactured off site to minimise timber cutting on site.

The site roads will be constructed with rock won from the onsite borrow pit.

The waste types and list of waste (LoW) codes arising from the construction phase of the proposed development are outlined in Table 4-2 below.

Table 4-2 Expected waste types arising during the Construction Phase

Materials type	Example	LoW Code
Cables	Electrical wiring	17 04 11
Cardboard	Boxes, cartons	15 01 01
Composite packaging	Containers	15 01 05

Materials type	Example	LoW Code
Metals	Copper, aluminium, lead, iron and steel	17 04 07
Inert materials	Sand, stones, plaster, rock, blocks	17 01 07
Mixed municipal waste	Daily canteen waste from construction workers, miscellaneous	20 03 01
Plastic	PVC frames, electrical fittings	17 02 03
Plastic packaging	Packaging with new materials	15 01 02
Tiles and ceramics	Slates and tiles	17 01 03
Wooden packaging	Boxes, pallets	15 01 03
Soil & Stone	Soils and subsoils	17 05 04

Hazardous wastes that may occur on site during the construction phase of the proposed development may include oil, diesel fuel, chemicals, paints, preservatives etc. All hazardous wastes will be stored in bunded containers/areas before being collected by an authorised waste contractor and brought to an EPA licensed waste facility. As mentioned above, hazardous wastes will be kept separate from non-hazardous wastes that contamination does not occur.

4.11.4.2 Waste Arisings and Proposals for Minimisation, Reuse and Recycling of Construction Waste

Construction waste will arise on the project mainly from excavation and unavoidable construction waste including material surpluses and damaged materials and packaging waste.

Appropriate measures should be taken to ensure excess waste is not generated during construction, including;

- Ordering of materials should be on an 'as needed' basis to prevent over supply to site. Co-ordination is required with suppliers enabling them to take/buy back surplus stock.
- Purchase of materials pre-cut to length to avoid excess scrap waste generated on site.
- Request that suppliers use least amount of packaging possible on materials delivered to the site.
- Ensuring correct storage and handling of goods to avoid unnecessary damage that would result in their disposal
- Ensuring correct sequencing of operations.
- Use reclaimed materials in the construction works.

Hazardous waste will be kept separate from all other construction waste to prevent contamination and removed appropriately.

4.11.4.3 Waste Arising from Construction Activities

All waste generated on site that will be contained in waste skips at a waste storage area on site. This waste storage area will be kept tidy with a waste skip clearly labelled to indicate the allowable material to be disposed of therein.

The expected waste volumes generated on site are unlikely to be large enough to warrant source segregation at the wind farm site. Therefore, all wastes streams generated on site will be deposited into a single waste skip. This waste material will be transferred to a Materials Recovery Facility (MRF) by a fully licensed waste contractor where the waste will be sorted into individual waste streams for recycling, recovery or disposal.

The waste generated from the turbine erection will be limited to the associated protective covers which are generally reusable. Considering the specialist nature of this packaging material the majority will be taken back by suppliers for their own reuse. Any other packaging waste generated from the turbine supply will be deposited into the on-site skips and subsequently transferred to the MRF.

It is not envisaged that there will be any waste material arising from the materials used to construct the road as only the quantity of stone necessary will be excavated from the borrow pit or brought on site on an 'as needed' basis.

Site personnel will be instructed at induction that no under no circumstances can waste be brought to site for disposal in the on-site waste skip. It will also be made clear that the burning of waste material on site is forbidden.

4.11.4.4 Waste Arising from Decommissioning

The design life of the wind farm is 30 years after which time a decision will be made to determine whether or not the turbines will be replaced by new turbines or if decommissioning will occur. The lengthy time frame between the completion of the construction phase and decommissioning will result in the only materials remaining on site at that time will be infrastructural material such as the turbine foundations, turbines and the granular material used to construct roads. If the site is decommissioned, cranes will disassemble each turbine tower and all equipment. The associated components will be removed from site for re-use, recycling or waste disposal. Any structural elements that are suitable for recycling will be disposed of in an appropriate manner. All lubrication fluids will be drained down and put aside for appropriate collection, storage, transport and disposal. Any materials which cannot be re-used or recycled will be disposed of by an appropriately licenced contractor.

The waste types arising from the decommissioning of the development are outlined in Table 4.3below.

Table 4-3 Expected waste types arising during the Decommissioning Phase

Material Type	Example	LoW Code
Cables	Electrical wiring	17 04 11
Metals	Copper, aluminium, lead and iron	17 04 07
Inert Materials	Crushed Stone, Concrete	17 01 07

4.11.4.5 Reuse

Many construction materials can be reused a number of times before they have to be disposed of:

- Concrete can be reused as aggregate for roads cable trench backfilling material.
- Plastic packaging etc. can be used to cover materials on site or reused for the delivery of other materials.
- Excavated peat can be reused for reinstatement of the areas around turbine foundations and adjacent to site roads.

4.11.4.6 Recycling

If a certain type of construction material cannot be reused onsite, then recycling is the most suitable option. The opportunity for recycling on site will be restricted to the associated packaging from the wind turbines.

All waste that is produced during the construction phase including dry recyclables will be deposited in the on-site skip initially and sent for subsequent segregation at a remote facility. The anticipated volume of all waste material to be generated at the proposed development is low which provides the justification for adopting this method of waste management.

4.11.4.7 Implementation

4.11.4.7.1 *Roles and Responsibilities for Waste Management*

Prior to the commencement of the proposed development a Construction Waste manager will be appointed by the project team. The Construction Waste Manager will be in charge of the implementation of the objectives of the plan, ensuring that all hired waste contractors have the necessary authorisations and that the waste management hierarchy is adhered to. The person nominated must have sufficient authority so that they can ensure everyone working on the proposed development adheres to the management plan.

4.11.4.7.2 *Training*

It is important for the Construction Waste Manager to communicate effectively with colleagues in relation to the aims and objectives of the waste management plan. All employees working on site during the construction phase of the project will be trained in materials management and thereby, should be able to:

- Distinguish reusable materials from those suitable for recycling;
- Ensure maximum segregation at source;
- Co-operate with site manager on the best locations for stockpiling reusable materials;
- Separate materials for recovery; and
- Identify and liaise with waste contractors and waste facility operators.

4.11.4.7.3 *Record Keeping*

The WMP will provide systems that will enable all arisings, movements and treatments of construction waste to be recorded. This system will enable the contractor to measure and record the quantity of waste being generated. It will highlight the areas from which most waste occurs and allows the measurement of arisings against performance targets. The WMP can then be adapted with changes that are seen through record keeping.

The fully licensed waste contractor employed to remove waste from the site will be required to provide documented records for all waste dispatches leaving the site. Each record will contain the following:

- Consignment Reference Number
- Material Type(s) and LoW Code(s)
- Company Name and Address of Site of Origin
- Trade Name and Collection Permit Ref. of Waste Carrier
- Trade Name and Licence Ref. of Destination Facility
- Date and Time of Waste Dispatch
- Registration no. of Waste Carrier vehicle
- Weight of Material
- Signature of Confirmation of Dispatch detail

- Date and Time of Waste Arrival at Destination
- Site Address of Destination Facility

4.11.4.8 Conclusion

The WMP will be properly adhered to by all staff involved in the project which will be outlined within the induction process for all site personnel. The waste hierarchy will always be employed to ensure that the least possible amount of waste is produced during the construction phase. Reuse of certain types of construction wastes will cut down on the cost and requirement of raw materials therefore further minimising waste levels.

4.12 Outline Construction Traffic Management Plan

4.12.1.1 Introduction

The Construction Traffic Management Plan can only be finalised when a contractor has been appointed to carry out and schedule the works. It is also appropriate that the Project Supervisor Construction Stage when appointed, along with the turbine supplier shall have an input in the preparation and review of the Traffic Management Plan.

The purpose of this Outline Construction Traffic Management Plan is to set out the volume of traffic generated by each element of the works. The plan will be reviewed and updated by the appointed contractor prior to the commencement of construction

4.12.2 Construction Phases

The construction phase of the proposed development will run for between 12 - 18 months. Due to the size of the site, its general layout and the total number of turbines proposed, it is unlikely that the construction phase will require phasing. Therefore, the following sequence of construction activities are proposed:

- Construction of main road access and site entrances.
- Initial installation of on-site tracks and drainage.
- Installation of new access tracks and upgrade of existing.
- Development of the construction compound and any other temporary works.
- Construction of substation and control building.
- Preparation of crane hard standings.
- Construction of turbine foundations.
- Installation of internal site cabling within wind farm
- Installation of the grid connection cabling
- Wind Turbine erection
- Land reinstatement.

4.12.2.1 Site Access Tracks

The internal access tracks will provide the required access to all turbine and associated infrastructure. The new and proposed upgraded access tracks have been designed to provide a minimum 5m running width along the straight sections of track with wider sections proposed at bends where required. Passing bays will be installed to allow a mechanism for two-way traffic. Appropriate signage at the location of these passing bays as well as instruction on priority vehicles will be installed throughout the site. The running surface on the existing and proposed new access tracks will facilitate the delivery of large and abnormal loads on oversized trucks.

Where upgrade of existing public road junctions as well as the provision of the link road for turbine deliveries are to be completed as outlined in Section 3 above, the traffic management on the public road at these locations will be provided by the appointed contractor with the approval of Westmeath County Council.

4.12.2.2 Access to the Site from National Roads

It is proposed to upgrade the existing forestry track entrance off the R396 Regional Road for use as the wind farm site entrance for the construction and operational phases. This entrance will be widened to facilitate the delivery of the construction materials and turbine components. The site entrance was subject to Autotrack assessment to identify the turning area required, as described in the Traffic and Transport Assessment in Section 14.1 of the EIAR. Appropriate sightlines will be established to the north and south of the proposed site entrance for the safe egress of traffic. The proposed works will result in a permanent upgrade of this current site access from the R396 Regional Road, which will also form the wind farm site entrance during the operational phase. The site entrance location is shown in Figure 4-1, and included in the detailed layout drawings in Appendix 4-1 of the EIAR.

The delivery of all turbine and construction materials to the site will be via the site entrance off the R396. From here, the vehicles will use the internal site roads to access the proposed infrastructure locations within the site.

The delivery of turbine and construction materials to Turbines T14 & T15 will be via the L5755 from the aforementioned crossing point on the L5755. There will be an entrance south to T14 approximately 0.3 kilometres east of the crossing point on the L5755 and an entrance north to T15 approximately 1.6 kilometres east of the crossing point on the L5755. Appropriate sightlines will be established to the east and west of these access junctions for the safe egress of traffic. The proposed works will result in permanent upgrade of the L5755 local road which will also form part of the wind farm site entrances to T14 and T15 during the operational phase. The section of L5755 and entrances to T14, T15 and the proposed borrow pit will be controlled appropriately to allow the safe passage of construction vehicles along the road, as described in the Traffic Management Plan in section 4.12.3. Priority along the section of road and at the site entrances will be maintained for public traffic.

4.12.2.3 Turbine Components Delivery

The proposed turbine delivery route is described in Section 4.3.17 of the EIAR. All deliveries of turbine components to the site will be by way of the proposed transport route outlined in Figure 4-18 of the EIAR.

Other construction materials will be delivered to the site via the proposed haul routes shown on Figure 4-19 of the EIAR. This general construction traffic will use the Regional roads in the area surrounding the site.

4.12.2.4 Grid Connection Consents

The proposed grid connection route will require a Road Opening Licence (ROL) prior to the commencement of any grid connection works on the public road. The ROL will require a detailed traffic management plan for the grid connection cabling works which will set out any proposed road closures, diversions, signage etc. The final details of such a traffic management proposals cannot be determined without the input of the appointed contractor.

The proposed grid connection route will traverse an Irish Rail level crossing in the townlands of Farranistick and Culleen More. Any such works on properties of Córas Iompair Éireann (CIE) who are authority for such properties requires a license agreement to be put in place between the developer and CIE. This license can only be agreed and signed a maximum of one year prior to the undertaking of

any works at CIE properties as CIE put a one year expiry on all such agreements to allow for amendments to any of the conditions should the standards change.

4.12.3 Detailed Traffic Management Plan

A detailed Traffic Management Plan (TMP), incorporating all the mitigation measures set out in the Outline TMP will be prepared by the appointed contractor which will details in respect of traffic management agreed with the roads authority and An Garda Síochána prior to construction works commencing on site. The detailed TMP will include the following:

Traffic Management Coordinator – a competent Traffic Management Co-ordinator will be appointed for the duration of the project and this person will be the main point of contact for all matters relating to traffic management.

Delivery Programme – a programme of deliveries will be submitted to Westmeath County Council in advance of deliveries of turbine components to site.

Information to locals – Locals in the area will be informed of any upcoming traffic related matters e.g. temporary lane/road closures (if required) or delivery of turbine components at night, via letter drops and posters in public places. Information will include the contact details of the Contract Project Co-ordinator, who will be the main point of contact for all queries from the public or local authority during normal working hours. An "out of hours" emergency number will also be provided.

A Pre and Post Construction Condition Survey – A pre-condition survey of roads associated with the proposed development will be carried out prior to construction commencement to record the condition of the road. A post construction survey will be carried out after works are completed. Where required the timing of these surveys will be agreed with the local authority. All road surfaces and boundaries will be re-instated to pre-development condition, as agreed with the local authority engineers.

Liaison with the relevant local authority - Liaison with the relevant local authority including the roads sections of local authorities that the delivery routes traverse and An Garda Siochana, during the delivery phase of the large turbine vehicles, when an escort for all convoys will be required. Liaison with the relevant local authority including the roads sections of local authorities that the cable route traverses. Once the surveys have been carried out and "prior to commencement" status of the relevant roads established, the Roads section will be informed of the name and contact number of the Project Supervisor of the construction stage as well as the Site Environmental Manager.

Implementation of temporary alterations to road network at critical junctions – At locations highlighted in Section 14.1.8. of the EIAR.

Identification of delivery routes – These routes will be agreed and adhered to by all contractors.

Travel plan for construction workers – While the assessment above has assumed the worst case that construction workers will drive to the site, the construction company will be required to provide a travel plan for construction staff, which will include the identification of a routes to / from the site and identification of an area for parking.

Temporary traffic signs – As part of the traffic management measures temporary traffic signs will be put in place at all key junctions, including all new junctions providing access to the site and temporary access road on the R395, R396 and the L5755. All measures will be in accordance with the *"Traffic Signs Manual, Section 8 – Temporary Traffic Measures and Signs for Road Works"* (Department of Transport, Tourism and Sport (DoTT&S)) and "Guidance for the Control and Management of Traffic at Roadworks" (DoTT&S). A member of construction staff (flagman) will be present at key junctions during peak delivery times and at each construction site location along the Grid Connection Route.

Delivery times of large turbine components - The management plan will include the option to deliver the large wind turbine plant components at night in order to minimise disruption to general traffic during the construction stage.

Additional measures - Various additional measures will be put in place in order to minimise the effects of the development traffic on the surrounding road network including wheel washing facilities on site and sweeping / cleaning of local roads as required.

Re-instatement works - All road surfaces and boundaries will be re-instated as described in section 14.1.8. A roads conditions survey (and any other analyses required by the Roads Section of the Council) would be undertaken immediately prior to construction commencement of the project to assess the condition of the road network at that time and to agree any required works with the local authority. Such a survey would be repeated immediately after completion of the construction phase of the project in order to ensure that any reinstatement works were carried out to a satisfactory standard as required by the local authority.

Road Opening Licence – Roads works associated with the grid connection cabling will be undertaken in line with the requirements of a road opening licence as agreed with Westmeath County Council.

Diversions and road closures – reasonable access to residences, farms and businesses will be maintained at all times during any road closures associated with the Grid Connection Route works. The details of this will be agreed with the roads authority in advance of works taking place. The network of local roads in the area will be used for traffic diversions for local traffic in order to expedite the works and limit the duration of the impact owing to the Grid Connection Route works.

Trench Reinstatement - Trenches on public roads, once backfilled, will be temporarily reinstated to the satisfaction of the roads authority. Following temporary reinstatement of trench sections on public roads along which the Grid Connection Route travels will receive a surface overlay subject to agreement with the roads authority. The roads conditions survey, which will be undertaken immediately prior to construction commencement of the project, will ensure that any section of road along the grid connection route is not left in a degraded condition. The repetition of the survey immediately after completion of the construction phase of the Proposed Development will ensure that any reinstatement works were carried out to a satisfactory standard.

4.13 Outline Site Reinstatement Plan

4.13.1 Post-Construction

Upon the completion of the major infrastructural elements of the project such as site roads, turbine bases and the substation, the initial site restoration will commence. This will involve the removal of machinery from the site which will have come to its end of use such as excavators, haulage vehicles and storage containers. As this equipment is removed, particularly from stoned areas such as the temporary construction compound, these areas will then be restored to their original state to promote revegetation. The restoration procedure for the site areas adjacent to infrastructure for which the original site conditions have been altered for the purpose of the construction of the wind farm are outlined in the following sections.

4.13.1.1 Site Roads and Turbine Foundations

Where the upgrade of existing roads and the construction of new roads has been completed, the restoration of either side of these roads will be carried out immediately after construction of this element of the works. The restoration along these road edges will mainly involve backfilling and landscaping with the material which will be removed during excavation and set aside for this purpose. The turbine foundations when complete will also be backfilled with this material. The replacing of this

material will restore the areas adjacent to the construction to its original state and will enhance revegetation opportunities.

4.13.1.2 Temporary Construction Compound

The site compound will be constructed using a similar methodology to that of the new site roads. This compound will be removed after the commissioning of the turbines. The stoned area will be excavated and all stone transported off site by a licensed haulier for reuse or recovery at an appropriately permitted site. The peat or overburden excavated prior to the installation of the site compound will be transported back to this original location and levelled with the area being restored to the original ground level.

Where restoration takes places in areas which have been previously used for agricultural purposes then the area will be reseeded for agricultural grassland. In areas of peat or blanket bog the areas in question will be restored with the similar material and will be allow to recolonise naturally. All restoration procedures will be carried out under the supervision and guidance of the supervising project ecologist.

4.13.1.3 Drainage Features

The supervising project hydrologist will provide supervision throughout the construction phase of the project. On completion of the construction phase, any drainage features which have been installed (as outlined in Section 4.2.4 prior to or during the construction phase and are deemed to be unnecessary for the operational phase by the hydrologist will be removed. Each area which has a drainage feature removed will be restored to its original condition. This will again be carried out under the supervision of the supervising project hydrologist.

4.13.1.4 Junction Works

All road junction will be reinstated once deliveries are completed the areas and boundaries will be reinstated restoring the junctions to their original configurations except where stated otherwise.

For the proposed link road between the R395 and R396 which measures approximately 1.2 kilometres in length the granular fill and final surface running layer will be left in place within the link road and will allow these to be used again in the future should it become necessary (i.e. at decommissioning stage for turbine removal, or in the unlikely event of having to swap out a blade component during the operational phase). A barrier/ gate will be put in place at the entrance to the link road and a gate will be installed at the exit. An existing stone wall at the exit will be reinstated either side of the gate

4.13.2 Decommissioning Plan

The wind turbines proposed as part of the Proposed Development are expected to have a lifespan of approximately 30 years. Following the end of their useful life, the wind turbines may be replaced with a new set of turbines, subject to planning permission being obtained, or the Proposed Development may be decommissioned fully. The substation will remain in place as it will be under the ownership of ESB/EirGrid.

Upon decommissioning of the Proposed Development, the wind turbines would be disassembled in reverse order to how they were erected. All above ground turbine components would be separated and removed off-site for recycling. Turbine foundations would remain in place underground and would be covered with earth and reseeded as appropriate. Leaving the turbine foundations in-situ is considered a more environmentally prudent option, as to remove that volume of reinforced concrete from the ground could result in significant environment nuisances such as noise, dust and/or vibration.

Site roadways could be in use for purposes other than the operation of the wind farm by the time the decommissioning of the Proposed Development is to be considered, and therefore it is considerd more

appropriate to leave the site roads in situ for future use. If it were to be confirmed that the roads were not required in the future for any other useful purpose, they could be removed where required. The underground cable ducting will be left in-situ as it is considered the most environmentally prudent option, avoiding unnecessary excavation and soil disturbance for an underground element that is not visible.

A Decommissioning Plan has been prepared (Appendix 4-11 of the EIAR) the detail of which will be agreed with the local authority prior to any decommissioning. The Decommissioning Plan will be updated prior to the end of the operational period in line with decommissioning methodologies that may exist at the time and will agreed with the competent authority at that time. The potential for effects during the decommissioning phase of the proposed renewable energy development has been fully assessed in the EIAR.

As noted in the Scottish Natural Heritage report (SNH) Research and Guidance on Restoration and Decommissioning of Onshore Wind Farms (SNH, 2013) reinstatement proposals for a wind farm are made approximately 30 years in advance, so within the lifespan of the wind farm, technological advances and preferred approaches to reinstatement are likely to change. According to the SNH guidance, it is therefore:

“best practice not to limit options too far in advance of actual decommissioning but to maintain informed flexibility until close to the end-of-life of the wind farm”.
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5. IMPLEMENTATION

5.1 Roles and Responsibilities

The Site Supervisor/Construction Manager and/or Environmental Manager are the project focal point relating to construction-related environmental issues.

In general, the Environmental Manager will maintain responsibility for monitoring the works and Contractors/Sub-contractors from an environmental perspective. The Environmental Manager will act as the regulatory interface on environmental matters by reporting to and liaising with Westmeath County Council and other statutory bodies as required.

The Environmental Manager will report directly to the Site Supervisor/Wind Farm Construction Manager. An Environmental Clerk of Works or Project Ecologist, Project Hydrologist, Project Archaeologist and Project Geotechnical engineer will visit the site regularly and report to the Site Environmental Office. This structure provides a "triple lock" review/interaction by external specialists. An organogram structure for the construction stage is as follows:

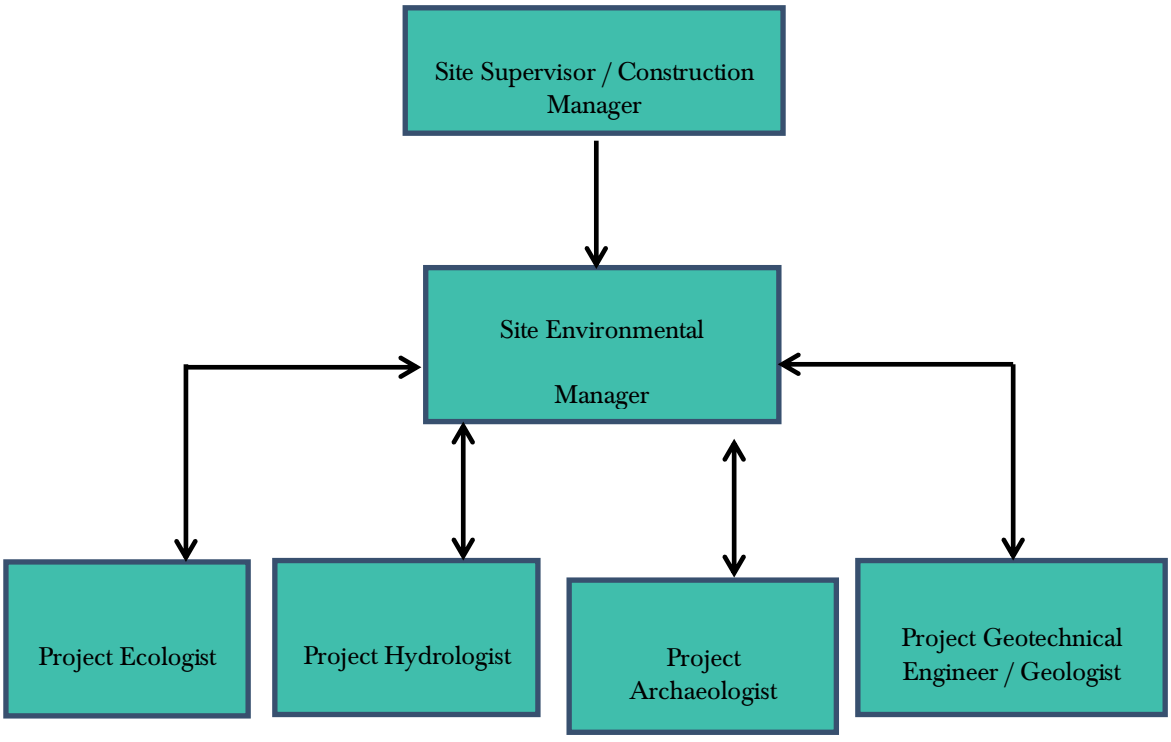


Figure 5-1 Site Management Chain of Command

Any requirement of the granted permission, for the works to be supervised by an engineer with professional indemnity insurance, who upon completion of the works, including site stability, shall certify the said works, will be adhered to. Such an engineer will be appointed to oversee and supervise the construction phase of the project.

There are currently peat extraction activities ongoing at the proposed development site. In order to ensure adequate interaction between the ongoing peat activities and the construction and operation of the wind farm an Interactions Management Group (IMG) will be set up. Refer to Section 5.1.7 for further details.

5.1.1 Wind Farm Construction Manager/Site Supervisor

The Site Supervisor/Construction Manager will have overall responsibility for the organisation and execution of all related environmental activities as appropriate, in accordance with regulatory and project environmental requirements. The duties and responsibilities of the Site Supervisor/Construction Manager will include:

- Ensure that all works are completed safely and with minimal environmental risk;
- Approve and implement the Project CEMP and supporting environmental documentation, and ensure that all environmental standards are achieved during the construction phase of the project;
- Take advice from the Environmental Manager on legislation, codes of practice, guidance notes and good environmental working practice relevant to their work;
- Ensure compliance through audits and management site visits;
- Ensure timely notification of environmental incidents; and,
- Ensure that all construction activities are planned and performed such that minimal risk to the environment is introduced.

5.1.2 Environmental Manager

The main contractor will be required to engage a qualified Environmental Engineer, Environmental Scientist, or equivalent, with experience in wind farm construction to fulfil the role of Environmental Manager, and to monitor all site works and to ensure that methodologies and mitigation are followed throughout construction to avoid negatively impacting on the receiving environment.

The Environmental Manager will report to the Site Supervisor/Construction Manager. The responsibilities and duties of the Environmental Manager will include the following:

- Preparation of the CEMP and supporting environmental documentation and review/approval of contractor method statements;
- Undertake inspections and reviews to ensure the works are carried out in compliance with the CEMP;
- Monitor the implementation of the CEMP, particularly all proposed/required Environmental Monitoring;
- Generate environmental reports as required to show environmental data trends and incidents and ensure environmental records are maintained throughout the construction period;
- Advise site management/contractor/sub-contractors on:
    - Prevention of environmental pollution and improvement to existing working methods;
    - Changes in legislation and legal requirements affecting the environment;
    - Suitability and use of plant, equipment and materials to prevent pollution;
    - Environmentally sound methods of working and systems to identify environmental hazards;
- Ensure proper mitigation measures are initiated and adhered to during the construction phase;
- Liaise with Project Ecologist, Project Hydrologist and Project Geotechnical Engineer to ensure regular site visits and audits/inspections are completed;
- Ensure adequate arrangements are in place for site personnel to identify potential environmental incidents;
- Ensure that details of environmental incidents are communicated in a timely manner to the relevant regulatory authorities, initially by phone and followed up as soon as is practicable by e-mail;

- Support the investigation of incidents of significant, potential or actual environmental damage, and ensure corrective actions are carried out, recommend means to prevent recurrence and communicate incident findings to relevant parties; and,
- Identify environmental training requirements, and arrange relevant training for all levels of site based staff/workers.
- The level, detail and frequency of reporting expected from the Environmental Manager for the Construction Manager, developer's project manager, and any Authorities or other Agencies, will be agreed by all parties prior to commencement of construction, and may be further adjusted as required during the course of the project.

5.1.3 Project Ecologist

The Project Ecologist will report to the Environmental Manager and is responsible for the protection of sensitive habitats and species encountered during the construction phase of the wind farm. The Project Ecologist will not be full time on site but will visit the site when required to fulfil ones duties.

The responsibilities and duties of the Project Ecologist will include the following:

- Review and input to the final construction phase CEMP in respect of ecological matters;
- In liaison with Environmental Manager, oversee and provide advice on all relevant ecology mitigation measures set out in the EIAR and planning permission conditions;
- Regular inspection and monitoring of the development, through all phases of construction/operation and provide ecological advice as required;
- Carry out ecological monitoring and survey work as may be required by the planning authority.

5.1.4 Project Hydrologist

The Project Hydrologist will report to the Environmental Manager and is responsible for inspection and review of drainage and water quality aspects associated with construction of the wind farm. The Project Hydrologist will not be full time on site but will visit the site at least once a month during construction and on a weekly basis during site preparation/groundworks.

The responsibilities and duties of the Project Hydrologist will include the following:

- Assist in compiling a detailed drainage design before construction commences and attend the site to set out and assist with micro siting of proposed drainage controls. This will be completed over several site visits at the start of the construction phase;
- Review and input to the final construction phase CEMP in respect of drainage and water quality management;
- Following the initial stage of drainage construction regular site visits will be required, at least once a month, to complete hydrological and water quality audits and reviews and report any issues noted to the Site Supervisor/Construction Manager; and,
- Complete ongoing inspection and monitoring of the development, particularly in areas of drainage control, through all phases of construction (including pre, during and post construction) and ensure construction is carried out as specified in the EIAR, and in relevant planning conditions.

5.1.5 Project Archaeologist

The Project Archaeologist will report to the Environmental Manager and is responsible for archaeological monitoring of the site during the construction phase. This will include monitoring of site

investigations and excavation works as well as the monitoring and metal detection of spoil during construction.

If new archaeological material is detected, during the pre-construction re-inspection, testing or monitoring, the project archaeologist will be responsible for ensuring they are preserved by record (archaeologically excavated) and therefore permanently removed with a full record made.

5.1.6 Project Geotechnical Engineer/Geologist

The Geotechnical Engineer or Project Geologist will report to the Environmental Manager and is responsible for inspection and review of geotechnical aspects associated with construction of the wind farm. The Geotechnical Engineer will not be full time on site but will visit site at least once a month during the construction phase and on a weekly basis during site preparation/groundworks.

The responsibilities and duties of the Geotechnical Engineer or Geologist will include the following:

- Visit site regularly, or at least once a month during the construction phase, to complete geotechnical audits and reviews and report any issues to the Site Supervisor/Construction Manager;
- Ensuring that identified hazards are listed in the Geotechnical Risk Register and that these are subject to ongoing monitoring; and,
- Ongoing inspection and monitoring of the development, particularly in areas of peatland and at the borrow pit and peat repository areas, through all phases of construction (including pre, during and post construction) and ensure construction is carried out as specified in the EIAR, and in relevant planning conditions.

5.1.7 Interactions Management Group

As detailed above there are currently peat extraction activities ongoing at the proposed development site. In order to ensure adequate interaction between the ongoing peat activities and the construction and operation of the wind farm at the proposed site an Interactions Management Group (IMG) will be set up. The key role of the IMG will be to establish an interface between the wind farm and peat activities at the proposed site. The setup of the IMG will allow for a co-ordinated approach in the management of site activities where there will be interactions between the two activities and to allow for the environmental management of all activities associated with the proposed wind farm including site drainage, ecology, archaeology, geology etc. The IMG will include the applicable Developers Construction/Operations Project Manager, the Main Contractors Construction Manager and Site Environmental Manager and the Operations Manager or Site Supervisor from each of the peat companies operating at the proposed development site. Coole Wind Farm Ltd will have control over the construction, operation and maintenance of the wind farm development for the lifetime of the project including its drainage system and any surface water discharges. The IMG will be set up prior to construction commencement and will continue for the duration of the lifetime of the wind farm project.

5.2 Water Quality Monitoring

5.2.1 Pre-construction Baseline Monitoring

Baseline water quality field testing and laboratory analysis will be undertaken where required prior to commencement of felling and construction at the site. The baseline monitoring programme will be subject to agreement with Westmeath County Council.

Analysis will be for a range of parameters with relevant regulatory limits along with EQSs and sampling will be undertaken for each stream that drains from the construction site.

Baseline sampling will be completed on at least two occasions and these should coincide with low flow and high flow stream conditions. The high flow sampling event will be undertaken after a period of sustained rainfall, and the low flow event will be undertaken after a dry spell.

5.2.2 Construction Phase Monitoring

5.2.2.1 Daily Visual Inspections

Daily visual inspections of drains and outfalls will be performed during the construction period to ensure suspended solids are not entering streams and rivers on site, to identify any obstructions to channels and to allow appropriate maintenance of the drainage regime. Should the suspended solids levels measured during construction be higher than the existing levels, the source will be identified and additional mitigation measures implemented.

5.2.2.2 Continuous Turbidity Monitoring

Turbidity monitors or sondes can be installed where required at locations surrounding the wind farm and Grid Connection site. The sondes will provide continuous readings for turbidity levels in the watercourse. This equipment will be supplemented by daily visual monitoring at their locations as outlined in the sections below.

5.2.2.3 Monthly Laboratory Analysis

Baseline laboratory analysis of a range of parameters with relevant regulatory limits and EQSs will be undertaken for each watercourse e.g. at SW01 to SW05 in the wind farm as outlined in Section 9 of the EIAR and along all primary watercourses along the grid connection route on a monthly basis. This will not be restricted to these four locations and further sampling points will be added as deemed necessary by the Environmental Manager in consultation with the Project Hydrologist and Site Manager.

5.2.2.4 Field Monitoring

Field chemistry measurements of unstable parameters, (pH, conductivity, temperature) analyses will be carried out by either the Environmental Manager or the Project Hydrologist at all surface water monitoring locations. In-situ field monitoring will be completed on a weekly basis. In-situ field monitoring will also be completed after major rainfall events, i.e. after events of >25mm rainfall in any 24-hour period. The supervising hydrologist will monitor and advise on the readings collected by in-situ field monitoring.

5.2.2.5 Monitoring Parameters

The analytical determinants of the monitoring programme (including limits of detection and frequency of analysis) will be as per S.I. No. 272 of 2009 European Communities Environmental Objectives (Surface Waters) Regulations and European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations 2009. The likely suite of determinants will include:

- pH (field measured)
- Electrical Conductivity (field measured)
- Temperature (field measured)
- Dissolved Oxygen (field measured)
- Total Phosphorus
- Chloride
- Nitrate
- Nitrite
- Total Nitrogen

- Ortho-Phosphate
- Ammonia N
- Biochemical Oxygen Demand
- Total Suspended Solids

5.2.3 Construction Phase Drainage Inspections

Drainage performance will form part of the civil works contract requirements. During the construction phase the effectiveness of drainage measures designed to minimise runoff entering works areas and capture and treatment of potentially silt-laden water from the works areas will be monitored periodically (daily, weekly, and event based monitoring, i.e. after heavy rainfall events) by the Environmental Manager and/or the Project Hydrologist. The Environmental Manager will respond to changing weather and drainage conditions on the ground as the project proceeds, to ensure the effectiveness of the drainage design is maintained.

Prior to the commencement of construction an inspection and maintenance plan for the on-site drainage system which will be prepared by the Environmental Manager in consultation with the Project Hydrologist. Regular inspections of all installed drainage systems will be undertaken, especially after heavy rainfall, to check for blockages, and ensure there is no build-up of standing water in parts of the systems where it is not intended.

Regular inspections of all existing and installed drainage systems will be undertaken, especially after heavy rainfall, to check for blockages, and ensure there is no build-up of standing water within the system. Any excess build-up of silt levels at check dams, the settlement ponds, or any other drainage features that may decrease the effectiveness of the drainage feature, will be removed.

The following periodic inspection regime is likely to be proposed:

- Daily general visual inspections by Environmental Manager;
- Weekly (existing & new drains) inspections by the Environmental Manager and/or the site Construction Manager;
- Inspection to include all elements of drainage systems and all monitoring. Inspections required to ensure that drainage systems are operating correctly and to identify any maintenance that is required. Any changes, such as discolouration, odour, oily sheen or litter should be noted and corrective action should be implemented. High risk locations such as settlement ponds will be inspected daily. Daily inspections checks will be completed on plant and equipment, and whether materials such as silt fencing or oil absorbent materials need replacement;
- Event based inspections by the Environmental Manager as follows:
    - >10 mm/hr (i.e. high intensity localised rainfall event);
    - >25 mm in a 24-hour period (heavy frontal rainfall lasting most of the day); or,
    - Rainfall depth greater than monthly average in 7 days (prolonged heavy rainfall over a week).
- Monthly site inspections by the Project Hydrologist during construction phase; and,
- Quarterly site inspections by the Project Hydrologist after construction for a period of one year following the construction phase.
- A written record will be maintained or available on-site of all construction phase monitoring undertaken.

5.2.4 Surface Water Monitoring Reporting

Visual inspection and laboratory analysis results of water quality monitoring shall assist in determining requirements for any necessary improvements in drainage controls and pollution prevention measures implemented on site.

It will be the responsibility of the Environmental Manager to present the ongoing results of water quality and weather monitoring at or in advance of regular site meetings.

Reports on water quality will consider all field monitoring and visual inspections, and results of laboratory analysis completed for that period. Reports will describe how the results compare with baseline data as well as previous reports on water quality. The reports will also describe whether any deterioration or improvement in water quality has been observed, whether any effects are attributable to construction activities and what remedial measures or corrective actions have been implemented. Any proposed alteration to sampling frequency will be agreed with Westmeath County Council in advance.

5.2.5 Post-Construction Monitoring

5.2.5.1 Monthly Laboratory Analysis Sampling

Monthly sampling for laboratory analysis for a range of parameters adopted during pre-commencement and construction phases will continue for six months after construction is complete. The supervising hydrologist will monitor and advise on the readings being received from the testing laboratory.

5.3 Environmental Induction

The Environmental Induction will be integrated into the general site induction on a case by case basis for each member of staff employed on-site depending on their assigned roles and responsibilities on site. Where necessary, the Environmental Induction will as a minimum include:

- A copy of the Environmental Management Site Plans and discussion of the key environmental risks and constraints;
- An outline of the CEMP structure;
- A discussion of the applicable Works Method Statement;
- The roles and responsibilities of staff, including contractors, in relation to environmental management; and,
- An outline of the environmental Incident Management Procedure.

5.3.1 Toolbox Talks

Tool box talks would be held by the Environmental Manager/Construction Manager at the commencement of each day, or at the commencement of new activities. The aims of the tool box talks are to identify the specific proposed work activities that are scheduled for that day. In addition, the necessary work method statements and sub plans would be identified and discussed prior to the commencement of the day's activities. The toolbox talks will include training and awareness on:

- Ecological Sensitivities on site
- Buffers to be upheld – watercourses, archaeology, ecology
- Sediment and Erosion Control
- Good site practice
- On-site Traffic Routes and Rules
- Keeping to tracks – vehicle rules
- Strictly adhering to the development footprint
- Fuel Storage
- Materials and waste procedures

Site meetings would be held on a regular basis involving all site personnel. The objectives of the site meetings are to discuss the coming weeks proposed activities and identify the relevant work method statements and sub plans that will be relevant to that week's activities. Additionally, any non-compliance

identified during the previous week would also be discussed with the aim to reduce the potential of the same non-compliance reoccurring.

6. EMERGENCY RESPONSE PLAN

An Emergency Response Plan (ERP) has been prepared to provide details of procedures to be adopted in the event of an emergency in terms of site health and safety and environmental protection during the construction and operational phases of the Coole Wind Farm Development. The construction phase of the development will have the highest volume of works activity and site personnel resulting in this phase being the most likely to engage this ERP should a situation require it. The operational phase is a much less intensive phase of the development. The physical site presence during operation is significantly reduced with every element of the site monitored remotely.

The decommissioning phase will adopt this ERP during that phase in the event of an incident during the works associated with decommissioning and site restoration

6.1 Emergency Response

The chain of command during an emergency response sets out who is responsible for coordinating the response. The appointed Site Manager will lead the emergency response which makes him responsible for activating and coordinating the emergency response procedure. The other site personnel who can be identified at this time who will be delegated responsibilities during the emergency response are presented in Figure 6-1. In a situation where the Site Manager is unavailable or incapable of coordinating the emergency response, the responsibility will be transferred to the next person in the chain of command outlined in Figure 6-1. This will be updated throughout the various stages of the project.

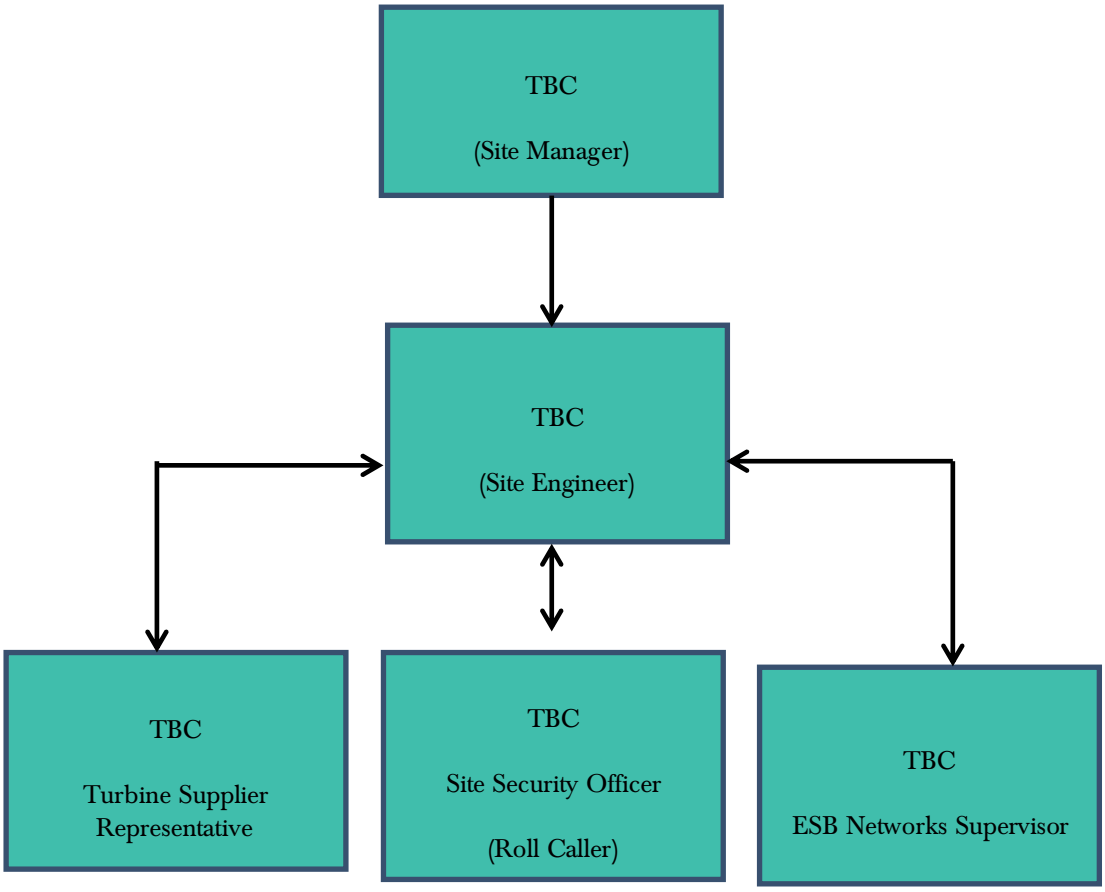


Figure 6-1 Emergency Response Procedure Chain of Command

6.1.1 Initial Steps

In order to establish the type and scale of potential emergencies that may occur, the following hazards have been identified as being potential situations that may require an emergency response in the event of an occurrence.

Table 6-1 Hazards associated with potential emergency situations

Hazard	Emergency Situation
Construction Vehicles: Dump trucks, tractors, excavators, cranes etc.	Collision or overturn which has resulted in operator or third-party injury.
Abrasive wheels/Portable Tools	Entanglement, amputation or electrical shock associated with portable tools
Contact with services	Electrical shock or gas leak associated with an accidental breach of underground services
Fire	Injury to operative through exposure to fire
Falls from heights including falls from scaffold towers, scissor lifts, ladders, roofs and turbines	Injury to operative after a fall from a height
Sickness	Illness unrelated to site activities of an operative e.g. heart attack, loss of consciousness, seizure

In the event of an emergency situation associated with, but not restricted to, the hazards outlined in Table 6-1 the Site Manager will carry out the following:

- Establish the scale of the emergency situation and identify the number of personnel, if any, have been injured or are at risk of injury.
- Where necessary, sound the emergency siren/fog horn that activates an emergency evacuation on the site. The Site Manager must proceed to the assembly point if the emergency poses any significant threat to their welfare and if there are no injured personnel at the scene that require assistance. The Site Manager will be required to use his own discretion at that point. In the case of fire, the emergency evacuation of the site should proceed, without exception. The site evacuation procedure is outlined in Section 6.1.2
- Make safe the area if possible and ensure that there is no identifiable risk exists with regard to dealing with the situation e.g. if a machine has turned over, ensure that it is in a safe position so as not to endanger others before assisting the injured.
- Contact the required emergency services or delegate the task to someone if he is unable to do so. If delegating the task, ensure that they follow the procedures for contacting the emergency services as set out in Section 6.3.
- Take any further steps that are deemed necessary to make safe or contain the emergency incident e.g. cordon off an area where an incident associated with electrical issues has occurred.
- Contact any regulatory body or service provider as required e.g. ESB Networks the numbers for which as provided in Section 6.3.2.
- Contact the next of kin of any injured personnel where appropriate. The procedure for this is outlined in Section 6.3.3.

6.1.2 Site Evacuation/Fire Drill

A site evacuation/fire drill procedure will provide basis for carrying out the immediate evacuation of all site personnel in the event of an emergency. The following steps will be taken:

- Notification of the emergency situation. Provision of a siren or fog horn to notify all personnel of an emergency situation.
- An assembly point will be designated in the construction compound area and will be marked with a sign. All site personnel will assemble at this point.
- A roll call will be carried out by the Site Security Officer to account for all personnel on site.
- The Site Security Officer will inform the Site Manager when all personnel have been accounted for. At this time the Site Manager will decide the next course of action which be determined by the situation that exists at that time. The Site Manager will advise all personnel accordingly.

All personnel will be made aware of the evacuation procedure during site induction. The Fire Services Acts of 1981 and 2003 require the holding of fire safety evacuation drills at specified intervals and the keeping of records of such drills.

6.2 Environmental Emergency Response Procedure

6.2.1 Excessive Peat Movement

Where there is excessive peat movement or continuing peat movement recorded at a monitoring location or identified at any location within the site but no apparent signs of distress to the peat (e.g. cracking, surface rippling) then the following shall be carried out.

- All construction activities shall cease within the affected area.
- Increased monitoring at the location shall be carried out. The area will be monitored, as appropriate, until such time as movements have ceased.
- Re-commencement of limited construction activity shall only start following a cessation of movement and the completion of a geotechnical risk assessment by a geotechnical engineer.

6.2.1.1 Onset of Peat Slide

Where there is the onset or actual detachment of peat (e.g. cracking, surface rippling) then the following shall be carried out.

- On alert of a peat slide incident, all construction activities will cease and all available resources will be diverted to assist in the required mitigation procedures.
- Where considered possible action will be taken to prevent a peat slide reaching any watercourse. This will take the form of the construction of check barrages on land. Due to the terrain, the possible short run-out length to watercourses, speed of movement and the inability to predict locations it may not be possible to implement any on-land prevention measures, in this case a watercourse check barrage will be implemented.
- For localised peat slides that do not represent a risk to a watercourse and have essentially come to rest the area will be stabilised initially by rock infill, if required. The failed area and surrounding area will then be assessed by the engineering staff and stabilisation procedures implemented. The area will be monitored, as appropriate, until such time as movements have ceased.

6.2.2 Spill Control Measures

Every effort will be made to prevent an environmental incident during the construction and operational phase of the proposed project. Oil/Fuel spillages are one of the main environmental risks that will exist on the proposed site which will require an emergency response procedure. The importance of a swift and effective response in the event of such an incident occurring cannot be over emphasised. The following steps provide the procedure to be followed in the event of such an incident.

- Stop the source of the spill and raise the alarm to alert people working in the vicinity of any potential dangers.
- If applicable, eliminate any sources of ignition in the immediate vicinity of the incident
- Contain the spill using the spill control materials, track mats or other material as required. Do not spread or flush away the spill.
- If possible, cover or bund off any vulnerable areas where appropriate such as drains, watercourses or sensitive habitats.
- If possible, clean up as much as possible using the spill control materials.
- Contain any used spill control material and dispose of used materials appropriately using a fully licensed waste contractor with the appropriate permits so that further contamination is limited.
- Notify the Environmental Manager immediately giving information on the location, type and extent of the spill so that they can take appropriate action.
- The Environmental manager will inspect the site and ensure the necessary measures are in place to contain and clean up the spill and prevent further spillage from occurring.
- The Environmental Manager will notify the appropriate regulatory body such as Westmeath County Council, and the Environmental Protection Agency (EPA), if deemed necessary.

Environmental incidents are not limited to just fuel spillages. Therefore, any environmental incident must be investigated in accordance with the following steps.

- The Environmental manager must be immediately notified.
- If necessary, the Environmental manager will inform the appropriate regulatory authority. The appropriate regulatory authority will depend on the nature of the incident.
- The details of the incident will be recorded on an Environmental Incident Form which will provide information such as the cause, extent, actions and remedial measures used following the incident. The form will also include any recommendations made to avoid reoccurrence of the incident.
- If the incident has impacted on an ecologically sensitive receptor, such as a sensitive habitat, protected species or designated conservation site (pSPA or cSAC), the Environmental manager will liaise with the Project Ecologist.
- If the incident has impacted on a sensitive receptor such as an archaeological feature the Environmental manager will liaise with the Project Archaeologist.
- A record of all environmental incidents will be kept on file by the Environmental manager and the Main Contractor. These records will be made available to the relevant authorities such as Westmeath County Council, EPA if required.

The Environmental Manager will be responsible for any corrective actions required as a result of the incident e.g. an investigative report, formulation of alternative construction methods or environmental sampling, and will advise the Main Contractor as appropriate.

6.3 Contacting the Emergency Services

6.3.1 Emergency Communication Procedure

In the event of requiring the assistance of the emergency services the following steps should be taken:

Stay calm. It's important to take a deep breath and not get excited. Any situation that requires 999/112 is, by definition, is an emergency. The dispatcher or call-taker knows that and will try to move things along quickly, but under control.

Know the location of the emergency and the number you are calling from. This may be asked and answered a couple of times but don't get frustrated. Even though many emergency call centres have enhanced capabilities meaning they are able to see your location on the computer screen they are still required to confirm the information. If for some reason you are disconnected, at least emergency crews will know where to go and how to call you back.

Wait for the call-taker to ask questions, then answer clearly and calmly. If you are in danger of assault, the dispatcher or call-taker will still need you to answer quietly, mostly "yes" and "no" questions.

If you reach a recording, listen to what it says. If the recording says your call cannot be completed, hang up and try again. If the recording says all call takers are busy, WAIT. When the next call-taker or dispatcher is available to take the call, it will transfer you.

Let the call-taker guide the conversation. He or she is typing the information into a computer and may seem to be taking forever. There's a good chance, however, that emergency services are already being sent while you are still on the line.

Follow all directions. In some cases, the call-taker will give you directions. Listen carefully, follow each step exactly, and ask for clarification if you don't understand.

Keep your eyes open. You may be asked to describe victims, suspects, vehicles, or other parts of the scene.

Do not hang up the call until directed to do so by the call taker.

Due to the remoteness of the site it may be necessary to liaise with the emergency services on the ground in terms of locating the site. This may involve providing an escort from a designated meeting point that may be located more easily by the emergency services. This should form part of the site induction to make new personnel and sub-contractors aware of any such arrangement or requirement if applicable.

6.3.2 Contact Details

A list of emergency contacts is presented in Table 6-2. A copy of these contacts will be included in the Site Safety Manual and in the site offices and the various site welfare facilities.

Table 6-2 Emergency Contacts

Contact	Telephone no.
Emergency Services – Ambulance, Fire, Gardaí	999/112
Doctor – Coole Surgery	044 9661104

Hospital – Midland Regional Hospital, Mullingar	044 9340221
ESB Emergency Services	1850 372 999
Bórd Gais Emergency	1850 20 50 50
Gardaí –Multyfarnham Garda Station	044 9371112
Health and Safety Co-oordinator - Health & Safety Services	TBC
Health and Safety Authority	1890 289 389
Inland Fisheries Ireland (IFI)	1890 347 424
Project Supervisor Construction Stage (PSCS): TBC	TBC
Project Supervisor Design Stage (PSDS): McCarthy, Keville, O' Sullivan Ltd.	091 735611
Client – Coole Wind Farm	021 2427786

6.3.3 Procedure for Personnel Tracking

All operatives on site without any exception will have undergo a site induction where they will be required to provide personal contact details which will include contact information for the next of kin.

In the event of a site operative becoming in an emergency situation where serious injury has occurred and hospitalisation has taken place, it will be the responsibility of the Site Manager or next in command if unavailable to contact the next of kin to inform them of the situation that exists.

6.4 Induction Checklist

Table 6-3 provides a list of items highlighted in this ERP which must be included or obtained during the mandatory site induction of all personnel that will work on the site. This will be updated throughout the various stages of the project.

Table 6-3 Emergency Response Plan Items Applicable to the Site Induction process

ERP Items to be included in Site Induction	Status
All personnel will be made aware of the evacuation procedure during site induction.	
Due to the location of the site it may be necessary to liaise with and assist the emergency services on the ground in terms of locating the site. This may involve providing an escort from a designated meeting point that may be located more easily by the emergency services. This should form part of the site induction to make new personnel and sub-contractors aware of any such arrangement or requirement if applicable.	

All operatives on site without any exception will have undergone a site induction where they will be required to provide personal contact details which will include contact information for the next of kin.	

7. SAFETY & HEALTH MANAGEMENT PLAN

7.1 Introduction

The Safety and Health Management Plan (SHMP) sets out the work practices procedures and management framework and responsibilities for the management of health and safety during the design, construction and operational phases of the proposed Coole Wind Farm development. The Safety and Health Management Plan shall be finalised by the appointed contractor who will ensure that all site personnel are familiarised with their individual responsibilities as set out the SHMP. The contractor will ensure that adequate site induction and ongoing training of site personnel will inform all operatives of their responsibilities.

7.2 Project Supervisor Design Process

MKO have been appointed to the role of Project Supervisor Design Process (PSDP) for the proposed Coole Wind Farm. In fulfilling this role, the PSDP is required to:

- Identify hazards arising from the design or from the technical, organisational, planning or time related aspects of the project
- Eliminate the hazards or reduce the risks, where possible,
- Communicate necessary control measure, design assumptions or remaining risks to the PSCS so they can be dealt with in the safety and health plan
- Ensure that the work of designers is coordinated to ensure safety
- Organise co-operation between designers
- Prepare a written safety and health plan for any project and deliver it to the client prior to tender

7.2.1 Preliminary Safety and Health Plan

A Preliminary Health and safety Plan has been developed by PSDP. The Safety, Health and Welfare at Work Act 2005 requires under Section 15 that the appointed Project Supervisor for the Construction Stage (PSCS) assume the responsibility of the 'person in control of places of work'. The PSCS is required to ensure that access, egress, articles or substances are safe and pose no risk to health.

This Preliminary Health and safety Plan has been developed by the PSDP as required by Regulation 12 of The Safety, Health and Welfare at Work (Construction) Regulations 2006. This document provides a general description of the project, client's considerations and management requirements, environmental restrictions and existing on-site risks i.e. Safety hazards, health hazards and any significant design and construction hazards. This information may assist the PSCS in the further development of the Health & Safety Plan as required under Regulation 16 of The Safety, Health & Welfare (Construction) Regulations 2006, in order to demonstrate that appropriate account will be taken of the health and safety arrangements, prior to the commencement of works on site.

- The preliminary safety and health plan includes the following information:
- General Project Description
- Construction Activities Overview
- Designers Risk Assessment
- Management and Site Rules
- Construction timing

7.3 Project Supervisor Construction Stage

The role of Project Supervisor Construction Stage will be awarded to the appointed contractor undertaking the construction phase of the works. The PSDP will facilitate the handover of the Preliminary Health & Safety Plan as well as all other necessary documents prepared during the planning process to enable the PSCS prepare the Construction Stage Health & Safety Plan.

7.3.1 Construction Stage Safety and Health Plan

On awarding of the contract, the PSCS shall submit to the developer before commencing the works, his customised Construction Phase Site Specific Safety and Health Plan. This document will include a Hazard Identification and Risk Assessment Plan for their activities on site during the execution of the Works. This plan must also include safety barrier analysis for the works proposed. Site Specific Risk Assessments and Method Statements will be submitted on behalf of each of the subcontractors before works commence on Site.

The Site-Specific Method Statements and Risk Assessments shall be subject to revision in order to maintain compatibility with the Construction Stage Safety and Health Plan prepared for the site. The PSCS will be responsible for preparing this plan before Works commence on site, and for maintaining and updating this plan as part of their role as PSCS.

A Daily Job Safety Plan is to be completed before each task commences with each work crew. This practice is to be followed by all contractors on site.

The Contractor shall be required to ensure that individual responsibility for safety measures are detailed in his Site-Specific Safety and Health Plan. This should be taken into account at the tendering, planning and execution stages of the work. The Construction Stage Safety and Health shall include but not be limited to the following:

- Provisions for the management of safety during the construction phase including a management organisation chart clearly showing those who perform a statutory safety role;
- Method statements for each and every component of their works on site;
- Risk assessments for site hazards identified prior to site mobilisation and provisions for subsequent hazard identification and risk assessment procedures for the site;
- A comprehensive inspection checklist, which the Contractor shall use on a weekly basis on site to ensure implementation of the controls detailed in this site-specific safety statement;
- Provisions for safety training of personnel upon their induction on Site and subsequently as the project proceeds;
- Provisions for the safe control and use of chemicals on site;
- Provisions for the control of the Contractor's and Subcontractor's activities on the site including permit to work, entry into confined spaces, hot work permits, etc.;
- The provision and maintenance of safe electrical supplied on the site;
- The provision of fire-fighting facilities on the Site;
- Site emergency procedures (fire, accident, etc.);
- Site first aid facilities and trained personnel;
- Arrangements for the promotion of safety on Site;
- Disciplinary procedures for breaches in safety by site personnel, including management staff;
- Personal protective equipment (PPE) policy;
- Inspection and control of work equipment;
- Recording of weekly Contractor/Subcontractor site labour returns;
- Accident reporting, recording and investigation;

- Provisions for ensuring the adequacy of Subcontractors safety standards prior to their appointment on site; and
- Safety consultation procedures for site workforce. This should Illustrate how the Contractor will meet the execution and deliverable requirements of the HSSE Obligations.

Should the extent, nature or method of working be changed in the course of its execution, the Contractor shall take account of the change by amending the Construction Stage Safety and Health for the works and submitting it for approval of the Employer. The Contractors revised risk assessments and method statements for works that change during the course of its execution must also be submitted to the PSCS. The amended Safety and Health must be distributed and fully understood by all the relevant persons before works relating to the revised Statement take place.

8. MITIGATION PROPOSALS

All mitigation measures relating to the pre-commencement, construction and operational phases of the proposed development were set out in the relevant chapters of the EIAR submitted as part of the planning permission application.

This section of the CEMP groups together the mitigation measures presented in the EIAR. It is intended that the CEMP would be updated where required prior to the commencement of the development, to include all mitigations measures, conditions and or alterations to the EIAR and application documents should they emerge during the course of the planning process, and would be submitted to the Planning Authority for written approval.

All mitigation measures which will be implemented during the pre-commencement, construction and operational phases of the project are outlined in Table 8-1. The mitigation measures have been grouped together according to their environmental field/topic and are presented under the following headings:

- Construction Management
- Drainage Design and Management
- Felling
- Peat, subsoils and bedrock
- Flora and Fauna
- Noise
- Air Quality/Dust
- Landscape and Visual
- Traffic

By presenting the mitigation proposals in the below format, it provides an easy to audit list that can be reviewed and reported on during the future phases of the project. The tabular format in which the below information is presented, can be further expanded upon during the course of future project phases to provide a reporting template for site compliance audit.

Table 8-1 Monitoring Measures

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
Pre-Commencement Phase					
MM1	Environmental Management	EIAR Chapter 4	All proposed site activities will be provided for in an Environmental Management Plan, prepared prior to the commencement of any operations onsite. The environmental management plan will set out all measures necessary to ensure works are carried out in accordance with the mitigation measures set out in the EIAR and will set out the monitoring and inspections procedures and frequencies.		
MM2	Environmental Management	EIAR Chapter4 CEMP Section 4	The Environmental Manager will maintain responsibility for monitoring the works and Contractors/Sub-contractors from an environmental perspective. In addition, an Environmental Clerk of Works or Project Ecologist, Project Hydrologist, Project Geotechnical engineer will visit the site regularly and report to the Site Environmental Office.		
MM3	Environmental Management	EIAR Chapter 4 CEMP Section 4	A Site Environmental Manager will oversee the site works and implementation of the Environmental Management Plan and provide on-site advice on the mitigation measures necessary to ensure the project proceeds as intended. The level, detail and frequency of reporting expected from the Site Environmental Manager for the Construction Manager, developer's project manager, and any Authorities or other Agencies, will be agreed by all parties prior to commencement of construction, and may be further adjusted as required during the course of the project.		
MM4	Environmental Management	EIAR Chapter 6	› An Ecological Clerk of Works (ECoW) will be appointed. Duties will include: o Undertake a pre-construction transect/walkover bird survey to ensure that significant effects on breeding birds will be avoided.		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			o Inform and educate on-site personnel of the ornithological and ecological sensitivities within the proposed development site. o Oversee management of ornithological and ecological issues during the construction period and advise on ornithological issues as they arise o Provide guidance to contractors to ensure legal compliance with respect to protected species onsite. o Liaise with officers of consenting authorities and other relevant bodies where required with regular updates in relation to construction progress.		
MM5	Concrete Deliveries	EIAR Chapter 4 CEMP Section 4	The arrangements for concrete deliveries to the site will be discussed with suppliers before work starts, agreeing routes, prohibiting on-site washout of trucks and discussing emergency procedures.		
MM6	Wastewater Management	EIAR Chapter 4, 9 CEMP Section 4	The removal and disposal of wastewater from the site will be carried out by a fully permitted waste collector holding valid Waste Collection Permits as issued under the Waste Management (Collection Permit) Regulations, 2007.		
MM7	Site Drainage Plan	CEMP Section 4	The Project Hydrologist/Design Engineer will complete a site drainage plan before construction commences.		
MM8	Drainage Swales	EIAR Chapter 4, 9.	Drainage swales will be installed in advance of any construction works commencing.		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
		CEMP Section 4			
MM9	Culverts	EIAR Chapter 4. CEMP Section 4	Culverts will be installed at locations where drainage channels cross the new proposed track route. All works involving culverts, whether they are new, upgraded or extended, will be carried out to follow a method statement to be agreed with Inland Fisheries Ireland.		
MM10	Protection of watercourses	EIAR Chapter 4	All materials and equipment necessary to implement the drainage measures outlined above, will be brought on-site in advance of any works commencing. An adequate amount of clean stone, silt fencing, stakes, etc. will be kept on site at all times to implement the drainage design measures as necessary. The drainage measures outlined in the above will be installed prior to, or at the same time as the works they are intended to drain.		
MM11	Pre-emptive site drainage management	EIAR Chapter 4. CEMP Section 4	The works programme for the groundworks part of the construction phase of the project will also take account of weather forecasts, and predicted rainfall in particular.		
MM12	Drainage Inspection	CEMP Section 5	Prior to commencement of works in sub-catchments across the site main drain inspections will be competed to ensure ditches and streams are free from debris and blockages that may impede drainage.		
MM13	Drainage Maintenance	EIAR Chapter 4.	An inspection and maintenance plan for the drainage system on site will be prepared in advance of commencement of any works. Regular inspections of all		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
		CEMP Section 5	installed drainage systems will be necessary, especially after heavy rainfall, to check for blockages, and ensure there is no build-up of standing water at parts of the systems where it is not intended. The inspection of the drainage system will be the responsibility of the site Environmental Manager or the supervising hydrologist.		
MM14	Earthworks	EIAR Chapter 8	Drainage and associated pollution control measures will be implemented onsite before the main construction works commence. Where possible drainage controls will be installed during seasonally dry ground conditions. This will reduce the possibility of impact on surface waters by suspended sediment released during construction and entrained in surface run-off.		
MM15	Earthworks	EIAR Chapter 8	A 50-metre buffer zone will be maintained around watercourses during the windfarm construction. With the exception of road crossings of streams and associated culvert construction, no other development infrastructure, construction activity or stock-piling of construction materials or construction waste will take place within this zone.		
MM16	Felling	EIAR Chapter 6 CEMP Section 10	The removal of woody vegetation will be undertaken in full compliance with Section 40 of the Wildlife Act 1976 – 2018. Any required removal of vegetation will be undertaken following inspection by a suitable qualify ornithologist to ensure no nesting birds are affected.		
MM17	Archaeology	EIAR Chapter 13	› A pre-construction walkover survey / inspection of areas proposed for excavation will be undertaken to re-assess the bog for new sites that may be exposed. › If present, the sites shall be archaeologically excavated under licence prior to construction. The archaeologist will liaise with the Department of Arts, Heritage, Regional, Rural and		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			Gaeltacht Affairs regarding the methods being proposed for excavation. › Pre-construction archaeological testing of turbine bases and hardstands proposed for excavation will be carried out. Liaise with DAHRRGA should archaeology be uncovered. › A report on the results of the monitoring shall be compiled and submitted to the relevant authorities on completion of the project.		
MM18	Traffic Management Plan	EIAR Chapter 4, CEMP Section 4	A detailed Traffic Management Plan (TMP) will be provided specifying details relating to traffic management and included in the CEMP prior to the commencement of the construction phase of the proposed development. The TMP will be agreed with the local authority and An Garda Síochána prior to construction works commencing on site. The detailed TMP will include a Traffic Management Coordinator – a competent Traffic Management Co-ordinator will be appointed for the duration of the project and this person will be the main point of contact for all matters relating to traffic management.		
Construction Phase					
Construction Management					
MM19	Health and Safety	EIAR Chapter 5	During construction of the proposed development, all staff will be made aware of and adhere to the Health & Safety Authority's *'Guidelines on the Procurement, Design and Management Requirements of the Safety, Health and Welfare at Work (Construction) Regulations 2006'*. This will encompass the use of all necessary Personal Protective Equipment and adherence to the site Health and Safety Plan.		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
MM20	Health and Safety	EIAR Chapter 5	Fencing will be erected in areas of the site where uncontrolled access is not permitted. Appropriate health and safety signage will be erected at locations around the site		
MM21	Health and Safety	EIAR Chapter 5	During construction of the proposed development, all staff will be made aware of and adhere to the Health & Safety Authority's *'Guidelines on the Procurement, Design and Management Requirements of the Safety, Health and Welfare at Work (Construction) Regulations 2006'*. This will encompass the use of all necessary Personal Protective Equipment and adherence to the site Health and Safety Plan		
MM22	Groundwater quality,	EIAR Chapter 4, 5, 9 CEMP Section 4	On-site refuelling will be carried out 100m from watercourses using a mobile double skinned, bunded fuel bowser. The fuel bowser will be towed around the site by a 4x4 jeep to where machinery is located. It is not practical for all vehicles to travel back to a single refuelling point, given the size of the cranes, excavators, etc. that will be used during the construction of the proposed wind farm development. The 4x4 towing vehicle will also carry fuel absorbent material and pads in the event of any accidental spillages. The fuel bowser will be parked on a level area in the construction when not in use.		
MM23	Potential Release of Hydrocarbons	EIAR Chapter 4, 5, 9 CEMP Section 4	› All plant will be inspected and certified to ensure they are leak free and in good working order prior to use on site; › Fuels stored on site will be minimised. Any storage areas will be bunded appropriately for the fuel storage volume for the time period of the construction; › The electrical control building will be bunded appropriately to the volume of oils likely to be stored and to prevent leakage of any associated chemicals and to groundwater or surface water. The bunded area will be fitted with a storm drainage system and an appropriate oil interceptor; An emergency plan for the construction phase to deal with accidental spillages will be contained within the Construction Environmental Management Plan. Spill kits will be available to deal with accidental spillages.		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
MM24	Plant and Equipment Inspections	EIAR Chapter 9. CEMP Section 4	A programme for the regular inspection of plant and equipment for leaks and fitness for purpose will be developed at the outset of the construction phase.		
MM25	Fuel and hazardous material storage	EIAR Chapter 5, 9 CEMP Section 4	Fuel and lubricant oils will be stored within a bunded area, sized to 110% of the volume of stored oils. The storage area will be located within a safe part of the sub-station building, with due attention to fire hazard. The bunded area will be roofed to prevent the ingress of rainwater and will be equipped with an appropriate oil interceptor.		
MM26	Accidental Spillage of Hydrocarbons	EIAR Chapter 4, 9 CEMP Section 6	The contractor will nominate an approved, certified clean-up consultant and will be available on 24-hour notice to commence a clean-up in the event of a hydrocarbon spillage from plant or vehicles the details of whom will be included in the Emergency Response Plan to be finalised by the appointed contractor.		
MM27	Temporary water supply and onsite Sanitation	EIAR Chapter 9	Water supply for the site office and other sanitation will be brought to site and removed after use from the site to be discharged at a suitable off-site treatment location. Potable water will be supplied via water coolers located within the staff facilities, which will be restocked on a regular basis as required during the construction phase. A supply contract will be set up with a water cooler supply company with water supplies delivered to site as required on a regular basis.		
MM28	Pre-emptive site drainage management	EIAR Chapter 4, 9	The works programme for the groundworks part of the construction phase of the project will also take account of weather forecasts, and predicted rainfall in particular.		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
		CEMP Section 4			
MM29	Protection of Watercourses	EIAR Chapter 9	During the near stream construction work and tree felling, double row silt fences may be emplaced immediately down-gradient of the working areas for the duration of the construction phase.		
MM30	Concrete Deliveries and Management	EIAR Chapter 9	No batching of wet-cement products will occur on site. Ready-mixed supply of wet concrete products and where possible, emplacement of pre-cast elements, will take place. Only ready-mixed concrete will be used during the construction phase, with all ready-mixed concrete being delivered from local batching plants in sealed concrete delivery trucks.		
MM31	Concrete Deliveries and Management	EIAR Chapter 9	No washing out of any plant used in concrete transport or concreting operations will be carried out onsite. When concrete is delivered to site, only the chute of the delivery truck will be cleaned, using the smallest volume of water necessary, before leaving the site. Concrete trucks will be directed back to their batching plant for washout.		
MM32	Concrete Deliveries and Management	EIAR Chapter 4, 9	No concrete will be transported around the site in open trailers or dumpers so as to avoid spillage while in transport.		
MM33	Concrete Deliveries and Management	EIAR Chapter 4	Clearly visible signs in prominent locations will be placed close to concrete pour areas specifically stating washout of concrete lorries is not permitted on the site		
MM34	Concrete Deliveries and Management	EIAR Chapter 4	Main pours will be planned days or weeks in advance. Large pours will be avoided when prolonged periods of heavy rain are forecast.		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
MM35	Concrete Deliveries and Management	EIAR Chapter 4	Concrete pumps and machine buckets will be restricted from slewing over watercourses while placing concrete.		
MM36	Concrete Deliveries and Management	EIAR Chapter 4	Excavations will be sufficiently dewatered before concreting begins. Dewatering will continue while concrete sets.		
MM37	Concrete Deliveries and Management	EIAR Chapter 4	Covers will be available for freshly placed concrete to avoid the surface washing away in heavy rain.		
MM38	Concrete Deliveries and Management	EIAR Chapter 4	Surplus concrete after completion of a pour will be returned to the concrete suppliers batching plant for recycling.		
MM39	Road Cleanliness	EIAR Chapter 4. CEMP Section 4	A road sweeper will be available if any section of the public roads were to be dirtied by trucks associated with the proposed development.		
MM40	Road Cleanliness	EIAR Chapter 4 CEMP Section 4	Where it is deemed necessary, wheel washes will be provided near all site entrances to the public road		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
MM41	Construction Traffic	EIAR Chapter 4	Construction traffic will be subject to standard construction health and safety requirements which will ensure traffic speeds are limited to 15 mph/25 kmph.		
MM42	Waste Materials	CEMP Section 4	All waste materials will be removed to an appropriately licenced facility		
MM43	Felling	EIAR Chapter 4,	The tree felling activities required as part of the proposed development will be the subject of a Felling Licence application to the Forest Service, as per the Forest Service's policy on granting felling licenses		
MM44	Staff Facilities	EIAR Chapter 9	› At the site compound a self-contained port-a-loo with an integrated waste holding tank will be used within the works area and at the site compound (substation), maintained by the providing contractor, and removed from site on completion of the construction works; › At the site compound the water supply for the site office (if necessary) and other sanitation will be brought to site and removed after use from the site to be discharged at a suitable off-site treatment location; and, No water will be sourced along the works area/at the site or discharged to same.		
Drainage Design and Maintenance					
MM45	Wastewater Management	EIAR Chapter 4, 9. CEMP Section 4	During the construction phase, a self-contained port-a-loo with an integrated waste holding tank will be used on site for toilet facilities. This will be maintained by the service contractor on a regular basis and will be removed from the site on completion of the construction phase. Water supply for the site office and other sanitation will be brought to site and removed after use from the site to be discharged at a suitable off-site treatment location; and, No water will be sourced on the site or discharged to the site.		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
MM46	Watercourse Buffer	EIAR Chapter 4, 9, CEMP Section 4	It is proposed to limit any works in any areas located within 50m of any water course including the stockpiling of excavated soils and subsoils. A constraint/buffer zone will be maintained for all crossing locations where possible whereby all watercourses will be fenced off		
MM47	Drainage Swales	EIAR Chapter 4, CEMP Section 4	Swales will be used to intercept and collect run off from construction areas of the site during the construction phase, and channel it to settlement ponds for sediment attenuation as per the drainage design.		
MM48	Interceptor Drains	EIAR Chapter 4, CEMP Section 4	Interceptor drains will be installed up-gradient of any works areas to collect surface flow runoff and prevent it reaching excavations and construction areas of the site. It will then be directed to areas where it can be re-distributed over the ground as sheet flow as per the drainage design.		
MM49	Transverse drains	EIAR Chapter 9	On steep sections of access road transverse drains ('grips') will be constructed where appropriate in the surface layer of the road to divert any runoff off the road into swales/road side drains;		
MM50	Silt Fences	EIAR Chapter 4, CEMP Section 4	Silt fences will be emplaced within drains down-gradient of all construction areas. Silt fences are effective at removing heavy settleable solids. This will act to prevent entry to the existing drainage network of sand and gravel-sized sediment, released from excavation of mineral sub-soils of glacial and glacio-fluvial origin and entrained in surface water runoff. Inspection and maintenance of these structures during construction phase is critical to their functioning to stated purpose. They will remain in place throughout the entire construction phase.		
MM51	Check dams	EIAR Chapter 4, CEMP Section 4	Check dams will not be used in any natural watercourses, only artificial drainage channels and interceptor drains. The check dams will be installed at regular intervals along interceptor drains to restrict flow velocity, minimise channel erosion and promote sedimentation behind the dam as per the drainage design.		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
MM52	Level Spreaders,	EIAR Chapter 4, 9. CEMP Section 4	A level spreader will be constructed at the end of each interceptor drain to convert concentrated flows in the drain into diffuse sheet flow on areas of vegetated ground. The levels spreaders will be located downgradient of any proposed works areas in locations where they are not likely to contribute further to water ingress to construction areas of the site.		
MM53	Vegetation filters	EIAR Chapter 4, 9. CEMP Section 4	Vegetation filters, that is areas of existing vegetation, accepting drainage water issuing from level spreaders as sheet flow, will remove any suspended sediment from water channelled via interceptor drains or any remaining sediment in waters channelled via swales and settlement ponds.		
MM54	Settlement ponds	EIAR Chapter 4, 9. CEMP Section 4	Settlement ponds, placed either singly or a pair in series, will buffer volumes of run-off discharging from the drainage system during periods of high rainfall, by retaining water until the storm hydrograph has receded, thus reducing the hydraulic loading to water courses as per the drainage design.		
MM55	Dewatering Silt Bag	EIAR Chapter 4. CEMP Section 4	Dewatering silt bags will be used which allow the flow of water through while trapping any silt or sediment suspended in the water. The silt bags provide a passive non-mechanical method of removing any remaining silt contained in the potentially silt-laden water collected from works areas within the site.		
MM56	Culverts	EIAR Chapter 4	Culverts will be installed at locations where interceptor drains cross the new proposed track route. All works involving culverts, whether they are new, upgraded or extended, will be carried out to follow a method statement to be agreed with Inland Fisheries Ireland.		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
MM57	Culverts	EIAR Chapter 9	Where possible all proposed new stream crossings will be bottomless culverts and the existing banks will remain undisturbed. No in-stream excavation works are proposed and therefore there will be no impact on the stream at the proposed crossing location.		
MM58	Culverts	EIAR Chapter 9	Any guidance / mitigation measures proposed by the OPW or the Inland Fisheries Ireland will be incorporated into the design of the proposed crossings. A 10m buffer is applied to the main drain (*i.e.* drain D1) s to allow for future OPW maintenance;		
MM59	Culverts	EIAR Chapter 9 CEMP Section 4	The following mitigation is proposed for completion of the watercourse crossings: › Protection of the riparian zone watercourses by implementing a constraints zone around stream crossings, in which construction activity will be limited to. › No stock-piling of construction materials will take place within the constraints zone. No refuelling of machinery or overnight parking of machinery is permitted in this area; › The shuttered for the bridge deck to be poured over the precast concrete slabs will be sealed and water tested before concrete pouring can commence. › When pouring concrete during the construction of the clear-span crossing, concrete pumps and machine buckets will be restricted from slewing over watercourses while placing concrete. › No concrete truck chute cleaning is permitted in this area; › Works shall not take place at periods of high rainfall, and shall be scaled back or suspended if heavy rain is forecast;		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			› Plant will travel slowly across bare ground at a maximum of 5km/hr. Bog mats will be employed to protect tracked areas as necessary; › Machinery deliveries shall be arranged using existing structures along the public road; › All machinery operations shall take place away from the stream and ditch banks, apart from where crossings occur. Although no instream works are proposed or will occur; › Any excess construction material shall be immediately removed from the area and taken to a licensed waste facility; › Spill kits shall be available in each item of plant required to complete the stream crossing; and, Silt fencing will be erected on ground sloping towards watercourses at the stream crossings if required		
MM60	Grid Connection	EIAR Chapter 4, 9	Within the wind farm site where the proposed grid connection cable route runs adjacent to a proposed access road or an existing access road proposed for upgrade, the cable will pass over the culvert (where one exists or is proposed) within the access road;		
MM61	Silt Fences,	EIAR Chapter 4, 9. CEMP Section 3	Silt fences will be installed along the routes of existing watercourses or drainage ditches where site roads pass over the watercourses, immediately downstream of the construction area.		
MM62	Sediment disposal	EIAR Chapter 4	Sediment that is removed from settlement ponds, check dams, silt bags etc. as part of routine maintenance will be carefully disposed of away from all aquatic		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
		CEMP Section 4	zones, or will be transported off-site for disposal or re-use elsewhere if deemed necessary.		
MM63	Temporary Stockpiles	EIAR Chapter 4, 9 CEMP Section 4	Material excavated to create the working area will be stored locally for later reuse in backfilling the working area around the turbine foundation. The excavated material will be covered with polythene sheets as required and surrounded by silt fences to ensure sediment-laden run-off does not occur.		
MM64	Temporary Material Storage Areas Drainage Controls	EIAR Chapter 4 CEMP Section 4	Construction and drainage controls around temporary stockpiles will be implemented prior to the development of the stockpile where temporary management of surface water run-off during stockpile filling may require pumping to a local settlement pond for sedimentation and water treatment prior to discharge;		
MM65	Grid Connection Drainage	EIAR Chapter 9	Where construction of the grid cable connection route is undertaken along sections of proposed access road or existing roads requiring upgrade, the proposed wind farm drainage infrastructure (as outlined above) will be in place to manage and control runoff from the trench excavation area. Where the cable trench is to be constructed off-road (within the development site) or along public roads surface water control measures such as silt fences will be employed when work is required within hydrological buffer zones.		
MM66	Timing of Site Construction Works	EIAR Chapter 9	Construction of the site drainage system will only be carried out during periods of low rainfall, and therefore minimum runoff rates. This will minimise the risk of entrainment of suspended sediment in surface water runoff, and transport via this pathway to surface watercourses		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
Felling					
MM67	Felling Licence	EIAR Chapter 4	Felling will be carried out under the terms of a licence application to the Forest Service, as per the Forest Service's policy on granting felling licenses for wind farm developments		
MM68	Clear felling of Coniferous Plantation	EIAR Chapter 9. CEMP Section 4	Best practice Forestry Service Guideline mitigation measures will reduce the risk of entrainment of suspended solids and nutrient release in surface watercourses as follows: › Machine combinations will be chosen which are most suitable for ground conditions at the time of felling, and which will minimise soils disturbance; › Checking and maintenance of roads and culverts will be on-going through any felling operation. No tracking of vehicle through watercourses will occur, as vehicles will use road infrastructure and existing watercourse crossing points. Where possible, existing drains will not be disturbed during felling works; › Ditches which drain from the proposed area to be felled towards existing surface watercourses will be blocked, and temporary silt traps will be constructed. No direct discharge of such ditches to watercourses will occur. Drains and sediment traps will be installed during ground preparation. Collector drains will be excavated at an acute angle to the contour (~0.3%-3% gradient), to minimise flow velocities. Main drains to take the discharge from collector drains will include water drops and rock armour, as required, where there are steep gradients, and should avoid being placed at right angles to the contour;		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			› Sediment traps will be sited in drains downstream of felling areas. Machine access will be maintained to enable the accumulated sediment to be excavated. Sediment will be carefully disposed of in the peat disposal areas. Where possible, all new silt traps will be constructed on even ground and not on sloping ground; › In areas particularly sensitive to erosion, it may be necessary to install double or triple sediment traps. This measure will be reviewed on site during construction; › All drainage channels will taper out before entering the aquatic buffer zone. This ensures that discharged water gently fans out over the buffer zone before entering the aquatic zone, with sediment filtered out from the flow by ground vegetation within the zone. On erodible soils, silt traps will be installed at the end of the drainage channels, to the outside of the buffer zone; › Drains and silt traps will be maintained throughout all felling works, ensuring that they are clear of sediment build-up and are not severely eroded. Correct drain alignment, spacing and depth will ensure that erosion and sediment build-up are minimized and controlled; › Brash mats will be used to support vehicles on soft ground, reducing peat and mineral soils erosion and avoiding the formation of rutted areas, in which surface water ponding can occur. Brash mat renewal should take place when they become heavily used and worn. Provision should be made for brash mats along all off-road routes, to protect the soil from compaction and rutting. Where there is risk of severe erosion occurring, extraction should be suspended during periods of high rainfall;		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			› Timber will be stacked in dry areas, and outside a local 50m watercourse buffer. Check dams to be emplaced on the down gradient side of timber storage/processing sites; › Works will be carried out during periods of no, or low rainfall, in order to minimise entrainment of exposed sediment in surface water run-off; › Checking and maintenance of roads and culverts will be on-going through the felling operation; › Any diesel or fuel oils stored at the temporary site compound will be bunded. The bund capacity will be sufficient to contain 110% of the storage tank's maximum capacity; › Refuelling or maintenance of machinery will not occur within 100m of a watercourse. Mobile bowser, drip kits, qualified personnel will be used where refuelling is required; and, › Branches, logs or debris will not be allowed to build up in aquatic zones. All such material will be removed when harvesting operations have been completed, but care will be taken to avoid removing natural debris deflectors.		
MM69	Clear Felling of Coniferous Plantation	EIAR Chapter 9	Drains and silt traps will be maintained throughout all felling works, ensuring that they are clear of sediment build-up and are not severely eroded. Correct drain alignment, spacing and depth will ensure that erosion and sediment build-up are minimised and controlled		
Peat, Subsoils and Bedrock					
MM70	Waste Material Generation and Management	EIAR Chapter 8	With the exception of peat and overburden which will be spread adjacent to the excavations of the development infrastructure, no waste materials, either from the site or introduced construction materials will be left on site but will be removed to suitable waste facilities.		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
MM71	Erosion of Exposed Subsoils and Peat	EIAR Chapter 8	Peat removed from the turbine no. 5, 14 and 15 location will be locally placed/spread alongside the excavations for the infrastructural elements.		
MM72	Erosion of Exposed Subsoils and Peat	EIAR Chapter 8	In order to minimise runoff during the construction phase, stripping of peat should not take place during excessively dry weather (to prevent dust generation) or extremely wet periods (to prevent increased silt rich runoff).		
MM73	Erosion of Exposed Subsoils and Peat	EIAR Chapter 8	Bog mats and brash mats will be used to support vehicles on soft ground, reducing peat and mineral soils erosion and avoiding the formation of rutted areas, in which surface water ponding can occur. Brash mat renewal should take place when they become heavily used and worn. Provision should be made for brash mats along all off-road routes, to protect the soil from compaction and rutting.		
MM74	Peat, Subsoil Excavation and Bedrock Excavation		› Placement of turbines and associated infrastructure in areas with shallower peat where possible; › Use of piled foundations in areas of deeper peat and soft mineral soils; › Use of floating roads (where geotechnically acceptable to do so) to reduce peat excavation volumes (i.e. along wind farm access tracks and the link road); › The peat and subsoil which will be removed during the construction of turbine hardstands (will be localised to the turbine locations. The peat will be placed/spread locally alongside the excavations (refer to Figure 7-1 of Appendix 4-2); › Small volumes of peat will be excavated and used for landscaping along proposed access/link roads; › No turbines or related infrastructure will be constructed in any designated sites such as NHAs or SACs;		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			› Construction of settlement ponds will be volume neutral, and all excess material will be used locally to form pond bunds and surrounding landscaping; › Placement of internal cable trenching will also be volume neutral, and all excess material will be used locally as landscaping; › Subsoils will be reinstated back into the cable trench along the proposed grid connection route where possible; and, › Peat/mineral soil excavated along the Grid Connection Route, will only be stored in low mounds (~0.5m high) directly adjacent to the excavated trench, and will be stored for no more than 24 hours before being backfilled where possible. The soil/subsoil will be covered in the event of heavy rainfall which would suspend further construction works along the Grid Connection Route.		
MM75	Erosion of Exposed Subsoils and Peat		› Peat removed from the turbine locations and associated access roads will be used for landscaping or placed/spread locally alongside the excavation. A full Peat and Spoil Management Plan for the Proposed Development is shown as Appendix 4-2. › In order to minimise erosion of mineral subsoils, stripping of peat will not take place during extremely wet periods (to prevent increased silt-rich runoff). Temporary drainage systems will be required to limit runoff impacts during the construction phase. › In forestry areas brash mats will be used to support vehicles on soft ground, reducing peat and mineral soils erosion and avoiding the formation of rutted areas, in which surface water ponding can occur. Brash mat renewal will take place when they become heavily used and worn. Provision will be made for brash mats along all off-road routes, to protect the soil from compaction and rutting. › Peat and subsoil removed from the cable trench will be used to reinstate the trench where possible or removed to an appropriately licenced facility. Peat and subsoil removed from the proposed		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			substation groundworks will be removed and either used for Wind Farm Site reinstatement/landscaping works or taken to an appropriately licenced facility.		
MM76	Peat Instability	EIAR Chapter 8	› Appointment of experienced and competent contractors; › The site should be supervised by experienced and qualified personnel; › Allocate sufficient time for the project (be aware that decreasing the construction time has the potential to increase the risk of initiating a peat movement); › Prevent undercutting of slopes and unsupported excavations; › Maintain a managed robust drainage system; › Prevent placement of loads/overburden on marginal ground; › Set up, maintain and report findings from monitoring systems; › Ensure construction method statements are followed or where agreed modified/ developed; and, › Revise and amend the Geotechnical Risk Register as construction progresses		
MM77	Peat Instability	EIAR Chapter 4, 8	Prior to commencing floating road construction movement monitoring posts will be installed in areas where the peat depth is greater than 4m.		
MM78	Peat Instability	CEMP Section 4	A Geotechnical Risk Register will be maintained throughout the construction phase by the Project Engineer which will provide the means to carry out a geotechnical risk assessment and recommend remedial action.		
Biodiversity					
MM79	Removal of Vegetation	EIAR Chapter 4, 6, 7	The removal of woody vegetation will be undertaken in full compliance with Section 40 of the Wildlife Act 1976 – 2018. Any required removal of vegetation will be undertaken following inspection by a suitable qualify ornithologist to ensure no nesting birds are affected.		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
		CEMP Section 10	› In line with best practise, no construction works are permitted 1st of March to the 31st of August inclusive within a 350m radius of lapwing breeding territories. › In line with best practise, no construction works are permitted 1st of March to the 31st of August inclusive within a 500m radius of barn owl breeding site. › No works shall be permitted within the buffer for the given timeframe, until it can be demonstrated that the roost/nest is no longer occupied.		
MM80	Bats	EIAR Chapter 6	› Pre-construction roost surveys will be required to identify and protect any bats potentially occupying roosts in vegetation earmarked for removal. For any trees found to be occupied by roosting bats prior to construction, an exclusion zone will be implemented to prevent disturbance during times of occupancy. Table 20 of the Bat Survey and Impact Assessment Report provided in Appendix 6-2 provides optimal time periods for works at different roost types, and therefore by extension restrictive periods for construction works, during which the exclusion zone for construction work would be applicable. The extent of the exclusion zone can be up to 30m for any notably disruptive works such as pile-driving; however, the mitigation measure should be proportional to the disturbance levels emanating from the construction activity. Pre-construction surveys will inform the application to undertake		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			appropriate mitigation actions as required to ensure the conservation of bats, if found to be utilising roosts within the construction corridor. › The loss of approximately 960m of treeline and 220m of hedgerow will be replaced as part of the Proposed Development. This will take place along the access road to T15. › Treeline lost along the proposed link road will be replaced 'like for like'. › Where treeline is lost in the woodland habitat between T5 and T9 the remaining woodland will be retained. The buffer created around T5 will be maintained throughout the operation of the wind farm in order to maintain a homogenous habitat around the turbine throughout its lifespan.		
MM81	Habitat Fragmentation	EIAR Chapter 6	The welfare of Otters will be ensured primarily through the provision of continued safe access for Otters along the river corridor. Adequate provision for Otters at the River crossing is required to allow the species to retain continued access to their foraging areas. The watercourses will be crossed by a clear span structure and part of the riverbank will be retained to provide dry passage for Otter under the structure.		
MM82	Habitat Fragmentation	EIAR Chapter 6	The Proposed Development has been deliberately designed to minimise loss of bog woodland. Vegetation removal will be conducted in line with the provisions of the Wildlife Act. Tree line that is lost as part of the Proposed Development will be replaced along the proposed access road to T15.		
MM83	Invasive Species	EIAR Chapter 6 CEMP Section 4	› The outline Invasive Species Management Plan will be further developed A following a preconstruction invasive survey. This report will describe the best practice measures to be adhered to during the laying of the cable route in proximity to identified stands of invasive species. Good construction site hygiene will be employed to prevent the introduction and spread of invasive alien plant species (e.g. Himalayan Balsam, Japanese Knotweed etc.) by thoroughly washing vehicles prior to leaving any site.		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			› All plant and equipment employed on the construction site (e.g. excavator, footwear, etc.) will be thoroughly cleaned down using a power washer unit prior to arrival on site to prevent the spread of invasive plant species › All washing must be undertaken in areas with no potential to result in the spread of invasive species. This process will be detailed in the contractor's method statement. › Any soil and topsoil required on the site will be sourced from a stock that has been screened for the presence of any invasive species and where it is confirmed that none are present. › All planting and landscaping associated with the proposed development shall avoid the use on invasive shrubs such as Rhododendron.		
MM84	Invasive Species	EIAR Chapter 4, 6	› All earthworks machinery will be thoroughly pressure-washed prior to arrival on site and prior to their further use elsewhere. › Care will be taken not to disturb or cause the movement of invasive species fragments, either intentionally or accidentally. › Stands of Knotweed will be clearly demarcated by temporary fencing and tracking within them will be strictly avoided. A minimum buffer of seven metres will be applied to avoid disturbance of lateral Knotweed rhizomes. › Where works occur within 7m of a Knotweed stand these will be carried out under the supervision of a suitably qualified ecologist. › Where a Knotweed stand is encountered along the road the grid connection will be laid on the opposite side of the road to avoid excavation of potential Knotweed root material insofar as possible.		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			› Should removal of Knotweed off site be required this will be done so under the supervision of an ecologist in line with NPWS licensing. › The machinery must be thoroughly cleaned down under supervision of an ecologist prior to moving away from the Knotweed contaminated area. › All contractors and staff will be briefed about the presence, identification and significance of Knotweed before commencement of works. › Good construction site hygiene will be employed to prevent the spread of these species with vehicles thoroughly cleaned down prior to leaving any site with the potential to have supported invasive species. All plant and equipment employed on the construction site (e.g., excavator, footwear, etc.) will be thoroughly cleaned down on site to prevent the spread of invasive plant species such as Knotweed and Rhododendron. All clean down must be undertaken in areas with no potential to result in the spread of invasive species. › When working at locations in proximity to natural watercourses, a suitable barrier will be erected between the watercourse and the stand of invasive species. This will assist in preventing the spread of any invasive species into the watercourse during their removal. › Any soils or subsoils contaminated with invasive species will sent to an appropriate licenced facility.		
MM85	Aquatic Species	EIAR Chapter 6	› No watercourse will be interfered with as part of the proposed works. › During periods of heavy precipitation and run-off, works will be halted or working surfaces/pads will be provided to minimise soil disturbance.		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			› Any requirement for temporary fills or stockpiles will be covered with polyethylene sheeting to avoid sediment release associated with heavy rainfall. › Silt fences will be used to prevent siltation of watercourses in or surrounding the study area.		
Noise and Vibration					
MM86	Construction Phase Noise, Noise from Construction Activities	EIAR Chapter 4, 11	Equipment will be sensitively located, taking account of local topography and natural screening. It is proposed that various practices be adopted during construction, including: › managing the hours according to the CEMP [Appendix 4-8 during which site activities likely to create high levels of noise or vibration are permitted; › establishing channels of communication between the contractor/developer, Local Authority and residents; › appointing a site representative responsible for matters relating to noise and vibration; › monitoring typical levels of noise and vibration during critical periods and at sensitive locations; › keeping site access roads even to mitigate the potential for vibration from lorries. › selection of plant with low inherent potential for generation of noise and/ or vibration; › placing of noisy / vibratory plant as far away from sensitive properties as permitted by site constraints, and; › regular maintenance and servicing of plant items.		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
MM87	Construction Phase Noise,	EIAR Chapter 4, 11	The following list of measures will be implemented on site, to ensure compliance with the relevant construction noise criteria: › No plant used on site will be permitted to cause an on-going public nuisance due to noise. › The best means practicable, including proper maintenance of plant, will be employed to minimise the noise produced by on site operations. › All vehicles and mechanical plant will be fitted with effective exhaust silencers if required and maintained in good working order for the duration of the contract. › Compressors will be attenuated models fitted with properly lined and sealed acoustic covers which will be kept closed whenever the machines are in use and all ancillary pneumatic tools shall be fitted with suitable silencers. › Machinery that is used intermittently will be shut down or throttled back to a minimum during periods when not in use. › Any plant, such as generators or pumps, which is required to operate close to NSLs outside of general construction hours will be surrounded by an acoustic enclosure or portable screen.		
MM88	Construction Phase Noise,	EIAR Chapter 4, 11	All construction work will be restricted to the specified working hours between 7:00hrs and 19:00hrs Monday to Saturday. Any construction work carried out outside of these hours shall be restricted to activities that will not generate noise of a level that may cause a nuisance.		
MM89	Construction Phase Noise,	EIAR Chapter 4, 11	Plant will be selected taking account of the characteristics of noise emissions from each item. All plant and machinery used on the site shall comply with E.U. and Irish legislation in relation to noise emissions. The timing of on- and off-site movements of plant near occupied properties will be controlled.		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
	Noise from Construction Activities				
MM90	Construction Phase Noise Control,	EIAR Chapter 4, 11. CEMP Section 4	Training and supervision of drivers to ensure smooth machinery operation/driving, and to minimise unnecessary noise generation.		
MM91	Construction Phase Noise, Noise from Construction Activities	EIAR Chapter 4, 11	All construction operations shall comply with guidelines set out in British Standard documents *'BS 5338: Code of Practice for Noise Control on Construction and Demolition Sites'* and *'BS5228: Part 1: 1997: Noise & Vibration Control on Construction and Open Sites'*.		
MM92	Noise	EIAR Chapter 4, 11	Training and supervision of drivers to ensure smooth machinery operation/driving, and to minimise unnecessary noise generation.		
MM93	Noise	EIAR Chapter 4, 11	Where rock breaking is employed in relation to the proposed borrow pit, the following are examples of measures that will be considered, where necessary, to mitigate noise emissions from these activities: › Fit suitably designed muffler or sound reduction equipment to the rock breaking tool to reduce noise without impairing machine efficiency. › Ensure all leaks in air lines are sealed.		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			› Use a dampened bit to eliminated ringing. › Erect acoustic screen between compressor or generator and noise sensitive area. When possible, line of sight between top of machine and reception point needs to be obscured. › Enclose breaker or rock drill in portable or fixed acoustic enclosure with suitable ventilation.		
Air Quality/Dust					
MM94	Construction Phase Dust Control	EIAR Chapter 4. CEMP Section 4	Truck wheels will be washed to remove mud and dirt before leaving the site.		
MM95	Construction Phase Dust Control	EIAR Chapter 4. CEMP Section 4	Construction traffic will be restricted to defined routes and a speed limit of 15 kph will be implemented.		
MM96	Construction Phase Dust Control	EIAR Chapter 4. CEMP Section 4	Water misting or bowsers will operate on-site as required to mitigate dust in dry weather conditions;		
MM97	Construction Phase Air Quality	EIAR Chapter 10	All construction machinery will be maintained in good operational order while on-site, minimising any emissions that are likely to arise.		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
MM98	Dust	EIAR Chapter 10 CEMP Section 4	The roads adjacent the site will be regularly inspected for cleanliness, and cleaned as necessary; Sporadic wetting of loose stone surface will be carried out during the construction phase to minimise movement of dust particles to the air.		
MM99	Dust	EIAR Chapter 10	The transport of soils or other material, which has significant potential to cause dust, will be undertaken in tarpaulin-covered vehicles where necessary;		
MM100	Greenhouse Gases	EIAR Chapter 10	› All construction vehicles and plant will be maintained in good operational order while onsite, thereby minimising any emissions that arise. › Turbines and construction materials will be transported to the site on specified routes only unless otherwise agreed with the Planning Authority. › Aggregate materials for the construction of the proposed wind farm will be obtained from the proposed borrow pit. This will significantly reduce the number of delivery vehicles accessing the site from significant distances, thereby reducing the amount of emissions associated with vehicle movements.		
MM101	Waste Management	EIAR Chapter 10	The Material Recovery Facility will be local to the Proposed Development site to reduce the amount of emissions associated with waste management vehicle movements. The nearest licensed waste facility to the site is located approximately 22 km south of the Proposed Development.		
Cultural Heritage					
MM102	National Monuments or	EIAR Chapter 13	A buffer zone of 20m should be established around the unnamed bridge to the north-west of the proposed access road to T15 and maintained for the duration of the construction stage of the project.		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
	recorded monuments				
Landscape and Visual					
MM103	Construction Phase: Visual Impact	EIAR Chapter 12	One main construction compound will be used for the storage of all construction materials.		
MM104	Borrow Pit	EIAR Chapter 12	Following the completion of the construction phase, the borrow pit will be reinstated. the borrow pit will be levelled, covered over with overburden and allowed to re-vegetate naturally. Overburden will also be deposited along the edge of the borrow pit, which will be allowed to re-vegetate and this will reduce visibility of the pit. Safety fencing and signage will be constructed. Following this, the gravel road will be allowed to re-vegetate		
MM105	Borrow Pit	EIAR Chapter 12	Maintain natural screening around the perimeter of proposed borrow pit.		
Material Assets and Traffic					
MM106	Management of Large Deliveries	EIAR Chapter 14	All deliveries comprising abnormally large loads will be made outside the normal peak traffic periods to avoid disruption to work and school related traffic.		
MM107	Construction Phase Traffic and Transport - Mitigation	EIAR Chapter 14. CEMP Section 4	A detailed Traffic Management Plan will be prepared by the appointed contractor and will include details of: › The appointed Traffic Management Co-ordinator › Turbine delivery programme, schedule and times › Procedure for providing information to locals to keep them informed of any upcoming traffic related matters e.g., temporary lane/road closures › Agreements with local authority and An Garda Siochana on delivery phases etc.		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			› Temporary alterations of road junctions › Delivery routes for construction materials › Travel plan for construction workers › Temporary traffic signs › Diversions and road closures Trench and road surface reinstatement		
MM108	Construction Phase Traffic and Transport - Mitigation	EIAR Chapter 14. CEMP Section 4	All traffic management at the required locations will comply the *"Traffic Signs Manual, Section 8 – Temporary Traffic Measures and Signs for Road Works"* (DoT now DoTT&S) and "Guidance for the Control and Management of Traffic at Roadworks" (DoTT&S). A member of construction staff (flagman) will be present at key junctions during peak delivery times.		
MM109	Construction Phase Traffic and Transport - Mitigation	EIAR Chapter 14. CEMP Section 4	The contractor will consult with the roads section of the local authority that the delivery routes traverses and An Garda Siochana during the delivery phase of the large turbine vehicles, when an escort for all convoys will be required		
MM110	Construction Phase Traffic and Transport - Mitigation	EIAR Chapter 14 CEMP Section 4	Phased development will be employed to allow for construction traffic to be managed and to minimise the volume of construction traffic using the road network at any one time.		
MM111	Construction Phase Traffic and Transport - Mitigation	EIAR Chapter 14.	The contractor will be required to provide a travel plan for construction staff, which will include the identification of routes to / from the site and an area for non-work vehicle parking.		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
		CEMP Section 4			
Operational Phase					
MM112	Wastewater Management	EIAR Chapter 4	The removal and disposal of wastewater from the site will be carried out by a fully permitted waste collector holding valid Waste Collection Permits as issued under the Waste Management (Collection Permit) Regulations, 2007.		
MM113	Site Drainage	CEMP Section 4	The project hydrologist will inspect and review the drainage system after construction has been completed to provide guidance on the requirements of an operational phase drainage system. This operational phase drainage system will have been installed during the construction phase in conjunction with the road and hardstanding construction work as described below: › Runoff from individual turbine hardstanding areas will not be discharged into the existing drain network, but discharged locally at each turbine location through settlement ponds and buffered outfalls onto vegetated surfaces; › Interceptor drains will be installed up-gradient of all proposed infrastructure to collect clean surface runoff, in order to minimise the amount of runoff reaching areas where suspended sediment could become entrained. It will then be directed to areas where it can be re-distributed over the ground by means of a level spreader; › Swales/road side drains will be used to collect runoff from access roads and turbine hardstanding areas of the site, likely to have entrained suspended sediment, and channel it to settlement ponds for sediment settling;		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			› On steep sections of access road transverse drains ('grips') will be constructed where appropriate in the surface layer of the road to divert any runoff off the road into swales/road side drains; › Check dams will be used along sections of access road drains to intercept silts at source. Check dams will be constructed from a 4/40mm non-friable crushed rock; › Settlement ponds, emplaced downstream of road swale sections and at turbine locations, will buffer volumes of runoff discharging from the drainage system during periods of high rainfall, by retaining water until the storm hydrograph has receded, thus reducing the hydraulic loading to watercourses; and, › Settlement ponds will be designed in consideration of the greenfield runoff rate.		
MM114	Site Drainage	EIAR Chapter 9	The proposed onsite substation will be located on the south west of the Wind Farm Site. It is proposed to drain the onsite substation using shallow swales, with a stilling pond at the end of the swale run. The stilling pond will remain in place following the construction period		
MM115	Site Drainage	EIAR Chapter 9	A rainwater harvesting system will be used for toilet flushing at the Substation Control Building in the Wind Farm Site. There will be a very small net loss of water to local streams but this will be imperceptible over the course of a year		
MM116	Site Drainage	EIAR Chapter 9	It is proposed to install a sealed underground holding tank for effluent (wastewater) from the onsite substation building. The tank shall be routinely emptied by a licensed contractor. A level sensor will be installed in the tank which shall be linked to the on-site SCADA system. Should the level of the tank rise to a predetermined 'high 'level a warning shall appear on the overall SCADA system for the Wind Farm Site and automatic notification shall be sent to the facility manager. A formal service agreement will be entered into with a suitably permitted waste contractor, in relation to the servicing and de-sludging of the wastewater holding tank on site. There will be no discharge of wastewater to ground at the Wind Farm Site, and therefore there is no potential to impact groundwater or surface water quality.		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
MM117	Borrow Pit Drainage	CEMP Section 4	Appropriate operational phase drainage will be implemented to attenuate drainage water.		
MM118	Bats	EIAR Chapter 6	In order to reduce the value of the habitat for bat species in the areas surrounding the turbines, a buffer of at least 50m between the tip of the blade and any trees or other tall vegetation that could provide high quality foraging habitat for bat species will be implemented. Full details of this mitigation and how it is calculated is provided in Appendix 6-2 and summarised below: › A three-year monitoring programme is recommended for bats, with monitoring in years 1, 2, and 3 post-construction, and will include several elements, including bat activity surveys and collision monitoring, which incorporates turbine searches and scavenger removal trails.		
MM119	Noise	EIAR Chapter 11	An assessment of the operational noise levels has been undertaken in accordance with best practice guidelines and procedures as outlined in Section 11.3.2.2 in Chapter 11. The findings of the assessment identified that there are two NSLs where potential exceedances are predicted. If confirmed during post-construction monitoring, a curtailment strategy will be implemented to reduce noise levels due to the wind farm to within the criteria at all NSLs.		
MM120	Shadow Flicker	EIAR Chapter 5	Where shadow flicker occurrences are experienced at buildings, a site visit will be undertaken firstly to determine the level of occurrence, existing screening and window orientation. If annoyance is found, suitable mitigation measures such as screening and/or wind turbine control measures including turbine shutdown will be employed to limit the shadow flicker to zero at the affected property.		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
MM121	Fuel Control	EIAR Chapter 8, 9	Mitigation measures to avoid contamination by accidental fuel leakage and compaction of soil by on-site plant will be implemented as per the construction phase mitigation measures		
MM122	Air Quality	EIAR Chapter 4	Any vehicles or plant brought onsite during the operational phase will be maintained in good operational order that comply with the Road Traffic Acts 1961 as amended, thereby minimising any emissions that arise.		
MM123	Telecoms and other service interference	EIAR Chapter 4	In the event of interference to the transmission or reception of RTÉ Transmission Network (operating as 2rn) or radio waves as a result of the operation of the proposed wind farm, the appropriate measures as set out in the 2rn Protocol Document will be carried out in order to rectify this. This Protocol Document has been prepared by 2rn and signed by the wind farm developers.		
MM124	Telecommunications	EIAR Chapter 14.	Ai Bridges approached Ripplecom with the following mitigation measures for the telecoms link that would potentially be impacted by turbine T15: › A new lattice structure be erected at the Ripplecom end of the link and the link dish at the customer end of the Ripplecom link would be relocated to the corner of the customer building. This would provide a clearance between T15 and the Ripplecom link. › Alternatively, should fibre broadband be installed in the area and be utilised by Ripplecom prior to the commissioning of the Proposed Development, the above mitigation measures would not be required and there would be no interference as the link through the development would no longer be required . These mitigation measures have been accepted by Ripplecom and are further detailed in Appendix 14-3 attached.		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
MM125	Aviation	EIAR Chapter 14	Coole Wind Farm Ltd. will agree an acceptable aviation obstacle warning lighting scheme with the Department of Defence and the Irish Aviation Authority (IAA) ahead of turbine construction and will supply the coordinates and elevations for built turbines to the IAA, as is standard for wind farm developments.		
MM126	Construction Phase: Visual Impact	EIAR Chapter 12	The construction compound will be fully re-instated at the end of the construction phase.		
MM127	Health and Safety	EIAR Chapter 5	Access to the turbines is through a door at the base of the structure, which will be locked at all times outside maintenance visits. Signs will also be erected at suitable locations across the site as required for the ease and safety of operation of the wind farm. These signs include: › Buried cable route markers at 50m (maximum) intervals and change of cable route direction; › Directions to relevant turbines at junctions; › "No access to Unauthorised Personnel" at appropriate locations; › Speed limits signs at site entrance and junctions; › "Warning these Premises are alarmed" at appropriate locations; › "Danger HV" at appropriate locations; › "Warning – Keep clear of structures during electrical storms, high winds or ice conditions" at site entrance; › "No unauthorised vehicles beyond this point" at specific site entrances; and › Other operational signage required as per site-specific hazards.		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			An operational phase Health and Safety Plan will be developed to fully address identified Health and Safety issues associated with the operation of the site and providing for access for emergency services at all times.		
MM128	Borrow Pit	EIAR Chapter 13	The operational phase of the proposed borrow pit will not impact on the immediate setting of any National Monuments, Recorded Monuments, Protected Structures or NIAH structures/gardens. Maintain natural screening around the perimeter of proposed borrow pit.		
MM129	Substation	EIAR Chapter 13	The substation site may have a slight negative impact on the surrounding archaeological and cultural heritage landscape as it will result in a change to their wider setting. Existing screening will be maintained to alleviate any potential impacts on setting.		
Decommissioning Phase					
MM130	Drainage on Decommissioning	EIAR Chapter 9	Following decommissioning of the wind farm at the end of its life restoration of the hydrological regime will take place by the blocking of all the drains associated with the wind farm development. Some additional drains may also be blocked in order to restore natural drainage conditions of adjacent bog and peat habitat.		
MM131	Decommissioning	EIAR Chapter 4 DP Section 3	The following mitigation measures are proposed to avoid release of hydrocarbons at the site: › Road-going vehicles will be refuelled off site wherever possible; › On-site refuelling will be carried out at designated refuelling areas at various locations throughout the site. Machinery will be refuelled directly by a fuel truck that will come to site as required › Only designated trained and competent operatives will be authorised to refuel plant on site. › Fuel volumes stored on site should be minimised. Any fuel storage areas will be bunded appropriately;		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			› The plant used will be regularly inspected for leaks and fitness for purpose; and, › An emergency plan for the decommissioning phase to deal with accidental spillages will be developed (refer to Section 4) Spill kits will be available to deal with and accidental spillage in and outside the refuelling area. A programme for the regular inspection of plant and equipment for leaks and fitness for purpose will be developed at the outset of the decommissioning phase.		
MM132	Decommissioning	EIAR Section 7	A Decommissioning Plan has been prepared (see Appendix 4-11 of the EIAR) The following measures are proposed for the decommissioning phase: › During the decommissioning phase, disturbance limitation measures will be as per the construction phase (see Chapter 7 of the EIAR). › Plant machinery will be turned off when not in use. › All plant and equipment for use will comply with the Construction Plant and the European Communities (Noise Emission by Equipment for Use Outdoors) Regulations 2001 (S.I. No. 632 of 2001). A project ecologist will be appointed to oversee the decommissioning phase, with similar duties to those outlined above during the construction phase.		
MM133	Decommissioning	EIAR Chapter 4 DP Section 2	On removal of turbines, soil will be spread and graded over the foundation using a tracked excavator and revegetation enhanced by spreading of an appropriate seed mix to assist in revegetation and accelerate the resumption of the natural drainage management that will have existed prior to any construction		
MM134	Site rehabilitation during decommissioning	EIAR Chapter 8	In order to reverse or at least reduce some of the potential impacts caused during construction by rehabilitating construction areas such as turbine bases, hardstanding areas and site compound, covering with peatland vegetation/scraw or		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			poorly humified peat to encourage vegetation growth and reduce run-off and sedimentation is proposed.		
MM135	Noise	EIAR Chapter 8	The mitigation measures that will be considered in relation to any decommissioning of the site are the same as those proposed for the construction including: › managing the hours according to the CEMP [Appendix 4-8 during which site activities likely to create high levels of noise or vibration are permitted; › establishing channels of communication between the contractor/developer, Local Authority and residents; › appointing a site representative responsible for matters relating to noise and vibration; › monitoring typical levels of noise and vibration during critical periods and at sensitive locations; › keeping site access roads even to mitigate the potential for vibration from lorries. Furthermore, a variety of practicable noise control measures will be employed. These include: › selection of plant with low inherent potential for generation of noise and/ or vibration; › placing of noisy / vibratory plant as far away from sensitive properties as permitted by site constraints, and; › regular maintenance and servicing of plant items.		
MM136	Traffic	EIAR Chapter 14	In the event that the Proposed Development is decommissioned after the 30 years of operation, a decommissioning plan, including material recycling / disposal and traffic management plan will be prepared for agreement with the local authority.		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
MM137	Ornithology	EIAR Chapter 7	› During the decommissioning phase, disturbance limitation measures will be as per the construction phase. › Plant machinery will be turned off when not in use. › All plant and equipment for use will comply with industry best practise Construction Plant and Equipment Permissible Noise Levels Regulations.		

9. MONITORING PROPOSALS

All monitoring measures relating to the pre-commencement, construction and operational phases of the proposed development were set out in the relevant chapters of the EIAR submitted as part of the planning permission application.

This section of the CEMP groups together the monitoring measures presented in the EIAR. It is intended that the CEMP would be updated where required prior to the commencement of the development, to include all monitoring measures, conditions and or alterations to the EIAR and application documents should they emerge during the course of the planning process, and would be submitted to the Planning Authority for written approval.

All mitigation measures which will be implemented during the pre-commencement, construction and operational phases of the project are outlined in Table 9-1. The monitoring proposals are presented in terms of the monitoring requirement, frequency of monitoring and the mechanism for reporting results where applicable.

By presenting the monitoring proposals in the below format, it is intended to provide a monitoring schedule that can be reviewed and tracked during all phases of the project.to ensure all the required monitoring is completed as required.

Table 9-1 Schedule of Monitoring Measures

Ref. No.	Reference Heading	Reference Location	Monitoring Measure
Pre-Commencement Phase			
MX1	Water Quality and Monitoring	EIAR Chapter 9	An inspection and maintenance plan for the on-site drainage system will be prepared in advance of commencement of any works.
MX2	Water Quality and Monitoring	CEMP Section 5	Turbidity monitors or sondes can be installed where required at locations surrounding the wind farm and will provide continuous readings for turbidity levels in the watercourse.
MX3	Water Quality and Monitoring	CEMP Section 5	Baseline sampling will be completed on at least two occasions and these should coincide with low flow and high flow stream conditions.
MX4	Water Quality and Monitoring	EIAR Chapter 9	Sampling will be completed before, during and after the felling activity. The 'before' sampling should be conducted within 4 weeks of the felling activity, preferably in medium to high water flow conditions.
MX5	Invasive Species	CEMP Section 4	A pre-commencement invasive species survey shall be completed for the site
MX6	Mammal Survey	EIAR Chapter 6	A pre-construction mammal survey will be undertaken to identify any Otter holts or Badger setts within the works areas associated with the proposed development. The survey will be undertaken to ensure that Otter or Badger have not taken up residence within or close to the development footprint
MX7	Ornithology	EIAR Chapter 7	Pre-commencement surveys will be undertaken prior to the initiation of works at the wind farm. The survey will include a thorough walkover survey to a 500m radius of the development footprint and/or all works areas, where access allows
MX8	Archaeological Testing	EIAR Chapter 13	Pre-construction archaeological testing of turbine bases and hardstands proposed for excavation will be carried out. A report will be submitted to the relevant authorities for consideration
Construction Phase			

Ref. No.	Reference Heading	Reference Location	Monitoring Measure
MX9	Water Quality and Monitoring	EIAR Chapter 9	During the construction phase field testing and laboratory analysis of a range of parameters with relevant regulatory limits and EQSs should be undertaken for each primary watercourse, and specifically following heavy rainfall events (*i.e.* weekly, monthly and event based).
MX10	Water Quality and Monitoring	EIAR Chapter 9	An inspection and maintenance plan for the on-site drainage system will be prepared in advance of commencement of any works. Regular inspections of all installed drainage systems will be undertaken, especially after heavy rainfall, to check for blockages, and ensure there is no build-up of standing water in parts of the systems where it is not intended. Inspections will also be undertaken after tree felling
MX11	Daily Monitoring	EIAR Chapter 9 CEMP Section 5	Daily monitoring of excavations by a suitably qualified person will occur during the construction phase. If high levels of seepage inflow occur, excavation work should immediately be stopped and a geotechnical assessment undertaken
MX12	Water Quality and Monitoring	CEMP Section 5	The following periodic inspection regime is likely to be proposed: › Daily general visual inspections by Environmental Manager; › Weekly (existing & new drains) inspections by the Environmental Manager and/or the site Construction Manager; › Inspection to include all elements of drainage systems and all monitoring. Inspections required to ensure that drainage systems are operating correctly and to identify any maintenance that is required. Any changes, such as discolouration, odour, oily sheen or litter should be noted and corrective action should be implemented. High risk locations such as settlement ponds will be inspected daily. Daily inspections checks will be completed on plant and equipment, and whether materials such as silt fencing or oil absorbent materials need replacement; › Event based inspections by the Environmental Manager as follows: › >10 mm/hr (*i.e.* high intensity localised rainfall event); › >25 mm in a 24-hour period (heavy frontal rainfall lasting most of the day); or, › Rainfall depth greater than monthly average in 7 days (prolonged heavy rainfall over a week).

Ref. No.	Reference Heading	Reference Location	Monitoring Measure
			› Monthly site inspections by the Project Hydrologist during construction phase; and, › Quarterly site inspections by the Project Hydrologist after construction for a period of one year following the construction phase. A written record will be maintained or available on-site of all construction phase monitoring undertaken.
MX13	Check Dams	EIAR Chapter 4 CEMP Section 4	Check dams will be inspected and maintained regularly to insure adequate performance. Maintenance checks will also ensure the centre elevation of the dam remains lower than the sides of the dam.
MX14	Settlement Ponds	EIAR Chapter 4 CEMP Section 5	Settlement ponds will be inspected weekly and following rainfall events. Inlet and outlets will be checked for sediment accumulation and anything else that might interfere with flows. Inspection and maintenance of these of these structures during construction phase is critical to their functioning to stated purpose.
MX15	Culverts	EIAR Chapter 4 CEMP Section 4	All culverts will be inspected regularly to ensure they are not blocked by debris, vegetation or any other material that may impede conveyance.
MX16	Drainage Management	EIAR Chapter 4 CEMP Section 4	The effectiveness of drainage measures designed to minimise runoff entering works areas and capture and treat silt-laden water from the works areas, will be monitored continuously by the environmental manager or supervising hydrologist on-site. The environmental manager or supervising hydrologist will respond to changing weather, ground or drainage conditions on the ground as the project proceeds, to ensure the effectiveness of the drainage design is maintained in so far as is possible. This may require the installation of additional check dams, interceptor drains or swales as deemed necessary on-site.

Ref. No.	Reference Heading	Reference Location	Monitoring Measure
MX17	Plant and Equipment Inspections	EIAR Chapter 7 CEMP Section 4	The plant used should be regularly inspected for fuel leaks, unnecessary noise generation and general fitness for purpose.
MX18	Drainage Inspection	EIAR Chapter 9 CEMP Section 5	Regular inspections of all installed drainage systems will be undertaken, especially after heavy rainfall, to check for blockages, and ensure there is no build-up of standing water in parts of the systems where it is not intended. Inspections will also be undertaken after tree felling.
MX19	Water Quality Monitoring	EIAR Chapter 9 CEMP Section 5	During the construction phase field testing and laboratory analysis of a range of parameters with relevant regulatory limits and EQSs should be undertaken for each watercourse (*i.e. at sample points SW1, SW2 & SW3 used in this assessment*) and specifically following heavy rainfall events (*i.e.* weekly, monthly and event based). This will be completed in consultation with the Inland Fisheries Board.
MX20	Wheel wash effectiveness	CEMP Section 4	The effectiveness of the wheel wash will be monitored as part of road cleanliness inspections. The water will be replaced in the wheel wash enclosure as required.
MX21	Archaeological Monitoring	EIAR Chapter 13	Archaeological monitoring of ground works and metal detection of spoil will be carried out during the construction phase. The archaeological monitoring will be undertaken with the benefit of a licence from the Department of Arts, Heritage and Gaeltacht (DAHG). If archaeological features or finds re encountered during site works the archaeologist will report the findings to the relevant authorities to discuss a suitable means of preservation of the features (preservation by record or *in situ* may be required). A report on the monitoring will be submitted to the Local Authority and DAHG

Ref. No.	Reference Heading	Reference Location	Monitoring Measure
			Archaeological monitoring of ground works during construction will also be carried out at the following locations with a report on the results of the monitoring compiled and submitted to the relevant authorities on completion of the project: › If the works extend immediately adjacent to ringfort WM012-088 › Where the works extend past the ecclesiastical site at Abbeyland › Where the works extend past the church and graveyard WM006-061 and WM006-061001. Where the works extend past the NIAH/Protected Structures at Farranistick.
MX22	Archaeological Monitoring	EIAR Chapter 13	The remains of a 19th-20th century stone building are extant adjacent to the eastern end of the proposed link road. The building is not a Protected Structure or listed in the NIAH. It is proposed to carry out: › Pre-construction archaeological building survey of remains accompanied by measured drawings. › Archaeological monitoring of ground works in this area and removal of stone structure if necessary. A report on the monitoring should be compiled on completion of the work and submitted to the relevant authorities. Archaeological monitoring of ground works for proposed junction accommodation works. A report on the monitoring should be compiled and the results submitted to the relevant authorities.
MX23	Archaeological Monitoring	EIAR Chapter 13	Archaeological monitoring of ground works during construction where they extend past the church and graveyard at Mayne. A report on the results of the monitoring shall be compiled and submitted to the relevant authorities on completion of the project.
MX24	Archaeological Monitoring	EIAR Chapter 13	Archaeological monitoring of ground works during construction where they extend past the church and graveyard WM006-061 and WM006-061-001. A report on the results of the monitoring shall be compiled and submitted to the relevant authorities on completion of the project.

Ref. No.	Reference Heading	Reference Location	Monitoring Measure
MX25	Archaeological Monitoring	EIAR Chapter 13	Archaeological monitoring of ground works where the grid connection route extends past the Water mill (WM006-076) and Ecclesiastical site (WM006-059). A report on the results of the monitoring shall be compiled and submitted to the relevant authorities on completion of the project
MX26	Archaeological Monitoring	EIAR Chapter 13	Archaeological monitoring of ground works where the grid connection route extends past the recorded monuments WM012-088 - 090 (ringforts) will be required during construction. A report on the results of the monitoring shall be compiled and submitted to the relevant authorities on completion of the project.
MX27	Archaeological Monitoring	EIAR Chapter 13	Archaeological monitoring of ground works during construction where they extend past the NIAH/Protected Structures at Farranistick. A report on the results of the monitoring shall be compiled and submitted to the relevant authorities on completion of the project.
MX28	Archaeological Monitoring	EIAR Chapter 13	A bridge is denoted on the proposed route on the 2nd ed. OS map at Shrubbywood/Clonva townlands where the public road crosses the River Inny. Archaeological monitoring of ground works during construction where it extends past the bridge. A report on the results of the monitoring shall be compiled and submitted to the relevant authorities on completion of the project.
MX29	Dust Monitoring	EIAR Chapter 10	Dust monitoring will also take place during the construction phase, with dust jars been placed at the same monitoring locations and left in situ for 30 days at a time. It is proposed to carry out this monitoring on a quarterly basis. The dust monitoring locations around the Proposed Development site boundary will be selected with regard to the location of these nearest sensitive receptors
Operational Phase			
MX30	Vantage Point Surveys	EIAR Chapter 7 – Appendix 7-6	Vantage point surveys will be undertaken monthly between January and December during operational years 1, 2, 3, 5, 10 and 15 of the life-time of the wind farm. The methodology for vantage point watches will follow guidelines issued by the SNH (2009) and SNH (2017). The proposed vantage point watches will adhere to a minimum of 36 hours/VP per season as per guidelines issued by SNH. Monthly visits will be undertaken throughout the year.

Ref. No.	Reference Heading	Reference Location	Monitoring Measure
			During each visit, six-hour vantage point watches will be undertaken from each fixed vantage point location that offers an un-interrupted view of the study area .
MX31	Breeding Bird Walkover Surveys	EIAR Chapter 7 – Appendix 7-6	Survey methodology will be similar to methods employed for baseline EIAR surveys which will allow a comparison of data to be made for each monitoring year in years 1, 2, 3, 5, 10 and 15 of the life-time of the wind farm.
MX32	Collision Searches (Bird Casualties)	EIAR Chapter 7 – Appendix 7-6	It is proposed to undertake a minimum of one visit per month during each survey year in years 1, 2, 3, 5, 10 and 15 of the life-time of the wind farm. During each visit, searches will be undertaken at each operating turbine location by a team of two surveyors. A plot measuring 130m x 130m from the centre of each turbine location will be the subject of target searches for bird casualties. Searches will incorporate the use of transects spaced at 10m intervals apart with the observer covering 5m on either side for each transect. Locations and coordinates of transect routes will be confirmed using a portable GPS recording device. Recording sheets will be used to document bird carcasses encountered in the field.
MX33	Reporting	EIAR Chapter 7 – Appendix 7-5	A report summarising the findings of the bird monitoring surveys will be submitted to the Planning Authority at the end of each monitoring year.
MX34	Bats	EIAR Chapter 6	Ongoing monitoring of bat activity will be undertaken for at least three years' post construction of the wind farm. This will provide data and information on the actual recorded impact of the wind turbines on the local bat populations. Details of the proposed monitoring programme are provided in Appendix 6-2 of this EIAR
MX35	Drainage Inspection	EIAR Chapter 4, 9	Monitoring the effectiveness of drainage measures installed during the construction phase will continue to be monitored into the operational phase. Any excess build-up of silt levels at dams, the settlement pond, or any other drainage features that may decrease the effectiveness of the drainage feature, will be removed.

Ref. No.	Reference Heading	Reference Location	Monitoring Measure
MX36	Water Quality and Monitoring	CEMP Section 5	During the operational phase field testing and laboratory analysis of a range of parameters will continue for six months after construction is complete.
MX37	Drainage Inspection	EIAR Chapter 9	Monitoring the effectiveness of drainage measures installed during the construction phase will continue to be monitored into the operational phase. Any excess build-up of silt levels at dams, the settlement pond, or any other drainage features that may decrease the effectiveness of the drainage feature, will be removed.
MX38	Operational Phase Noise	EIAR Chapter 11	The following programme of measures would be implemented in the event of an issue of aerodynamic modulation being identified and associated with the site: › A detailed noise survey conducted by an appropriately qualified acoustic consultant will be commissioned in order to confirm the presence or not of the issue, the extent of the issue (i.e. number of locations, wind speeds and environmental conditions in which it is occurring); Based on the findings of this work and where aerodynamic modulation is identified a schedule of measures will be formulated and agreed with the planning authority, which would typically be envisaged to focus on control and regulation of the operation of turbine unit(s) in certain atmospheric and meteorological conditions.
Decommissioning Phase			
MX39	Decommissioning	DP Section 3	The Site Manager in consultation with the ECoW will be responsible for employing the services of a suitably qualified ecologist and any other suitably qualified professionals as required throughout the decommissioning works.
MX40	Decommissioning	DP Section 3	Prior to decommissioning, a suitably qualified ecologist will complete an invasive species survey of any material proposed for use as part of foundation backfilling.

10. PROGRAMME OF WORKS

10.1 Construction Schedule

It is estimated that the construction phase will take approximately between 12 – 18 months from starting on site to the commissioning of the electrical system. In the interest of breeding birds, removal of woody vegetation will be conducted outside of the general breeding bird season (1st of March to 31st of August).

Works during the construction phase of the development, including delivery of construction materials will be limited to avoid unsociable hours as per Section 8.5 (d) of the code of practice for BS 5228: Part 1: 1997. Construction operations shall generally be restricted to between 07:00 hours and 19:00 hours Monday to Saturday. However, to ensure that optimal use is made of good weather period or at critical periods within the programme it could occasionally be necessary to work out with these hours. It may also be necessary to commence turbine base concrete pours earlier due to time constraints incurred by the concrete curing process. Any such out of hours working would be agreed in advance with the local planning authority.

Work on Sundays or public holidays will only be conducted in exceptional circumstances or in an emergency. Additional emergency works may also be required outside of normal working hours as quoted above. This work, if required, will be agreed through notification and consultation with the affected parties as deemed necessary.

Delivery of abnormal loads such as turbine tower sections and blades will take place at night outside of peak traffic hours.

The anticipated phasing and scheduling main construction task items are outlined in Figure 10-1 below.

Figure 10-1 Indicative Construction Schedule

11. COMPLIANCE AND REVIEW

11.1 Site Inspections and Environmental Audits

Routine inspections of construction activities will be carried out on a daily and weekly basis by the Site Environmental Manager and the Construction Manager to ensure all controls to prevent environmental impact, relevant to the construction activities taking place at the time, are in place.

Environmental inspections will ensure that the works are undertaken in compliance with this CEMP and any subsequent updates to this document. Environmental site inspections will be carried out by suitably trained staff.

11.2 Auditing

Environmental audits will be carried out during the construction phase of the project. In contrast to monitoring and inspection activities, audits are designed to shed light on the underlying causes of non-compliance, and not merely detect the non-compliance itself. In addition, audits are the main means by which system and performance improvement opportunities may be identified. Environmental audits will be carried out by contractor staff or alternatively by external personnel acting on their behalf. It is important that an impartial and objective approach is adopted. Environmental audits will be conducted at planned intervals to determine whether the CEMP is being properly implemented and maintained. The results of environmental audits will be provided to project management personnel.

11.3 Environmental Compliance

The following definitions shall apply in relation to the classification of Environmental Occurrences during construction of the wind farm:

Environmental Near Miss: An occurrence which if not controlled or due to its nature could lead to an Environmental Incident.

Environmental Incident: Any occurrence which has potential, due to its scale and nature, to migrate from source and have an environmental impact beyond the site boundary.

Environmental Exceedance Event: An environmental exceedance event occurs when monitoring results indicate that limits for a particular environmental parameter (as indicated in the Environmental Monitoring Programme) has been exceeded.

An exceedance will immediately trigger an investigation into the reason for the exceedance occurring and the application of suitable mitigation where necessary.

Exceedance events can be closed out on achieving a monitoring result below the assigned limit for a particular environmental parameter.

Environmental Non-Compliance: Non-fulfilment of a requirement and includes any deviations from established procedures, programs and other arrangements related to the EMP.

11.4 Corrective Action Plan Procedure

A corrective action is implemented to rectify an environmental problem on-site. Corrective actions will be implemented by the Construction Manager, as advised by the Site Environmental manager. Corrective actions may be required as a result of the following;

- Environmental Audits;
- Environmental Inspections and Reviews;
- Environmental Monitoring;
- Environmental Incidents; and,
- Environmental Complaints.

A Corrective Action Notice will be used to communicate the details of the action required to the main contractor. A Corrective Action Notice is a form that describes the cause and effect of an environmental problem on site and the recommended corrective action that is required. The Corrective Action Notice, when completed, will include details of close out and follow up actions.

If an environmental problem occurs on site that requires immediate attention direct communications between the Construction Manager and the Site Environmental manager will be conducted. This in turn will be passed down to the site staff involved. A Corrective Action Notice will be completed at a later date.

11.5 Construction Phase Plan Review

This CEMP will be updated and reviewed prior to commencement of construction, and also every six months thereafter during the construction phase of the project.

APPENDIX 1

PROCEDURE FOR PUBLIC COMPLAINTS

Coole Wind Farm Limited

Coole Wind Farm Limited,
Building 4200,
Cork Airport Business Park,
Cork.
Tel: +353 (0)21 2427786

PROCEDURE FOR PUBLIC COMPLAINTS FOR OPERATIONAL WIND FARMS

Communicate

Coole Wind Farm Limited - Operations Management is committed to ensuring that all our communications and interactions with the general public will be simple in its message and easy to complete.

If a member of the general public wants to communicate about any aspect of an operating wind farm they can make contact through the following channels:

Telephone & Email

Contact the 'Operational Controller':

- *Tel:* TBA
- *E mail:* TBA

This number and e-mail will be monitored on a continuous basis and will be the primary points of contact for access control to the wind farm and communications for works and emergencies on the wind farm.

The 'Operational Controller' number will be posted on the information noticeboard which will be located at the entrance to the wind farm.

Contact the Operations Manager TBA:

- Tel: TBA
- E-mail: TBA

Contact the head office directly

- Tel: TBA
- Fax: TBA
- E-mail: TBA

or

Writing

Write to:
TBA
Group Operations Manager
Head office address TBA

Coole Wind Farm Limited

Coole Wind Farm Limited,
Building 4200,
Cork Airport Business Park,
Cork.
Tel: +353 (0)21 2427786

Listen

- Irrespective of the context of the communication, we will listen to what is being said and the message being conveyed with both understanding and empathy.
- We will record all aspects of the communication to allow us have a better understanding of the conveyed message.
- We will respond to all contacts in an organised and professional manner and treat all contact seriously.
- We will deal with all contacts quickly and politely and we will aim to learn from all feedback.

Respond

- If an issue is communicated in person or over the phone, we will try to resolve the issue there and then.
- If an issue is communicated by email or in writing we will endeavour to acknowledge the communication within 7 days and do everything we can to resolve it within 28 days.
- If this is not possible to resolve an issue within these timeframes, we will explain why and provide a plan for addressing the issues in the longer term.

APPENDIX 2

WATERCOURSE CROSSING METHODOLOGIES

Crossing No.	Type and size	Cover from road level to top of bridge/ culvert	Maximum depth of trench from road level under bridge /culvert	Description	Watercourse Crossing Assumed Option	Extent of In-stream Works
1	1500 x 3000mm high stone bridge	600mm	n/a (5100mm where directional drilling required)	The structure of the existing bridge may make it difficult to achieve adequate cover over the cable ducts. It is proposed to lay the cable ducts in a flatbed formation in a shallow trench in the deck of the bridge. Alternatively if the structure of the bridge deck cannot accommodate a trench of any depth, the cable ducts will be installed under the watercourse by means of directional drilling. Either option will ensure that no contact will be made with the watercourse during the works.	Option 3 or 5	None. No in-stream works required.
2	900mm Ø concrete pipe.	1100mm.	n/a	No in-stream works required at this culvert crossing. The culvert consists of a socketed concrete pipe over which the proposed cable duct will be laid. Therefore no contact will be made with the watercourse during the works.	Option 1	None. No in-stream works required.
3	18m long X 6m high concrete bridge	900mm	n/a (8500mm where directional drilling required)	The structure of the existing bridge may make it difficult to achieve adequate cover over the cable ducts. It is proposed to place the cables in a stainless steel ducts secured to the outside deck of the bridge. Alternatively, the cable ducts will be installed under the watercourse by means of directional drilling. Either option will ensure that no contact will be made with the watercourse during the works.	Option 4 or 5	None. No in-stream works required.
4	Pipe outlet not visible	1200mm. est.	n/a	No in-stream works required at this culvert crossing. It is assumed the culvert consists of a socketed concrete pipe over which the proposed cable duct will be laid.. Therefore, no contact will be made with the watercourse during the works.	Option 1	None. No in-stream works required.

Crossing No.	Type and size	Cover from road level to top of bridge/ culvert	Maximum depth of trench from road level under bridge /culvert	Description	Watercourse Crossing Assumed Option	Extent of In-stream Works
5	900mm Ø concrete pipe.	1200mm.	n/a	No in-stream works required at this culvert crossing. The culvert consists of a socketed concrete pipe over which the proposed cable duct will be laid. Therefore, no contact will be made with the watercourse during the works.	Option 1	None. No in-stream works required.
6	600mm Ø concrete pipe.	1800mm.	n/a	No in-stream works required at this culvert crossing. The culvert consists of a socketed concrete pipe over which the proposed cable duct will be laid. Therefore, no contact will be made with the watercourse during the works.	Option 1	None. No in-stream works required.
7	600mm Ø concrete pipe.	1300mm.	n/a	No in-stream works required at this culvert crossing. The culvert consists of a socketed concrete pipe over which the proposed cable duct will be laid. Therefore, no contact will be made with the watercourse during the works.	Option 1	None. No in-stream works required.
8	2 no. 300mm Ø concrete pipes.	1200mm.	n/a	No in-stream works required at this culvert crossing. The culvert consists of a socketed concrete pipe over which the proposed cable duct will be laid. Therefore, no contact will be made with the watercourse during the works.	Option 1	None. No in-stream works required.
9	600mm Ø concrete pipe.	800mm.	1900mm	No in-stream works required at this culvert crossing. The culvert consists of a socketed concrete pipe under which the proposed cable duct will be laid. Therefore, no contact will be made with the stream during the works.	Option 2	None. No in-stream works required.
10	80m long x 5m high	900mm	n/a	The structure of the existing bridge may make it difficult to achieve adequate cover over the cable ducts. It is proposed to lay the cable ducts in a flatbed formation in a shallow	Option 3, 4 or 5	None. No in-stream works required.

Crossing No.	Type and size	Cover from road level to top of bridge/ culvert	Maximum depth of trench from road level under bridge /culvert	Description	Watercourse Crossing Assumed Option	Extent of In-stream Works
	concrete bridge		(7500mm where directional drilling required)	trench in the deck of the bridge or else place the cables in a stainless steel duct secured to the outside deck of the bridge. Alternatively, if the structure of the bridge deck cannot accommodate either option above, the cable ducts will be installed under the watercourse by means of directional drilling. All options will ensure that no contact will be made with the watercourse during the works.		
11	600mm Ø concrete pipe.	1200mm.	n/a	No in-stream works required at this culvert crossing. The culvert consists of a socketed concrete pipe over which the proposed cable duct will be laid. Therefore, no contact will be made with the watercourse during the works.	Option 1	None. No in-stream works required.
12	500mm Ø concrete pipe.	1000mm.	n/a	No in-stream works required at this culvert crossing. The culvert consists of a socketed concrete pipe over which the proposed cable duct will be laid. Therefore, no contact will be made with the watercourse during the works.	Option 1	None. No in-stream works required.
13	1000mm Ø concrete pipe.	600mm	2100mm	No in-stream works required at this culvert crossing. The culvert consists of a socketed concrete pipe under which the proposed cable duct will be laid. Therefore, no contact will be made with the stream during the works.	Option 2	None. No in-stream works required.
14	3500 x 1200mm high concrete bridge	500mm	n/a	No in-stream works required at this culvert crossing. It is proposed to construct the ducts in a flatbed formation over the culvert. Therefore, no contact will be made with the stream during the works.	Option 3	None. No in-stream works required.

Crossing No.	Type and size	Cover from road level to top of bridge/ culvert	Maximum depth of trench from road level under bridge /culvert	Description	Watercourse Crossing Assumed Option	Extent of In-stream Works
15	1000mm Ø concrete pipe.	300-500mm est.	2000mm	No in-stream works required at this culvert crossing. The culvert consists of a socketed concrete pipe under which the proposed cable duct will be laid. Therefore, no contact will be made with the stream during the works.	Option 2	None. No in-stream works required.
16	3000 x 1500mm high stone bridge	300mm	3300mm	Due to the lack of cover over the existing stone bridge and its proximity to the railway level crossing, the cable will be installed under this culvert by means of directional drilling which will ensure that no contact will be made with the stream during the works.	Option 5	None. No in-stream works required.

APPENDIX 3

METHOD STATEMENT FOR LINK ROAD, JUNCTION ACCOMMODATION AND PUBLIC ROAD WORKS

METHOD STATEMENT FOR LINK ROAD, JUNCTION ACCOMMODATION AND PUBLIC ROAD WORKS

COOLE WIND FARM DEVELOPMENT, CO. WESTMEATH

1.1 Scope of the Works

Improvements and modifications to the existing public road network to facilitate turbine delivery will be required as part of the Proposed Development works. This will include construction of a link road between the R395 and R396 Regional Roads and junction improvement works, including providing hardsurfacing at eleven locations; along the public road corridor at: the N4 junction with the L1927 in the townland of Joanstown, clearing of existing verge and vegetation to the south east of the railway line level crossing on the L1927, hardsurfacing and widening of the L1927 and L5828 junction in the townland of Boherquill, clearing of existing verge and vegetation and hardsurfacing at the gentle right turn from the L5828 onto the R395; hardsurfacing including clearance of vegetation and road verge to provide access and egress at proposed link road; hardsurfacing including clearance of vegetation and road verge at site access points off the R396, and at four points contained within the proposed wind farm site at junctions along the L5755.

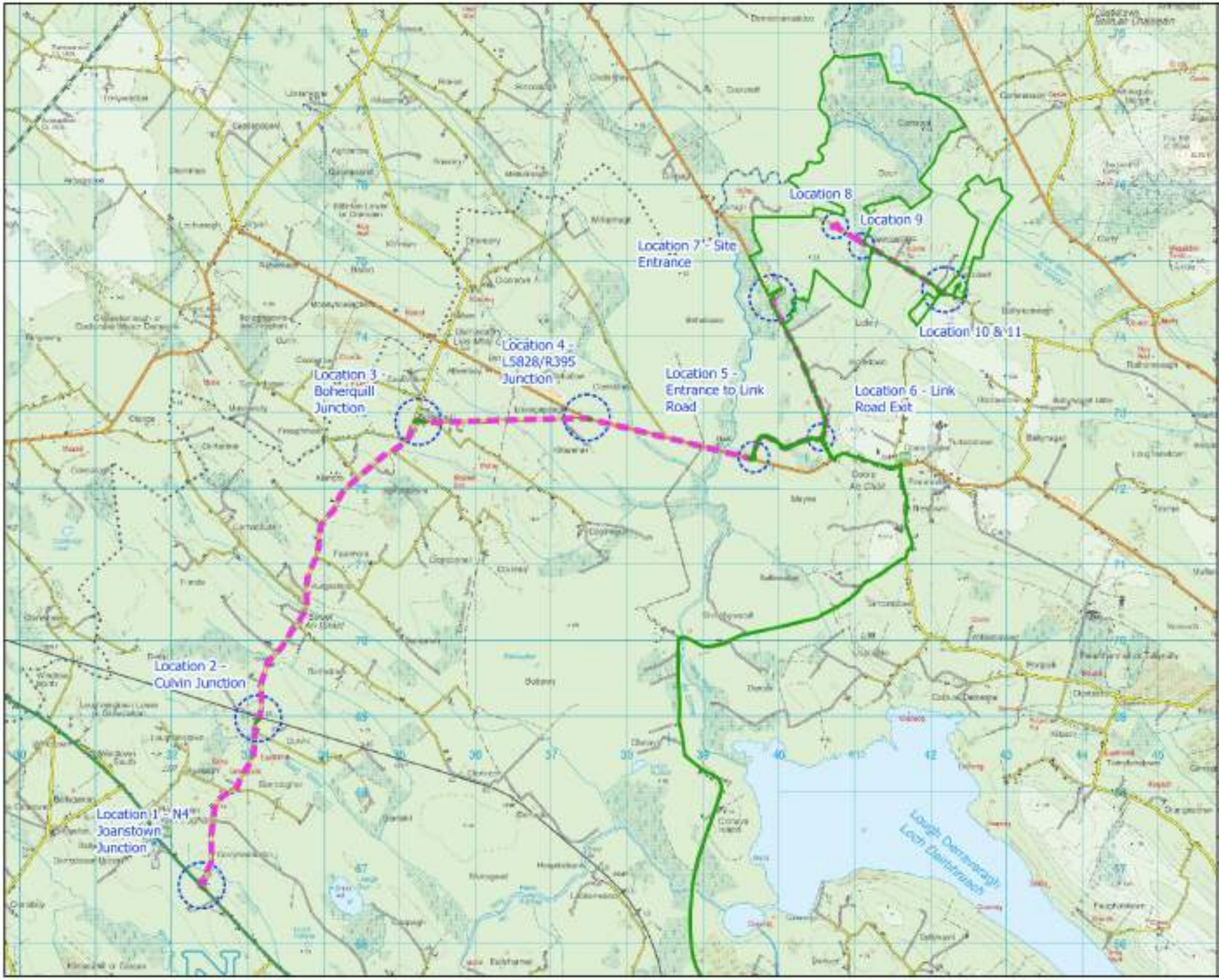
The proposed link road between the R395 and R396 measures approximately 1.2 kilometres in length with a running width of approximately 5m. The road will traverse areas of cutover peat and improved agricultural grassland.

Leaving the granular fill and final surface running layer in place within the link road will allow these to be used again in the future should it become necessary (i.e. at decommissioning stage for turbine removal, or in the unlikely event of having to swap out a blade component during the operational phase).

The minor junction improvement works will require clearing back the existing road verge and field vegetation at the junctions, and excavation of material to allow the placing of stone/hard surfacing within the proposed areas. A series of removable bollards and/or temporary fencing will be placed along the existing road edge in order to preserve the structure of the junctions outside of those periods when deliveries of turbine components are underway. Once deliveries are completed the areas and boundaries will be reinstated restoring the junctions to their original configurations except as stated otherwise.

1.2 Location

- The location of the works are outlined in Figure 1-1 below.



Map Legend

- EIAR Site Boundary
- Proposed Turbine Delivery Route
- Turbine Delivery Route Junction Works Locations

Drawing Title
Turbine Delivery Route Junction Works Locations

Project Title
Coole Wind Farm, Co. Westmeath

Drawn By	Checked By
EC	MW
Project No.	Drawing No.
200445	Figure 1-1
Scale	Date
1:65000	11.02.2021

MKO
Planning and Environmental Consultants

1.3 Timeframe/Timescale

The construction phase of the entire wind farm will take approximately 12-18 months to complete from starting on site to the commissioning of the electrical system and export of electricity from site. The junction accommodation works will be completed in advance of the delivery of abnormal loads. The junction accommodation works at Boherquill will be complete over 4 - 5 days with the widening of the road verge at Joanstown taking 1-2 days to complete

1.4 Materials and Equipment

- 360º Excavator
- Roller
- Trucks (stone)
- Lighting tower
- 4" - 6" stone
- Cl 804 granular fill
- Geogrid
- Temporary fencing
- Permanent fencing materials
- Temporary bollards

1.5 Construction Methodology

- The works proposed at both locations will involve the same methodology and sequence of works. The existing soils and overburden at each location will be excavated and replace with granular fill material which will be finished to provide a suitable running surface. A traffic management plan for each location will be prepared in advance of the works
- The following provides a detail of the proposed works:
- On the implementation of the traffic management at each works locations, the area will be secured with temporary fencing to ensure the general public are prevented from coming in contact with the works
- The works at Joanstown will utilise 1 no. rigid truck and 1 no. 360º Excavator due to the size of the proposed works area. The Boherquill accommodation works will utilise 2-3 trucks due to the larger works area.
- The proposed accommodation works shall be to the line and level given in the design requirements with the construction carried out under the supervision of the design engineer.
- Peat and overburden will be excavated to bedrock, where practical or to a competent stratum as determined by the design engineer.
- The excavated overburden material from the accommodation works at Boherquill will be stockpiled for any future bank and verge reinstatement. The overburden from the Joanstown works will be exported off site to licenced facility.
- Well-graded granular fill will be spread and compacted in layers to provide a homogeneous running surface. The thickness of layers and amount of compaction required will be decided by the Construction Manager based on the characteristics of the material and the compaction plant to be used;
- A layer of geogrid/geotextile may be required at the surface of the competent stratum (to be confirmed by the designer) and at the top of each subsequent layer of granular fill.
- Geogrid will be hand rolled with no plant or equipment permitted to travel on the geogrid prior to the placement of the fill material

- A final unbound surface layer shall be placed on the, as per design requirements, to provide a road profile and graded to accommodate wind turbine construction and delivery traffic.
- The finished level of all accommodation works will be relative to the adjacent public road level
- All fill material will be compacted with the tracked excavator initially and finished with a vibrating roller.
- The junction accommodation works at Boherquill will be secured with temporary fencing to prevent public access upon completion and will only be accessible to vehicles delivering abnormally large loads. A permanent stockproof fence will be installed after all abnormal deliveries have taken place and a hedgerow will be planted outside the fencing
- The Joanstown works will not require fencing due to the scale of the area. The final arrangement will be agreed with the Westmeath County Council Roads Engineer

The construction methodology for the link road is summarised as follows:

- Overburden within the required areas for the accommodation works will be excavated and temporarily stockpiled adjacent to the works area, where possible, until a competent stratum is reached.
- A layer of geogrid/geotextile may be required at the surface of the competent stratum to provide further structural formation.
- The competent stratum will be overlain with granular fill.
- A final surface running layer will be placed over the granular fill to provide a suitable surface to accommodate the turbine delivery/abnormal load vehicles.
- The accommodation works when not in use during the construction phase will be cordoned off from the public road, using bollards/fencing as required.
- Upon completion of the turbine delivery phase of the proposed wind farm the granular fill and final surface running layer will be left in situ, within the works areas.
- A barrier/ gate will be put in place at the entrance to the link road and a gate will be installed at the exit. An existing stone wall at the exit will be reinstated either side of the gate.
- Gates/barriers will be left in situ post construction to prevent access.

1.6 Environmental Considerations

- The following measures are proposed to minimise any environmental or ecological impacts:
- The excavations at the two locations will be undertaken during a period of dry weather conditions to prevent any potential run-off the from the works areas.
- Measures will be installed to prevent surface water run discharging to the public. Measures which include suitable cambers and collector channels which will be considered during the detailed design.
- Re-fuelling will be carried out at designated locations with spill kits contained in all plant and equipment.
- If increased dust levels are encountered during the accommodation works, dust suppression will take place using water

1.7 Health and Safety Considerations

The appointed contractor will carry out a risk assessment which identifies the hazards which will be encountered during the works and the most appropriate techniques to manage the risk as well as

training requirements. General site arrangements and emergency contacts are outlined in the following section which will be further populated prior to the commencement of works.

1.7.1 Personal Protective Equipment

The following is a list of the Personal Protective Equipment (PPE) required for each operative undertaking the described works.

No.	Item
1	Hard Hat (Worn at all times)
2	Hi-Visibility Jacket/Vest (Worn at all times)
3	Steel Toe Cap Boots (Worn at all times)
4	Gloves (Worn when required)
5	Eye Protection (Worn when required)
6	Ear Protection (Worn when required)
7	Additional PPE (as required)

1.7.2 Emergency Arrangements

In the case of an emergency, all operatives are to follow the emergency procedures as detailed in the site induction for Fire, Injury or Bog slide. General arrangements are;

- Assess/Attend to casualty if one is present
- Raise the alarm and call 999/112
- Alert the other site personnel as to the emergency
- Locate at the site assembly point and do not return to work until instructed that it is safe to do so
- Substation construction assembly point located at the site entrance gate

First Aid

The appointed contractor will provide details on the location of First Aid kits at site induction

Emergency Contacts

No.	Item
1	Emergency Numbers – 999/112
2	Doctor – Coole Surgery 044 9661104
3	Hospital - Midlands Regional Hospital, Mullingar– 066 718 4000
4	Multyfarnham Garda Station – 044 9371112
5	TBC – Project Manager – TBC
6	TBC – Safety Officer – TBC

No.	Item
7	TBC – Site Engineer – TBC

APPENDIX 4

SITE DRAINAGE PLAN

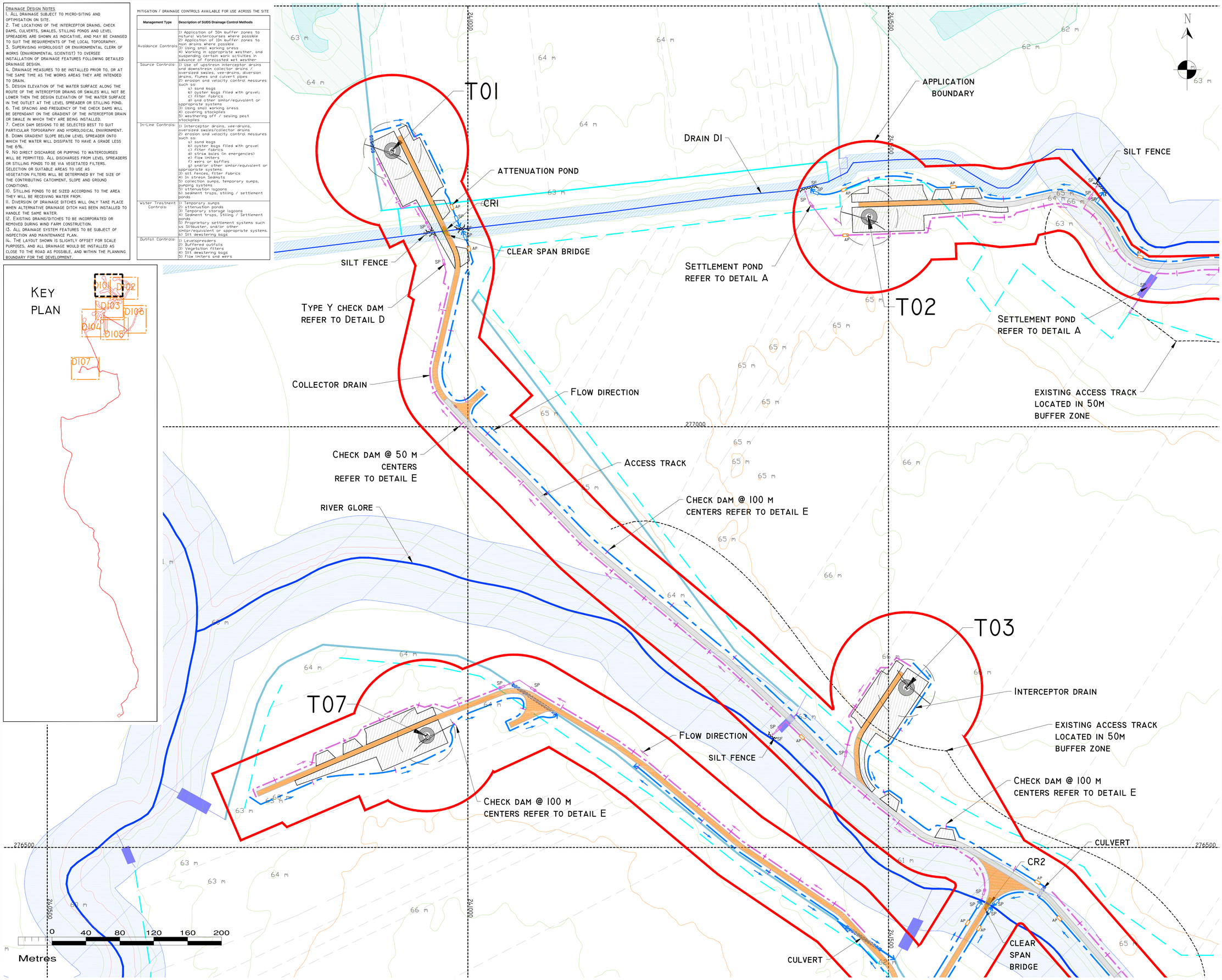
Drainage Design Notes

1. All drainage subject to micro-siting and optimisation on site.
2. The locations of the interceptor drains, check dams, culverts, swales, stilling ponds and level spreaders are shown as indicative, and may be changed to suit the requirements of the local topography.
3. Supervising hydrologist or environmental clerk of works (environmental scientist) to oversee installation of drainage features following detailed drainage design.
4. Drainage measures to be installed prior to, or at the same time as the works areas they are intended to drain.
5. Design elevation of the water surface along the route of the interceptor drains or swales will not be lower then the design elevation of the water surface in the outlet at the level spreader or stilling pond.
6. The spacing and frequency of the check dams will be dependant on the gradient of the interceptor drain or swale in which they are being installed.
7. Check dam designs to be selected best to suit particular topography and hydrological environment.
8. Down gradient slope below level spreader onto which the water will dissipate to have a grade less the 6%.
9. No direct discharge or pumping to watercourses will be permitted. All discharges from level spreaders or stilling ponds to be via vegetated filters. Selection or suitable areas to use as vegetation filters will be determined by the size of the contributing catchment, slope and ground conditions.
10. Stilling ponds to be sized according to the area they will be receiving water from.
11. Diversion of drainage ditches will only take place when alternative drainage ditch has been installed to handle the same water.
12. Existing drains/ditches to be incorporated or removed during wind farm construction.
13. All drainage system features to be subject of inspection and maintenance plan.
14. The layout shown is slightly offset for scale purposes, and all drainage would be installed as close to the road as possible, and within the planning boundary for the development.

Mitigation / Drainage Cointrols Available for Use Across the Site

Management Type	Description of SUDS Drainage Control Methods
Avoidance Controls:	1) Application of 50m buffer zones to natural Watercourses where possible 2) Application of 10m buffer zones to main drains where possible 3) Using small working areas 4) Working in appropriate weather, and suspending certain work activities in advance of forecasted wet weather
Source Controls:	1) Use of upstream interceptor drains and downstream collector drains / oversized swales, vee-drains, diversion drains, flumes and culvert pipes 2) erosion and velocity control measures such as: a) sand bags b) oyster bags filled with gravel; c) filter fabrics d) and other similar/equivalent or appropriate systems 3) Using small working areas 4) covering stockpiles 5) weathering off / sealing peat stockpiles
In-Line Controls:	1) Interceptor drains, vee-drains, oversized swales/collector drains 2) erosion and velocity control measures such as: a) sand bags b) oyster bags filled with gravel c) filter fabrics d) straw bales (in emergencies) e) flow inters f) weirs or baffles g) and/or other similar/equivalent or appropriate systems. 3) silt fences, filter fabrics 4) In stream Sedmats 5) collection sumps, temporary sumps, pumping systems 5) attenuation lagoons 6) sediment traps, stilling / settlement ponds
Water Treatment Controls:	1) Temporary sumps 2) attenuation ponds 3) Temporary storage lagoons 4) Sediment traps, Stilling / Settlement ponds 5) Proprietary settlement systems such as Siltbuster, and/or other similar/equivalent or appropriate systems. 6) Silt dewatering bags
Outfall Controls:	1) Levelspreaders 2) Buffered outfalls 3) Vegetation filters 4) Silt dewatering bags 5) Flow inters and weirs

Key Plan



Drawing Legend :

Proposed Drainage

- Upstream Interceptor Ditches
- Direction of Flow
- Downstream Collector Ditches
- Settlement Pond (SP)
- Attenuation Pond (AP)
- culvert
- silt fence (SF)
- headland drain
- field drain
- CR - new stream/river crossing location
- clear span bridge
- existing settlement pond

- application boundary
- Existing ground surface majour contour (5 m interval)
- Existing ground surface minor contour (1 m interval)
- rivers/streams
- Lakes
- natural rivers/streams 50m buffer
- drain 10m buffer
- Lake 50m buffer
- turbine and swept area
- turbine foundation
- regional road
- local road
- proposed road
- existing road to be upgraded
- passing bay
- crane platform
- borrow pit

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6. The use of or reliance upon this drawing shall be deemed to be acceptance of these conditions of use unless otherwise agreed in writing, such written agreement to be sought from and issued by the copyright holder to the use or reliance upon this drawing.
7. Layout plans show typical Turbine rotor diameter as per turbine drawing.

Date	Description	Chkd	Signed
Revisions			

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Client: MKO

Job: Coole WF, Co. Westmeath

Title: Drainage Layout Sheet 1 of 7

Figure No: D101

Drawing No: P1320-2-0221-A1-D101-00A	
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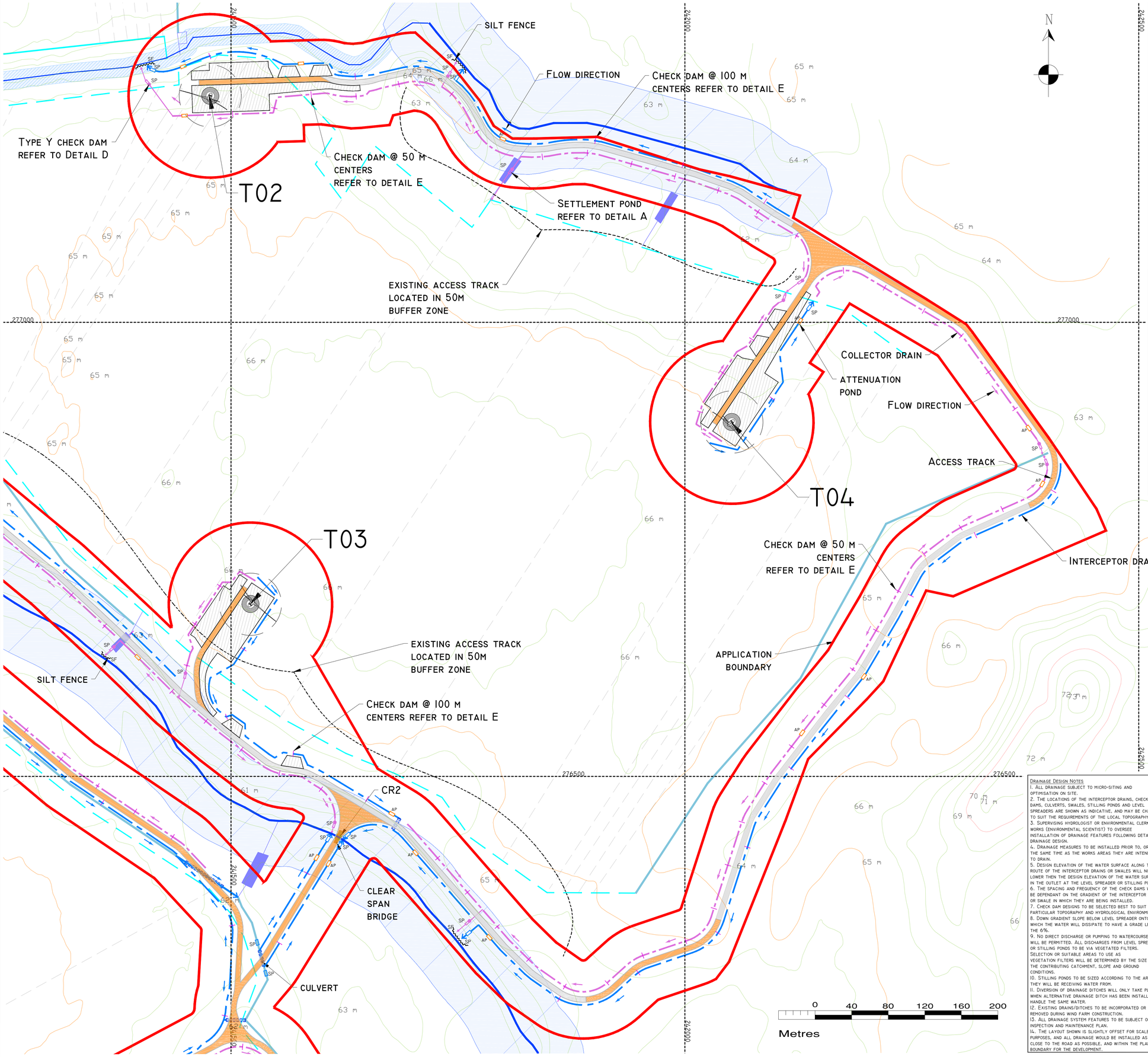
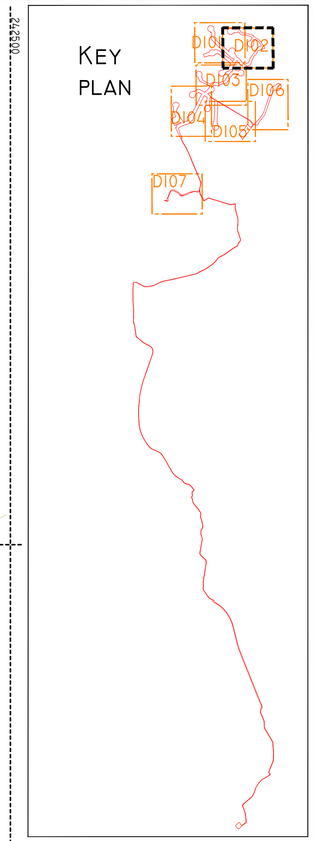
Scale: 1:2,000 (A1)	Drawn By: MG/GD
Date: 17/02/2021	Checked By: MG





DRAWING LEGEND :

PROPOSED DRAINAGE

- UPSTREAM INTERCEPTOR DITCHES
- DIRECTION OF FLOW
- DOWNSTREAM COLLECTOR DITCHES
- SETTLEMENT POND (SP)
- ATTENUATION POND (AP)
- CULVERT
- SILT FENCE (SF)
- HEADLAND DRAIN
- FIELD DRAIN
- CR - NEW STREAM/RIVER CROSSING LOCATION
- CLEAR SPAN BRIDGE
- EXISTING SETTLEMENT POND

- APPLICATION BOUNDARY
- EXISTING GROUND SURFACE MAJOUR CONTOUR (5 M INTERVAL)
- EXISTING GROUND SURFACE MINOR CONTOUR (1 M INTERVAL)
- RIVERS/STREAMS
- LAKES
- NATURAL RIVERS/STREAMS 50M BUFFER
- DRAIN 10M BUFFER
- LAKE 50M BUFFER
- TURBINE AND SWEPT AREA
- TURBINE FOUNDATION
- REGIONAL ROAD
- LOCAL ROAD
- PROPOSED ROAD
- EXISTING ROAD TO BE UPGRADED
- PASSING BAY
- CRANE PLATFORM
- BORROW PIT

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7. LAYOUT PLANS SHOW TYPICAL TURBINE ROTOR DIAMETER AS PER TURBINE DRAWING.

Date	Description	Chkd	Signed

Revisions

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Job: COOLE WF, CO. WESTMEATH

Title: DRAINAGE LAYOUT SHEET 2 OF 7

Figure No: D102

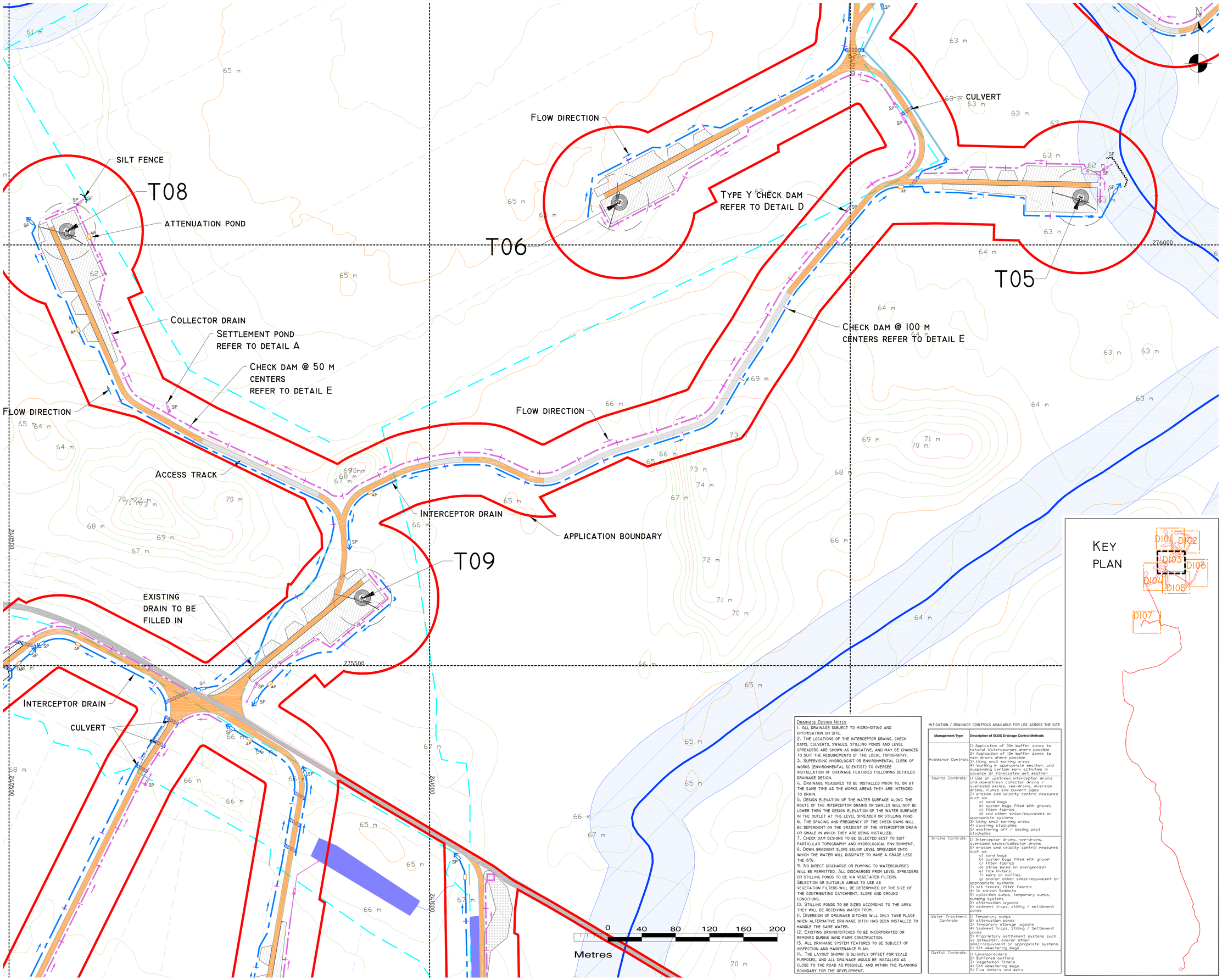
Drawing No: P1320-2-0221-A1-D102-00A	
Sheet Size: A1	Project No.: P1320-2
Scale: 1:2,000 (A1)	Drawn By: MG/GD
Date: 17/02/2021	Checked By: MG

DRAINAGE DESIGN NOTES

1. ALL DRAINAGE SUBJECT TO MICRO-SITING AND OPTIMISATION ON SITE.
2. THE LOCATIONS OF THE INTERCEPTOR DRAINS, CHECK DAMS, CULVERTS, SWALES, STILLING PONDS AND LEVEL SPREADERS ARE SHOWN AS INDICATIVE, AND MAY BE CHANGED TO SUIT THE REQUIREMENTS OF THE LOCAL TOPOGRAPHY.
3. SUPERVISING HYDROLOGIST OR ENVIRONMENTAL CLERK OF WORKS (ENVIRONMENTAL SCIENTIST) TO OVERSEE INSTALLATION OF DRAINAGE FEATURES FOLLOWING DETAILED DRAINAGE DESIGN.
4. DRAINAGE MEASURES TO BE INSTALLED PRIOR TO, OR AT THE SAME TIME AS THE WORKS AREAS THEY ARE INTENDED TO DRAIN.
5. DESIGN ELEVATION OF THE WATER SURFACE ALONG THE ROUTE OF THE INTERCEPTOR DRAINS OR SWALES WILL NOT BE LOWER THEN THE DESIGN ELEVATION OF THE WATER SURFACE IN THE OUTLET AT THE LEVEL SPREADER OR STILLING POND.
6. THE SPACING AND FREQUENCY OF THE CHECK DAMS WILL BE DEPENDANT ON THE GRADIENT OF THE INTERCEPTOR DRAIN OR SWALE IN WHICH THEY ARE BEING INSTALLED.
7. CHECK DAM DESIGNS TO BE SELECTED BEST TO SUIT PARTICULAR TOPOGRAPHY AND HYDROLOGICAL ENVIRONMENT.
8. DOWN GRADIENT SLOPE BELOW LEVEL SPREADER ONTO WHICH THE WATER WILL DISSIPATE TO HAVE A GRADE LESS THE 6%.
9. NO DIRECT DISCHARGE OR PUMPING TO WATERCOURSES WILL BE PERMITTED. ALL DISCHARGES FROM LEVEL SPREADERS OR STILLING PONDS TO BE VIA VEGETATED FILTERS. SELECTION OR SUITABLE AREAS TO USE AS VEGETATION FILTERS WILL BE DETERMINED BY THE SIZE OF THE CONTRIBUTING CATCHMENT, SLOPE AND GROUND CONDITIONS.
10. STILLING PONDS TO BE SIZED ACCORDING TO THE AREA THEY WILL BE RECEIVING WATER FROM.
11. DIVERSION OF DRAINAGE DITCHES WILL ONLY TAKE PLACE WHEN ALTERNATIVE DRAINAGE DITCH HAS BEEN INSTALLED TO HANDLE THE SAME WATER.
12. EXISTING DRAINS/DITCHES TO BE INCORPORATED OR REMOVED DURING WIND FARM CONSTRUCTION.
13. ALL DRAINAGE SYSTEM FEATURES TO BE SUBJECT OF INSPECTION AND MAINTENANCE PLAN.
14. THE LAYOUT SHOWN IS SLIGHTLY OFFSET FOR SCALE PURPOSES, AND ALL DRAINAGE WOLD BE INSTALLED AS CLOSE TO THE ROAD AS POSSIBLE, AND WITHIN THE PLANNING BOUNDARY FOR THE DEVELOPMENT.

MITIGATION / DRAINAGE CONTROLS AVAILABLE FOR USE ACROSS THE SITE

Management Type	Description of SUDS Drainage Control Methods
Avoidance Controls:	1) Application of 50m buffer zones to natural Watercourses where possible 2) Application of 10m buffer zones to main drains where possible 3) Using small working areas 4) Working in appropriate weather, and suspending certain work activities in advance of forecasted wet weather
Source Controls:	1) Use of upstream interceptor drains and downstream collector drains / oversized swales, vee-drains, diversion drains, flumes and culvert pipes. 2) erosion and velocity control measures such as: a) sand bags b) oyster bags filled with gravel c) filter fabrics d) and other similar/equivalent or appropriate systems 3) Using small working areas 4) covering stockpiles 5) weathering off / sealing peat stockpiles
In-Line Controls:	1) Interceptor drains, vee-drains, oversized swales/collector drains 2) erosion and velocity control measures such as: a) sand bags b) oyster bags filled with gravel c) filter fabrics d) straw bales (in emergencies) e) flow limiters f) weirs or baffles g) and/or other similar/equivalent or appropriate systems 3) silt fences, filter fabrics 4) In stream Sedmats 5) collection sumps, temporary sumps, pumping systems 5) attenuation lagoons 6) sediment traps, stilling / settlement ponds
Water Treatment Controls:	1) Temporary sumps 2) attenuation ponds 3) Temporary storage lagoons 4) Sediment traps, Stilling / Settlement ponds 5) Proprietary settlement systems such as Siltbuster, and/or other similar/equivalent or appropriate systems. 6) Silt dewatering bags
Outfall Controls:	1) Levelspreaders 2) Buffered outfalls 3) Vegetation filters 4) Silt dewatering bags 5) Flow limiters and weirs



Drawing Legend :

- Upstream Interceptor Ditches
- Direction of Flow
- Downstream Collector Ditches
- Settlement Pond (SP)
- Attenuation Pond (AP)
- Culvert
- Silt Fence (SF)
- Headland Drain
- Field Drain
- CR - New Stream/River Crossing Location
- Clear Span Bridge
- Existing Settlement Pond

Proposed Drainage

- Application Boundary
- Existing Ground Surface Majour Contour (5 m Interval)
- Existing Ground Surface Minor Contour (1 m Interval)
- Rivers/Streams
- Lakes
- Natural Rivers/Streams 50m Buffer
- Drain 10m Buffer
- Lake 50m Buffer
- Turbine and Swept Area
- Turbine Foundation
- Regional Road
- Local Road
- Proposed Road
- Existing Road to be Upgraded
- Passing Bay
- Crane Platform
- Borrow Pit

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5. All contractors, weather main or sub-contractors, must visit the site and are responsible for taking and checking any and all dimensions and levels that relate to the works.
6. The use of or reliance upon this drawing shall be deemed to be acceptance of these conditions of use unless otherwise agreed in writing, such written agreement to be sought from and issued by the copyright holder to the use or reliance upon this drawing.
7. Layout plans show typical Turbine rotor diameter as per turbine drawing.

Drainage Design Notes

1. All drainage subject to micro-siting and optimisation on site.
2. The locations of the interceptor drains, check dams, culverts, swales, stilling ponds and level spreaders are shown as indicative, and may be changed to suit the requirements of the local topography.
3. Supervising hydrologist or environmental clerk of works (environmental scientist) to oversee installation of drainage features following detailed drainage design.
4. Drainage measures to be installed prior to, or at the same time as the works areas they are intended to drain.
5. Design elevation of the water surface along the route of the interceptor drains or swales will not be lower then the design elevation of the water surface in the outlet at the level spreader or stilling pond.
6. The spacing and frequency of the check dams will be dependant on the gradient of the interceptor drain or swale in which they are being installed.
7. Check dam designs to be selected best to suit particular topography and hydrological environment.
8. Down gradient slope below level spreader onto which the water will dissipate to have a grade less the 6%.
9. No direct discharge or pumping to watercourses will be permitted. All discharges from level spreaders or stilling ponds to be via vegetated filters. Selection or suitable areas to use as vegetation filters will be determined by the size of the contributing catchment, slope and ground conditions.
10. Stilling ponds to be sized according to the area they will be receiving water from.
11. Diversion of drainage ditches will only take place when alternative drainage ditch has been installed to handle the same water.
12. Existing drains/ditches to be incorporated or removed during wind farm construction.
13. All drainage system features to be subject of inspection and maintenance plan.
14. The layout shown is slightly offset for scale purposes, and all drainage would be installed as close to the road as possible, and within the planning boundary for the development.

Mitigation / Drainage Cointrols available for use across the site

Management Type	Description of SUDS Drainage Control Methods
Avoidance Controls:	1) Application of 50m buffer zones to natural Watercourses where possible 2) Application of 10m buffer zones to main drains where possible 3) Using small working areas 4) Working in appropriate weather, and suspending certain work activities in advance of forecasted wet weather
Source Controls:	1) Use of upstream interceptor drains and downstream collector drains / oversized swales, vee-drains, diversion drains, flumes and culvert pipes 2) erosion and velocity control measures such as: a) sand bags b) oyster bags filled with gravel; c) filter fabrics d) and other similar/equivalent or appropriate systems 3) Using small working areas 4) covering stockpiles 5) weathering off / sealing peat stockpiles
In-Line Controls:	1) Interceptor drains, vee-drains, oversized swales/collector drains 2) erosion and velocity control measures such as: a) sand bags b) oyster bags filled with gravel c) filter fabrics d) straw bales (in emergencies) e) flow limiters f) weirs or baffles g) and/or other similar/equivalent or appropriate systems. 3) silt fences, filter fabrics 4) In stream Sedimats 5) collection sumps, temporary sumps, pumping systems 5) attenuation lagoons 6) sediment traps, stilling / settlement ponds
Water Treatment Controls:	1) Temporary sumps 2) attenuation ponds 3) Temporary storage lagoons 4) Sediment traps, Stilling / Settlement ponds 5) Proprietary settlement systems such as Siltbuster, and/or other similar/equivalent or appropriate systems. 6) Silt dewatering bags
Outfall Controls:	1) Levelspreaders 2) Buffered outfalls 3) Vegetation filters 4) Silt dewatering bags 5) Flow limiters and weirs

Key Plan

Date	Description	Chkd	Signed

Revisions

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Client: MKO

Job: Coole WF, Co. Westmeath

Title: Drainage Layout Sheet 3 of 7

Figure No: D103

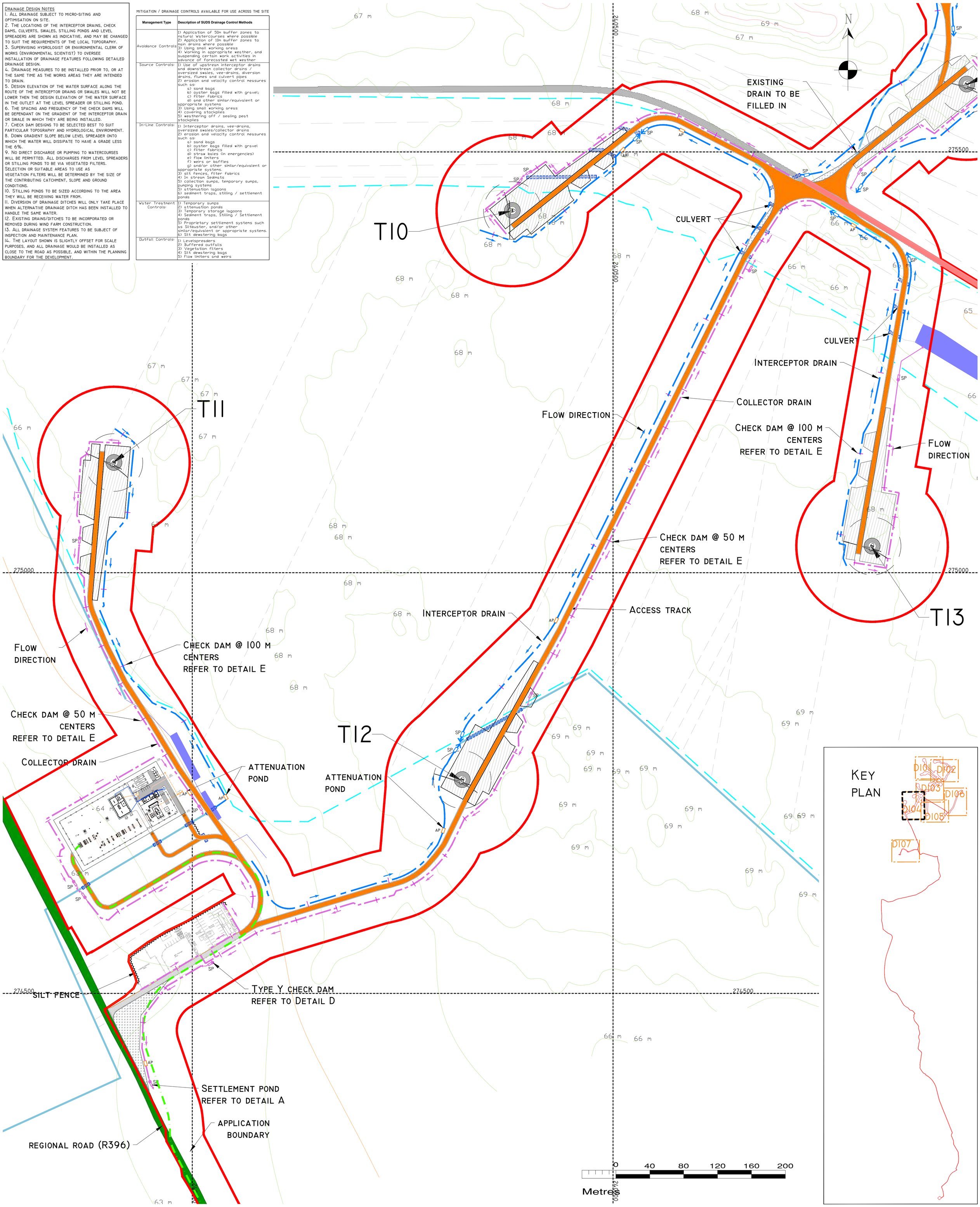
Drawing No: P1320-2-0221-A1-D103-00A	
Sheet Size: A1	Project No.: P1320-2
Scale: 1:2,000 (A1)	Drawn By: MG/GD
Date: 17/02/2021	Checked By: MG

Drainage Design Notes

1. All drainage subject to micro-siting and optimisation on site.
2. The locations of the interceptor drains, check dams, culverts, swales, stilling ponds and level spreaders are shown as indicative, and may be changed to suit the requirements of the local topography.
3. Supervising hydrologist or environmental clerk of works (environmental scientist) to oversee installation of drainage features following detailed drainage design.
4. Drainage measures to be installed prior to, or at the same time as the works areas they are intended to drain.
5. Design elevation of the water surface along the route of the interceptor drains or swales will not be lower then the design elevation of the water surface in the outlet at the level spreader or stilling pond.
6. The spacing and frequency of the check dams will be dependant on the gradient of the interceptor drain or swale in which they are being installed.
7. Check dam designs to be selected best to suit particular topography and hydrological environment.
8. Down gradient slope below level spreader onto which the water will dissipate to have a grade less the 6%.
9. No direct discharge or pumping to watercourses will be permitted. All discharges from level spreaders or stilling ponds to be via vegetated filters. Selection or suitable areas to use as vegetation filters will be determined by the size of the contributing catchment, slope and ground conditions.
10. Stilling ponds to be sized according to the area they will be receiving water from.
11. Diversion of drainage ditches will only take place when alternative drainage ditch has been installed to handle the same water.
12. Existing drains/ditches to be incorporated or removed during wind farm construction.
13. All drainage system features to be subject of inspection and maintenance plan.
14. The layout shown is slightly offset for scale purposes, and all drainage would be installed as close to the road as possible, and within the planning boundary for the development.

MITIGATION / DRAINAGE COINTROLS AVAILABLE FOR USE ACROSS THE SITE

Management Type	Description of SUDS Drainage Control Methods
Avoidance Controls:	1) Application of 50m buffer zones to natural Watercourses where possible 2) Application of 10m buffer zones to main drains where possible 3) Using small working areas 4) Working in appropriate weather, and suspending certain work activities in advance of forecasted wet weather
Source Controls:	1) Use of upstream interceptor drains and downstream collector drains / oversized swales, vee-drains, diversion drains, flumes and culvert pipes 2) erosion and velocity control measures such as: a) sand bags b) oyster bags filled with gravel; c) filter fabrics d) and other similar/equivalent or appropriate systems 3) Using small working areas 4) covering stockpiles 5) weathering off / sealing peat stockpiles
In-Line Controls:	1) Interceptor drains, vee-drains, oversized swales/collector drains 2) erosion and velocity control measures such as: a) sand bags b) oyster bags filled with gravel c) filter fabrics d) straw bales (in emergencies) e) flow limiters f) weirs or baffles g) and/or other similar/equivalent or appropriate systems. 3) silt fences, filter fabrics 4) In stream Sediments 5) collection sumps, temporary sumps, pumping systems 5) attenuation lagoons 6) sediment traps, stilling / settlement ponds
Water Treatment Controls:	1) Temporary sumps 2) attenuation ponds 3) Temporary storage lagoons 4) Sediment traps, Stilling / Settlement ponds 5) Proprietary settlement systems such as Siltbuster, and/or other similar/equivalent or appropriate systems. 6) Silt dewatering bags
Outfall Controls:	1) Levelspreaders 2) Buffered outfalls 3) Vegetation filters 4) Silt dewatering bags 5) Flow limiters and weirs



Drawing Legend :

Proposed Drainage
- Upstream Interceptor Ditches
- Direction of Flow
- Downstream Collector Ditches
- Settlement Pond (SP)
- Attenuation Pond (AP)
- Culvert
- Silt Fence (SF)
- Headland Drain
- Field Drain
- CR - New Stream/River Crossing Location
- Clear Span Bridge
- Existing Settlement Pond

- Application Boundary
- Existing Ground Surface Majour Contour (5 m Interval)
- Existing Ground Surface Minor Contour (1 m Interval)
- Rivers/Streams
- Lakes
- Natural Rivers/Streams 50m Buffer
- Drain 10m Buffer
- Lake 50m Buffer
- Turbine and Swept Area
- Turbine Foundation

- Regional Road
- Local Road
- Proposed Road
- Internal Existing Road to be Upgraded
- External Existing Road to be Upgraded
- Passing Bay
- Crane Platform
- Borrow Pit

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3. Do not scale off this drawing. Figured metric dimensions only should be taken off this drawing.
4. All dimensions are in metres.

Date	Description	Chkd	Signed

Revisions

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Client: MKO

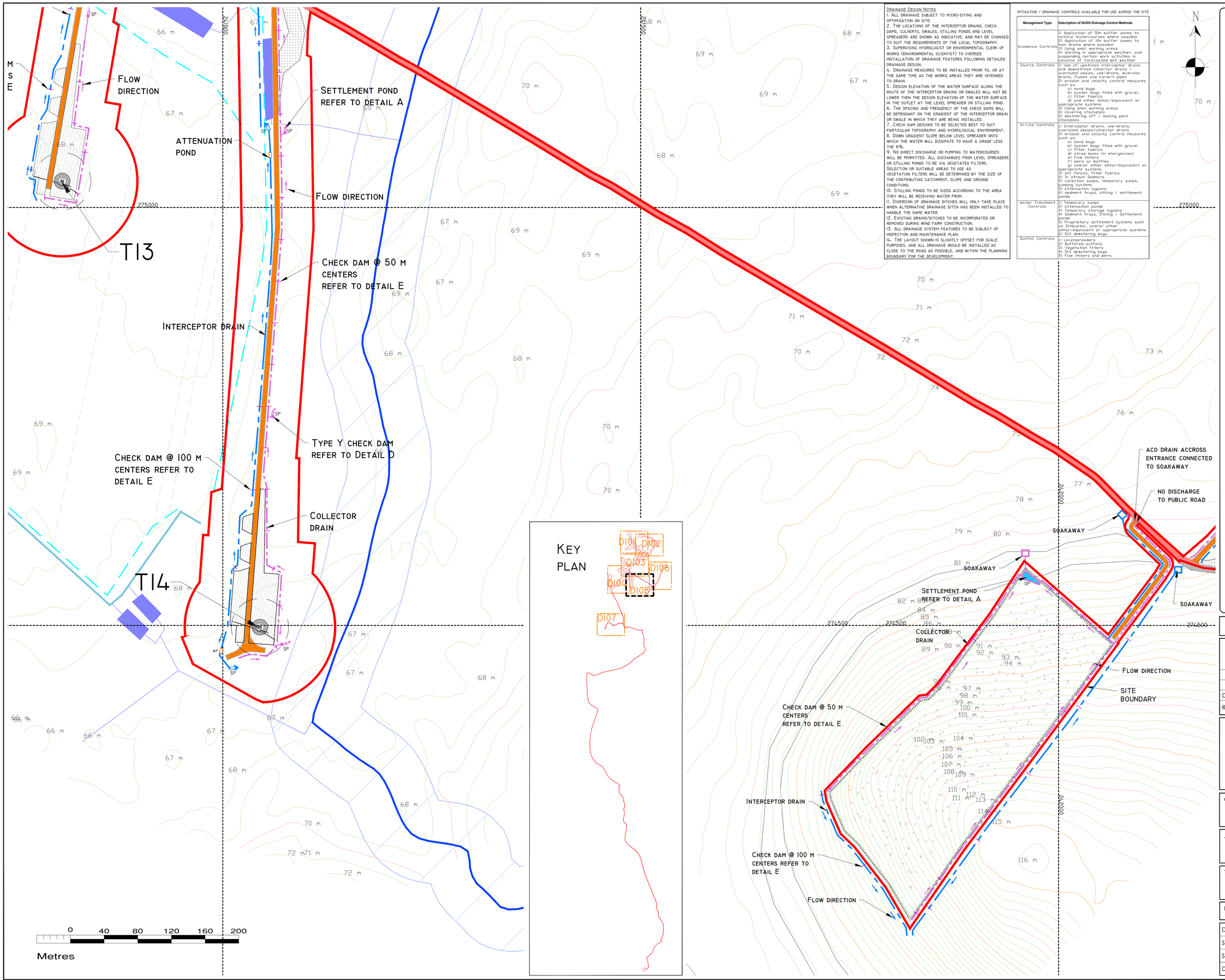
Job: Coole WF, Co. Westmeath

Title: Drainage Layout Sheet 4 of 7

Figure No: D104

Drawing No: P1320-2-0221-A1-D104-00A

Sheet Size: A1	Project No.: P1320-2
Scale: 1:2,000 (A1)	Drawn By: MG/GD
Date: 17/02/2021	Checked By: MG



DRAINAGE DESIGN NOTES

1. ALL DRAINAGE SUBJECT TO MICRO-SITING AND OPTIMISATION ON SITE.
2. THE LOCATIONS OF THE INTERCEPTOR DRAINS, CHECK DAMS, CULVERTS, SWALES, STILLING PONDS AND LEVEL SPREADERS ARE SHOWN AS INDICATIVE, AND MAY BE CHANGED TO SUIT THE REQUIREMENTS OF THE LOCAL TOPOGRAPHY.
3. SUPERVISING HYDROLOGIST OR ENVIRONMENTAL CLERK OF WORKS (ENVIRONMENTAL SCIENTIST) TO OVERSEE INSTALLATION OF DRAINAGE FEATURES FOLLOWING DETAILED DRAINAGE DESIGN.
4. DRAINAGE MEASURES TO BE INSTALLED PRIOR TO, OR AT THE SAME TIME AS THE WORKS AREAS THEY ARE INTENDED TO DRAIN.
5. DESIGN ELEVATION OF THE WATER SURFACE ALONG THE ROUTE OF THE INTERCEPTOR DRAINS OR SWALES WILL NOT BE LOWER THEN THE DESIGN ELEVATION OF THE WATER SURFACE IN THE OUTLET AT THE LEVEL SPREADER OR STILLING POND.
6. THE SPACING AND FREQUENCY OF THE CHECK DAMS WILL BE DEPENDANT ON THE GRADIENT OF THE INTERCEPTOR DRAIN OR SWALE IN WHICH THEY ARE BEING INSTALLED.
7. CHECK DAM DESIGNS TO BE SELECTED BEST TO SUIT PARTICULAR TOPOGRAPHY AND HYDROLOGICAL ENVIRONMENT.
8. DOWN GRADIENT SLOPE BELOW LEVEL SPREADER ONTO WHICH THE WATER WILL DISSIPATE TO HAVE A GRADE LESS THE 6%.
9. NO DIRECT DISCHARGE OR PUMPING TO WATERCOURSES WILL BE PERMITTED. ALL DISCHARGES FROM LEVEL SPREADERS OR STILLING PONDS TO BE VIA VEGETATED FILTERS. SELECTION OR SUITABLE AREAS TO USE AS VEGETATION FILTERS WILL BE DETERMINED BY THE SIZE OF THE CONTRIBUTING CATCHMENT, SLOPE AND GROUND CONDITIONS.
10. STILLING PONDS TO BE SIZED ACCORDING TO THE AREA THEY WILL BE RECEIVING WATER FROM.
11. DIVERSION OF DRAINAGE DITCHES WILL ONLY TAKE PLACE WHEN ALTERNATIVE DRAINAGE DITCH HAS BEEN INSTALLED TO HANDLE THE SAME WATER.
12. EXISTING DRAINS/DITCHES TO BE INCORPORATED OR REMOVED DURING WIND FARM CONSTRUCTION.
13. ALL DRAINAGE SYSTEM FEATURES TO BE SUBJECT OF INSPECTION AND MAINTENANCE PLAN.
14. THE LAYOUT SHOWN IS SLIGHTLY OFFSET FOR SCALE PURPOSES, AND ALL DRAINAGE WOULD BE INSTALLED AS CLOSE TO THE ROAD AS POSSIBLE, AND WITHIN THE PLANNING BOUNDARY FOR THE DEVELOPMENT.

MITIGATION / DRAINAGE COINTROLS AVAILABLE FOR USE ACROSS THE SITE

Management Type	Description of SUDS Drainage Control Methods
Avoidance Controls:	1) Application of 50m buffer zones to natural watercourses where possible 2) Application of 10m buffer zones to main drains where possible 3) Using small working areas 4) Working in appropriate weather, and suspending certain work activities in advance of forecasted wet weather
Source Controls:	1) Use of upstream interceptor drains and downstrean collector drains / oversized swales, vee-drains, diversion drains, flumes and culvert pipes 2) erosion and velocity control measures such as: a) sand bags b) oyster bags filled with gravel c) filter fabrics d) and other similar/equivalent or appropriate systems 3) Using small working areas 4) covering stockpiles 5) weathering off / sealing pest stockpiles
In-Line Controls:	1) Interceptor drains, vee-drains, oversized swales/collector drains 2) erosion and velocity control measures such as: a) sand bags b) oyster bags filled with gravel c) filter fabrics d) straw bales (in emergencies) e) Flow limiters f) weirs or baffles g) and/or other similar/equivalent or appropriate systems 3) silt fences, filter fabrics 4) In stream Sediments 5) collection sumps, temporary sumps, pumping systems 5) attenuation lagoons 6) sediment traps, stilling / settlement ponds
Water Treatment Controls:	1) Temporary sumps 2) attenuation ponds 3) Temporary storage lagoons 4) Sediment traps, Stilling / Settlement ponds 5) Proprietary settlement systems such as Siltbuster, and/or other similar/equivalent or appropriate systems. 6) Silt dewatering bags
Outfall Controls:	1) Levelspreaders 2) Buffered outfalls 3) Vegetation filters 4) Silt dewatering bags 5) Flow limiters and weirs

DRAWING LEGEND :

PROPOSED DRAINAGE
- UPSTREAM INTERCEPTOR DITCHES
- DIRECTION OF FLOW
- DOWNSTREAM COLLECTOR DITCHES
- SETTLEMENT POND (SP)
- ATTENUATION POND (AP)
- CULVERT
- SILT FENCE (SF)
- HEADLAND DRAIN
- FIELD DRAIN
- CR - NEW STREAM/RIVER CROSSING LOCATION
- CLEAR SPAN BRIDGE
- EXISTING SETTLEMENT POND

- APPLICATION BOUNDARY
- EXISTING GROUND SURFACE MAJOUR CONTOUR (5 M INTERVAL)
- EXISTING GROUND SURFACE MINOR CONTOUR (1 M INTERVAL)
- RIVERS/STREAMS
- LAKES
- NATURAL RIVERS/STREAMS 50M BUFFER
- DRAIN 10M BUFFER
- LAKE 50M BUFFER
- TURBINE AND SWEPT AREA
- TURBINE FOUNDATION
- REGIONAL ROAD
- LOCAL ROAD
- PROPOSED ROAD
- INTERNAL EXISTING ROAD TO BE UPGRADED
- EXTERNAL EXISTING ROAD TO BE UPGRADED
- PASSING BAY
- CRANE PLATFORM
- BORROW PIT

PROJECT DESIGN DRAWING NOTES

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6. THE USE OF OR RELIANCE UPON THIS DRAWING SHALL BE DEEMED TO BE ACCEPTANCE OF THESE CONDITIONS OF USE UNLESS OTHERWISE AGREED IN WRITING, SUCH WRITTEN AGREEMENT TO BE SOUGHT FROM AND ISSUED BY THE COPYRIGHT HOLDER TO THE USE OR RELIANCE UPON THIS DRAWING.
7. LAYOUT PLANS SHOW TYPICAL TURBINE ROTOR DIAMETER AS PER TURBINE DRAWING.

Date	Description	Chkd	Signed

Revisions

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Client: MKO

Job: COOLE WF, CO. WESTMEATH

Title: DRAINAGE LAYOUT SHEET 5 OF 7

Figure No: DI05

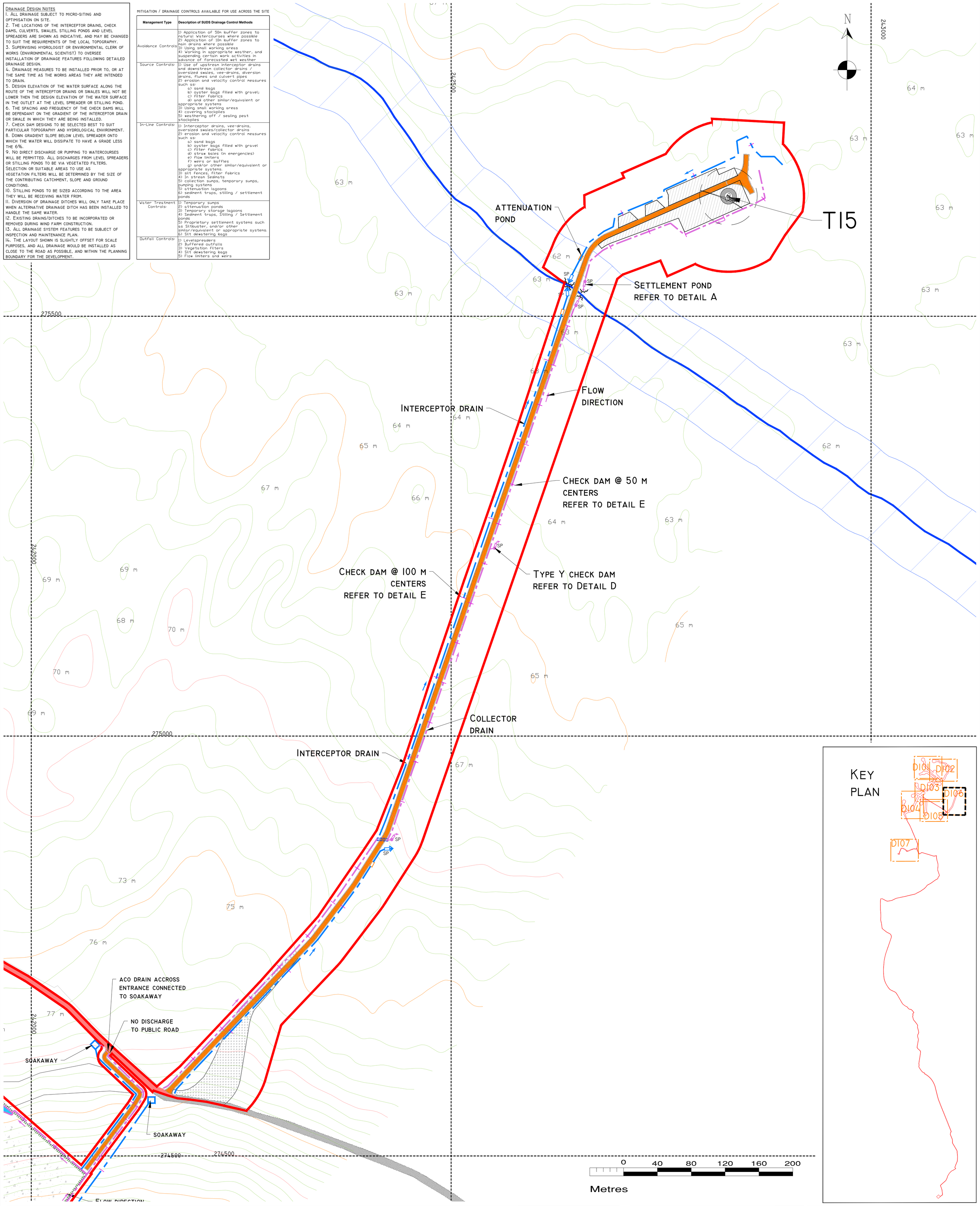
Drawing No: P1320-2-0221-A1-D105-00A	
Sheet Size: A1	Project No.: P1320-2
Scale: 1:2,000 (A1)	Drawn By: MG/GD
Date: 17/02/2021	Checked By: MG

Drainage Design Notes

1. All drainage subject to micro-siting and optimisation on site.
2. The locations of the interceptor drains, check dams, culverts, swales, stilling ponds and level spreaders are shown as indicative, and may be changed to suit the requirements of the local topography.
3. Supervising hydrologist or environmental clerk of works (environmental scientist) to oversee installation of drainage features following detailed drainage design.
4. Drainage measures to be installed prior to, or at the same time as the works areas they are intended to drain.
5. Design elevation of the water surface along the route of the interceptor drains or swales will not be lower then the design elevation of the water surface in the outlet at the level spreader or stilling pond.
6. The spacing and frequency of the check dams will be dependant on the gradient of the interceptor drain or swale in which they are being installed.
7. Check dam designs to be selected best to suit particular topography and hydrological environment.
8. Down gradient slope below level spreader onto which the water will dissipate to have a grade less the 6%.
9. No direct discharge or pumping to watercourses will be permitted. All discharges from level spreaders or stilling ponds to be via vegetated filters. Selection or suitable areas to use as vegetation filters will be determined by the size of the contributing catchment, slope and ground conditions.
10. Stilling ponds to be sized according to the area they will be receiving water from.
11. Diversion of drainage ditches will only take place when alternative drainage ditch has been installed to handle the same water.
12. Existing drains/ditches to be incorporated or removed during wind farm construction.
13. All drainage system features to be subject of inspection and maintenance plan.
14. The layout shown is slightly offset for scale purposes, and all drainage would be installed as close to the road as possible, and within the planning boundary for the development.

Mitigation / Drainage Cointrols available for use across the site

Management Type	Description of SUDS Drainage Control Methods
Avoidance Controls:	1) Application of 50m buffer zones to natural Watercourses where possible 2) Application of 10m buffer zones to main drains where possible 3) Using small working areas 4) Working in appropriate weather, and suspending certain work activities in advance of forecasted wet weather
Source Controls:	1) Use of upstream interceptor drains and downstream collector drains / oversized swales, vee-drains, diversion drains, flumes and culvert pipes 2) erosion and velocity control measures such as: a) sand bags b) oyster bags filled with gravel; c) filter fabrics d) and other similar/equivalent or appropriate systems 3) Using small working areas 4) covering stockpiles 5) weathering off / sealing peat stockpiles
In-Line Controls:	1) Interceptor drains, vee-drains, oversized swales/collector drains 2) erosion and velocity control measures such as: a) sand bags b) oyster bags filled with gravel c) filter fabrics d) straw bales (in emergencies) e) flow limiters f) weirs or baffles g) and/or other similar/equivalent or appropriate systems. 3) silt fences, filter fabrics 4) In stream Sediments 5) collection sumps, temporary sumps, pumping systems 5) attenuation lagoons 6) sediment traps, stilling / settlement ponds
Water Treatment Controls:	1) Temporary sumps 2) attenuation ponds 3) Temporary storage lagoons 4) Sediment traps, Stilling / Settlement ponds 5) Proprietary settlement systems such as Siltbuster, and/or other similar/equivalent or appropriate systems. 6) Silt dewatering bags
Outfall Controls:	1) Levelspreaders 2) Buffered outfalls 3) Vegetation filters 4) Silt dewatering bags 5) Flow limiters and weirs



0 40 80 120 160 200

Metres

Drawing Legend :

- Upstream Interceptor Ditches
- Direction of Flow
- Downstream Collector Ditches
- Settlement Pond (SP)
- Attenuation Pond (AP)
- culvert
- silt fence (SF)
- headland drain
- field drain
- CR - new stream/river crossing location
- clear span bridge
- existing settlement pond

Proposed Drainage

- application boundary
- Existing ground surface majour contour (5 m interval)
- Existing ground surface minor contour (1 m interval)
- rivers/streams
- Lakes
- natural rivers/streams 50m buffer
- drain 10m buffer
- Lake 50m buffer
- turbine and swept area
- turbine foundation
- regional road
- local road
- proposed road
- internal existing road to be upgraded
- external existing road to be upgraded
- passing bay
- crane platform
- borrow pit

Drawing Notes

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4. All dimensions are in metres.

Date	Description	Chkd	Signed

Revisions

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web: www.hydroenvironmental.ie

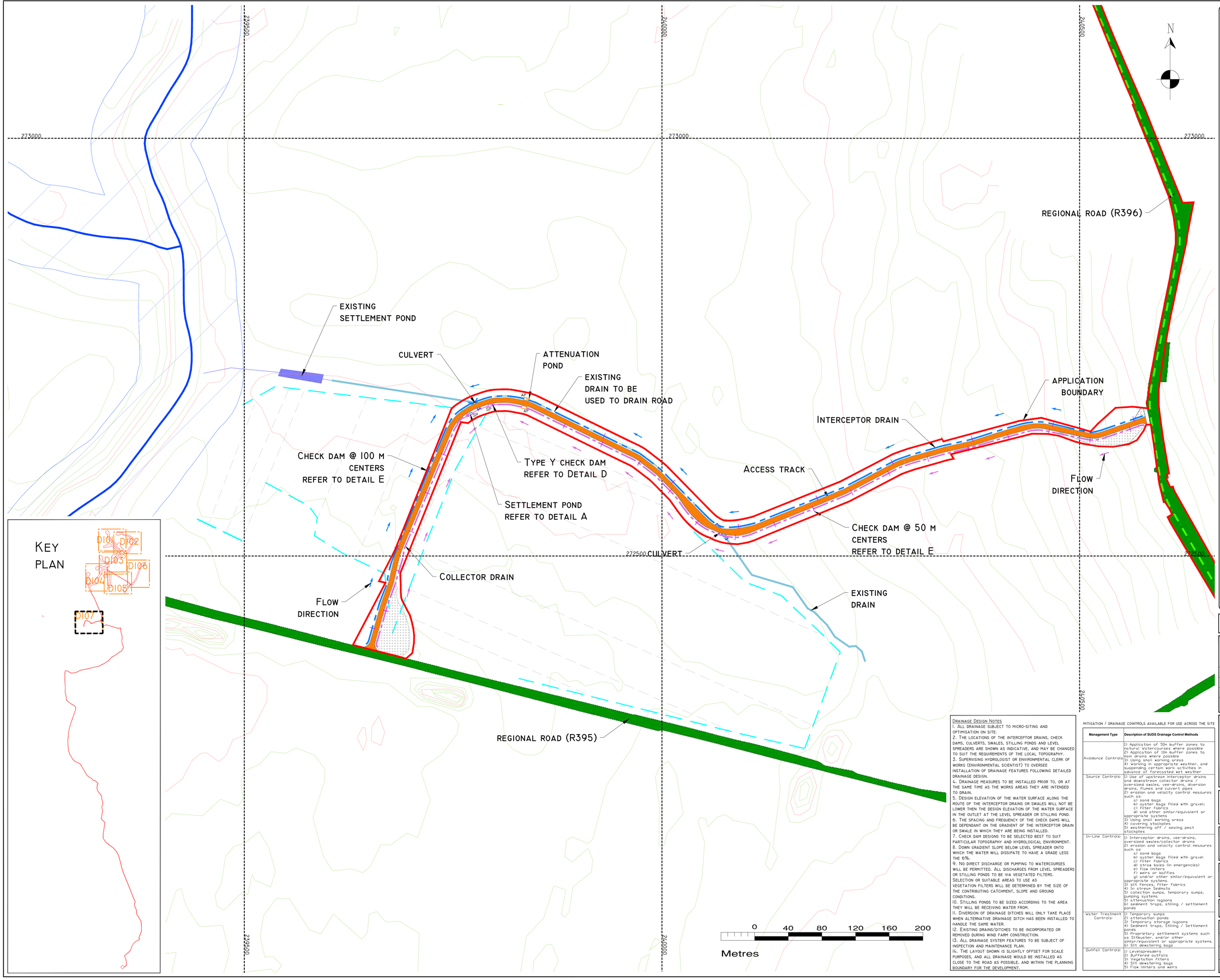
Client: MKO

Job: Coole WF, Co. Westmeath

Title: Drainage Layout Sheet 6 of 7

Figure No: D106

Drawing No: P1320-2-0221-A1-D106-00A	
Sheet Size: A1	Project No.: P1320-2
Scale: 1:2,000 (A1)	Drawn By: MG/GD
Date: 17/02/2021	Checked By: MG



KEY PLAN

DRAWING LEGEND :

PROPOSED DRAINAGE

- UPSTREAM INTERCEPTOR DITCHES
- DIRECTION OF FLOW
- DOWNSTREAM COLLECTOR DITCHES
- SETTLEMENT POND (SP)
- ATTENUATION POND (AP)
- CULVERT
- SILT FENCE (SF)
- HEADLAND DRAIN
- FIELD DRAIN
- CR - NEW STREAM/RIVER CROSSING LOCATION
- CLEAR SPAN BRIDGE
- EXISTING SETTLEMENT POND

- APPLICATION BOUNDARY
- EXISTING GROUND SURFACE MAJOUR CONTOUR (5 M INTERVAL)
- EXISTING GROUND SURFACE MINOR CONTOUR (1 M INTERVAL)
- RIVERS/STREAMS
- LAKES
- NATURAL RIVERS/STREAMS 50M BUFFER
- DRAIN 10M BUFFER
- LAKE 50M BUFFER
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- TURBINE FOUNDATION
- REGIONAL ROAD
- LOCAL ROAD
- PROPOSED ROAD
- INTERNAL EXISTING ROAD TO BE UPGRADED
- EXTERNAL EXISTING ROAD TO BE UPGRADED
- PASSING BAY
- CRANE PLATFORM
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7. LAYOUT PLANS SHOW TYPICAL TURBINE ROTOR DIAMETER AS PER TURBINE DRAWING.

Date	Description	Chkd	Signed

Revisions

DRAINAGE DESIGN NOTES

1. ALL DRAINAGE SUBJECT TO MICRO-SITING AND OPTIMISATION ON SITE.
2. THE LOCATIONS OF THE INTERCEPTOR DRAINS, CHECK DAMS, CULVERTS, SWALES, STILLING PONDS AND LEVEL SPREADERS ARE SHOWN AS INDICATIVE, AND MAY BE CHANGED TO SUIT THE REQUIREMENTS OF THE LOCAL TOPOGRAPHY.
3. SUPERVISING HYDROLOGIST OR ENVIRONMENTAL CLERK OF WORKS (ENVIRONMENTAL SCIENTIST) TO OVERSEE INSTALLATION OF DRAINAGE FEATURES FOLLOWING DETAILED DRAINAGE DESIGN.
4. DRAINAGE MEASURES TO BE INSTALLED PRIOR TO, OR AT THE SAME TIME AS THE WORKS AREAS THEY ARE INTENDED TO DRAIN.
5. DESIGN ELEVATION OF THE WATER SURFACE ALONG THE ROUTE OF THE INTERCEPTOR DRAINS OR SWALES WILL NOT BE LOWER THEN THE DESIGN ELEVATION OF THE WATER SURFACE IN THE OUTLET AT THE LEVEL SPREADER OR STILLING POND.
6. THE SPACING AND FREQUENCY OF THE CHECK DAMS WILL BE DEPENDANT ON THE GRADIENT OF THE INTERCEPTOR DRAIN OR SWALE IN WHICH THEY ARE BEING INSTALLED.
7. CHECK DAM DESIGNS TO BE SELECTED BEST TO SUIT PARTICULAR TOPOGRAPHY AND HYDROLOGICAL ENVIRONMENT.
8. DOWN GRADIENT SLOPE BELOW LEVEL SPREADER ONTO WHICH THE WATER WILL DISSIPATE TO HAVE A GRADE LESS THE 6%.
9. NO DIRECT DISCHARGE OR PUMPING TO WATERCOURSES WILL BE PERMITTED. ALL DISCHARGES FROM LEVEL SPREADERS OR STILLING PONDS TO BE VIA VEGETATED FILTERS. SELECTION OR SUITABLE AREAS TO USE AS VEGETATION FILTERS WILL BE DETERMINED BY THE SIZE OF THE CONTRIBUTING CATCHMENT, SLOPE AND GROUND CONDITIONS.
10. STILLING PONDS TO BE SIZED ACCORDING TO THE AREA THEY WILL BE RECEIVING WATER FROM.
11. DIVERSION OF DRAINAGE DITCHES WILL ONLY TAKE PLACE WHEN ALTERNATIVE DRAINAGE DITCH HAS BEEN INSTALLED TO HANDLE THE SAME WATER.
12. EXISTING DRAINS/DITCHES TO BE INCORPORATED OR REMOVED DURING WIND FARM CONSTRUCTION.
13. ALL DRAINAGE SYSTEM FEATURES TO BE SUBJECT OF INSPECTION AND MAINTENANCE PLAN.
14. THE LAYOUT SHOWN IS SLIGHTLY OFFSET FOR SCALE PURPOSES, AND ALL DRAINAGE WOULD BE INSTALLED AS CLOSE TO THE ROAD AS POSSIBLE, AND WITHIN THE PLANNING BOUNDARY FOR THE DEVELOPMENT.

MITIGATION / DRAINAGE CONTROLS AVAILABLE FOR USE ACROSS THE SITE

Management Type	Description of SUDS Drainage Control Methods
Avoidance Controls	1) Application of 50m buffer zones to natural Watercourses where possible 2) Application of 10m buffer zones to main drains where possible 3) Using small working areas 4) Working in appropriate weather, and suspending certain work activities in advance of forecasted wet weather
Source Controls	1) Use of upstream interceptor drains and downstream collector drains / oversized swales, vee-drains, diversion drains, flumes and culvert pipes 2) erosion and velocity control measures such as a) sand bags b) oyster bags filled with gravel; c) filter fabrics d) and other similar/equivalent or appropriate systems 3) Using small working areas 4) covering stockpiles 5) weathering off / sealing peat stockpiles
In-Line Controls	1) Interceptor drains, vee-drains, oversized swales/collector drains 2) erosion and velocity control measures such as a) sand bags b) oyster bags filled with gravel c) filter fabrics d) straw bales (in emergencies) e) flow inters f) weirs or baffles g) and/or other similar/equivalent or appropriate systems. 3) silt fences, filter fabrics 4) In stream Sedmats 5) collection sumps, temporary sumps, pumping systems 5) attenuation lagoons 6) sediment traps, stilling / settlement ponds
Water Treatment Controls	1) Temporary sumps 2) attenuation ponds 3) Temporary storage lagoons 4) Sediment traps, Stilling / Settlement ponds 5) Proprietary settlement systems such as Siltbuster, and/or other similar/equivalent or appropriate systems. 6) Silt dewatering bags
Outfall Controls	1) Levelspreaders 2) Buffered outfalls 3) Vegetation filters 4) Silt dewatering bags 5) Flow limiters and weirs

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Client: MKO

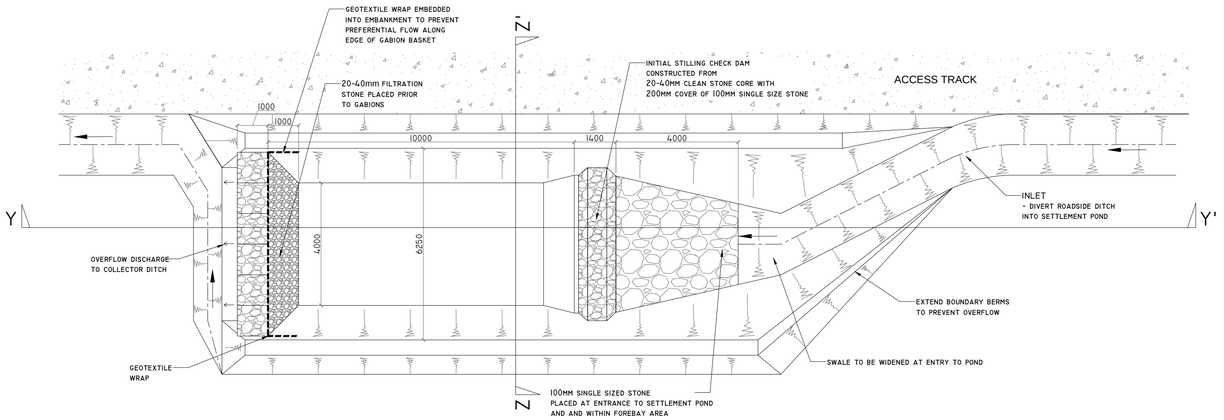
Job: COOLE WF, CO. WESTMEATH

Title: DRAINAGE LAYOUT SHEET 7 OF 7

Figure No: DI07

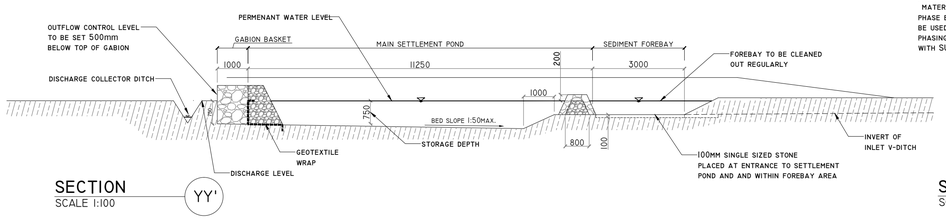
Drawing No: P1320-2-0221-A1-D107-00A	
Sheet Size: A1	Project No.: P1320-2
Scale: 1:2,000 (A1)	Drawn By: MG/GD
Date: 17/02/2021	Checked By: MG

DETAIL A



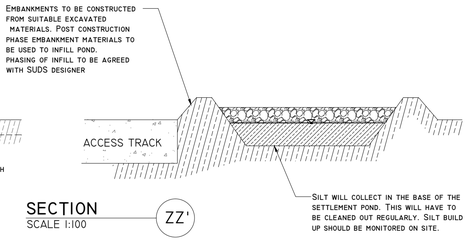
TYPICAL ROAD SIDE SETTLEMENT POND DETAIL

SCALE 1:200 (NOTE DIMENSIONS VARY DEPENDING ON CATCHMENT SIZE)



SECTION YY'

SCALE 1:100



SECTION ZZ'

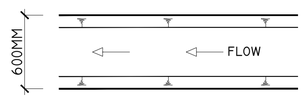
SCALE 1:100

DETAIL B

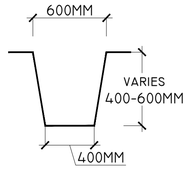
PEAT DITCH SILT TRAP

SCALE 1:25

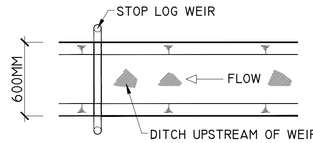
PLAN - EXISTING PEAT DITCH



CROSS SECTION



PLAN - PEAT DITCH SILT TRAP



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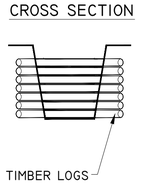
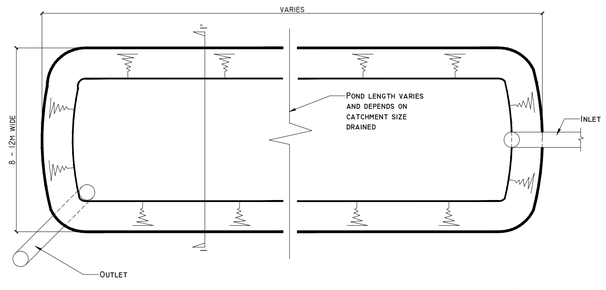


DETAIL C

TYPICAL PEATLAND SITE SETTLEMENT POND DETAIL

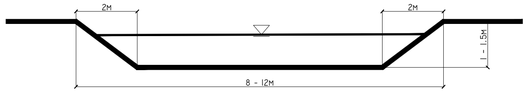
SCALE 1:200

PLAN



SECTION II'

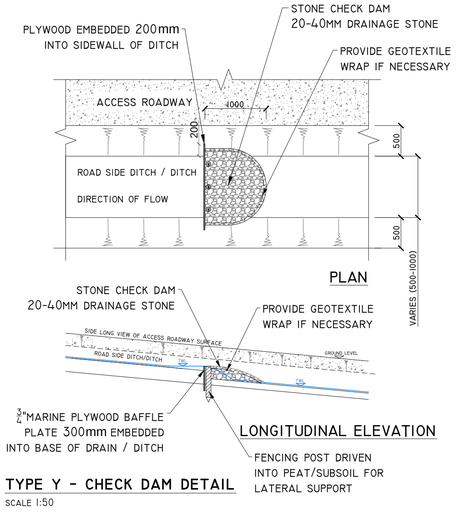
SCALE 1:100



NOTES-

- ALL SETTLEMENT PONDS OPERATE TO LICENCE REQUIREMENTS OF IPPC LICENCE REG No. P0914-01 AND P0974-01.
- SIZING LIKELY BASED ON ACCUMULATION OF 100 M^3/HA/YEAR SILT
- PONDS TYPICALLY CLEANED MINIMUM TWICE A YEAR (I.E. SILT DESIGN CAPACITY OF LAGOONS, MIN 50 M^3 PER NET HA OF BOG SERVICED), ONCE BEFORE DITCHING AND ONCE BEFORE HARVESTING, OR AS INSPECTIONS MAY DICTATE
- GENERALLY - 8 - 12 M WIDE, AND 1 - 1.5 M DEEP
- LIKELY VELOCITY THRESHOLD OF 0.1 M/SEC

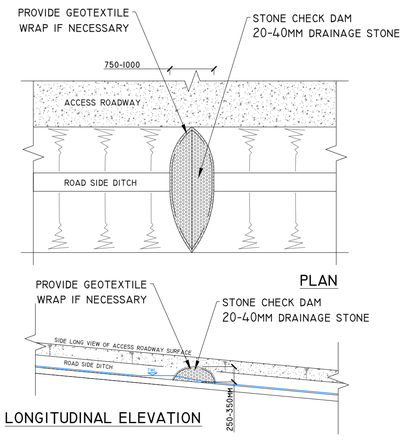
DETAIL D



TYPE Y - CHECK DAM DETAIL

SCALE 1:50

DETAIL E



TYPE X - CHECK DAM DETAIL

SCALE 1:50

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7. DRAINAGE SYSTEMS ARE OFFSET AT A DISTANCE APPROPRIATE TO THE SCALE OF THIS DRAWING. ALL DRAINAGE WILL BE LOCATED ADJACENT TO INFRASTRUCTURE, AS APPROPRIATE ACROSS THE SITE.

DRAINAGE DESIGN NOTES

1. ALL DRAINAGE SUBJECT TO MICRO-SITING AND OPTIMISATION ON SITE.
2. THE LOCATIONS OF THE INTERCEPTOR DRAINS, CHECK DAMS, CULVERTS, SWALES, SETTLEMENT PONDS AND LEVEL SPREADERS ARE SHOWN AS INDICATIVE, AND MAY BE CHANGED TO SUIT THE REQUIREMENTS OF THE LOCAL TOPOGRAPHY.
3. SUPERVISING HYDROLOGIST OR ENVIRONMENTAL CLERK OF WORKS (ENVIRONMENTAL SCIENTIST) TO OVERSEE INSTALLATION OF DRAINAGE FEATURES FOLLOWING DETAILED DRAINAGE DESIGN.
4. DRAINAGE MEASURES TO BE INSTALLED PRIOR TO, OR AT THE SAME TIME AS THE WORKS AREAS THEY ARE INTENDED TO DRAIN.
5. DESIGN ELEVATION OF THE WATER SURFACE ALONG THE ROUTE OF THE INTERCEPTOR DRAINS OR SWALES WILL NOT BE LOWER THEN THE DESIGN ELEVATION OF THE WATER SURFACE IN THE OUTLET AT THE LEVEL SPREADER OR SETTLEMENT POND.
6. THE SPACING AND FREQUENCY OF THE CHECK DAMS WILL BE DEPENDANT ON THE GRADIENT OF THE INTERCEPTOR DRAIN OR SWALE IN WHICH THEY ARE BEING INSTALLED.
7. CHECK DAM DESIGNS TO BE SELECTED BEST TO SUIT PARTICULAR TOPOGRAPHY AND HYDROLOGICAL ENVIRONMENT.
8. DOWN GRADIENT SLOPE BELOW LEVEL SPREADER ONTO WHICH THE WATER WILL DISSIPATE TO HAVE A GRADE <6%.
9. NO DIRECT DISCHARGE OR PUMPING TO WATERCOURSES WILL BE PERMITTED. ALL DISCHARGES FROM LEVEL SPREADERS OR STILLING PONDS TO BE VIA VEGETATED FILTERS. SELECTION OF SUITABLE AREAS TO USE AS VEGETATION FILTERS WILL BE DETERMINED BY THE SIZE OF THE CONTRIBUTING CATCHMENT, SLOPE AND GROUND CONDITIONS.
10. SETTLEMENT PONDS TO BE SIZED ACCORDING TO THE CATCHMENT AREA THEY WILL BE RECEIVING WATER FROM.
11. DIVERSION OF DRAINAGE DITCHES WILL ONLY TAKE PLACE WHEN ALTERNATIVE DRAINAGE DITCH HAS BEEN INSTALLED TO HANDLE THE SAME WATER.
12. EXISTING DRAINS/DITCHES TO BE INCONPORATED OR REMOVED DURING WIND FARM CONSTRUCTION.
13. ALL DRAINAGE SYSTEM FEATURES TO BE SUBJECT OF INSPECTION AND MAINTENANCE PLAN.
14. THE LAYOUT SHOWN IS SLIGHTLY OFFSET FOR SCALE PURPOSES, AND ALL DRAINAGE WILL BE INSTALLED AS CLOSE TO ACCESS TRACKS/ROADS AS POSSIBLE.

Date	Description	Chkd	Signed
08.02.21	Planning - Rev A	M.G.	M.Gill

Revisions

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Client: MKO

Job: COOLE WF, CO. WESTMEATH

Title: DRAINAGE DETAILS I

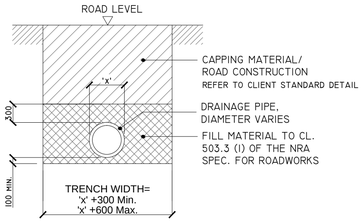
Figure No: 501

Drawing No: P1320--2-0221-A1-501-00A	
Sheet Size: A1	Project No.: P1320-2
Scale: as shown (A1)	Drawn By: M.Gill
Date: 17/02/2021	Checked By: M.G.

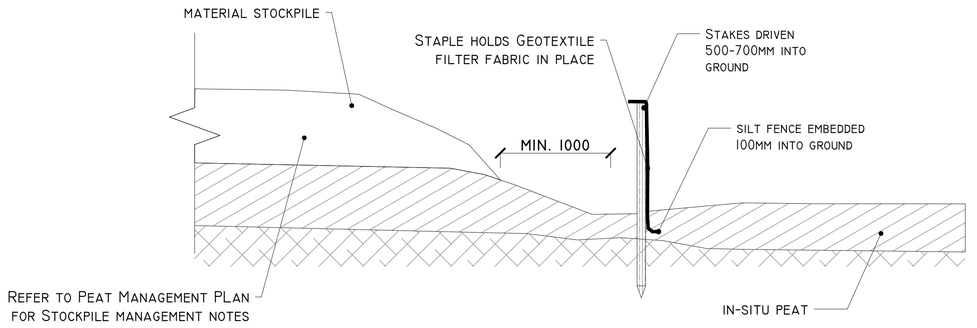
DETAIL F

'TYPE B' CULVERT - DRAINAGE CROSSING BENEATH EXCAVATED ROAD

SCALE 1:50



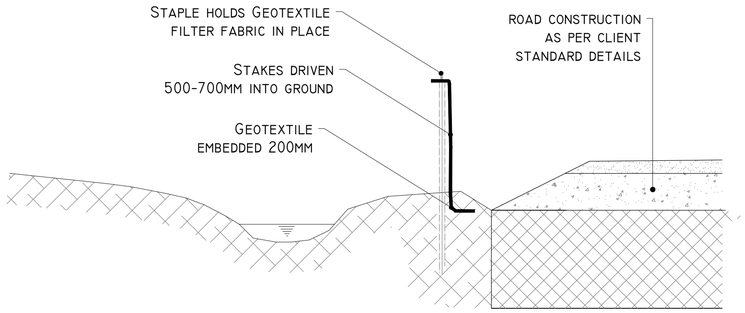
DETAIL G-I



SILT FENCE

SCALE 1:25

DETAIL G-II



SILT FENCE FOR WATERCOURSE PROTECTION

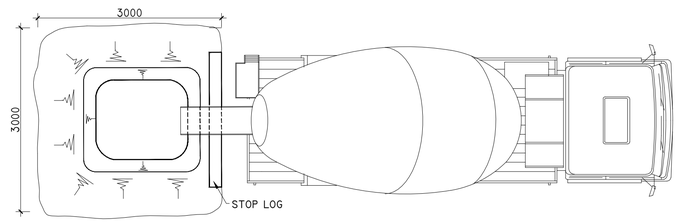
SCALE 1:25

DETAIL I

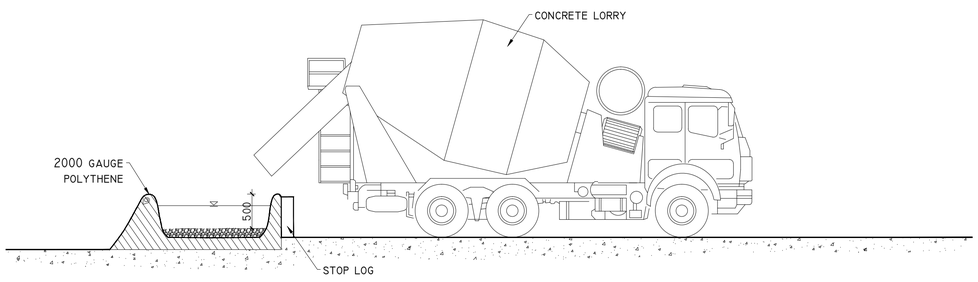
TEMPORARY CONCRETE WASH OUT PIT

SCALE 1:25

PLAN



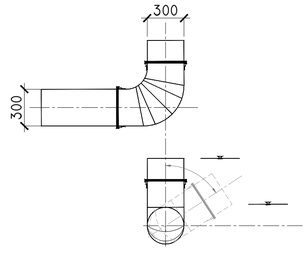
ELEVATION



DETAIL H

90° U BEND AND WATER LEVEL CONTROL MECHANISM

SCALE 1:25



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6. The use of or reliance upon this drawing shall be deemed to be acceptance of these conditions of use unless otherwise agreed in writing, such written agreement to be sought from and issued by the copyright holder to the use or reliance upon this drawing.
7. Drainage systems are offset at a distance appropriate to the scale of this drawing. All drainage will be located adjacent to infrastructure, as appropriate across the site.

Drainage Design Notes

1. All drainage subject to micro-siting and optimisation on site.
2. The locations of the interceptor drains, check dams, culverts, swales, settlement ponds and level spreaders are shown as indicative, and may be changed to suit the requirements of the local topography.
3. Supervising hydrologist or environmental clerk of works (environmental scientist) to oversee installation of drainage features following detailed drainage design.
4. Drainage measures to be installed prior to, or at the same time as the works areas they are intended to drain.
5. Design elevation of the water surface along the route of the interceptor drains or swales will not be lower then the design elevation of the water surface in the outlet at the level spreader or settlement pond.
6. The spacing and frequency of the check dams will be dependant on the gradient of the interceptor drain or swale in which they are being installed.
7. Check dam designs to be selected best to suit particular topography and hydrological environment.
8. Down gradient slope below level spreader onto which the water will dissipate to have a grade <6%.
9. No direct discharge or pumping to watercourses will be permitted. All discharges from level spreaders or stilling ponds to be via vegetated filters. Selection or suitable areas to use as vegetation filters will be determined by the size of the contributing catchment, slope and ground conditions.
10. Settlement ponds to be sized according to the catchment area they will be receiving water from.
11. Diversion of drainage ditches will only take place when alternative drainage ditch has been installed to handle the same water.
12. Existing drains/ditches to be incorporated or removed during wind farm construction.
13. All drainage system features to be subject of inspection and maintenance plan.
14. The layout shown is slightly offset for scale purposes, and all drainage will be installed as close to access tracks/roads as possible.

Date	Description	Chkd	Signed
08.02.21	Planning - Rev A	M.G.	M.Gill

Revisions

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Client: MKO

Job: Colle WF, Co. Westmeath

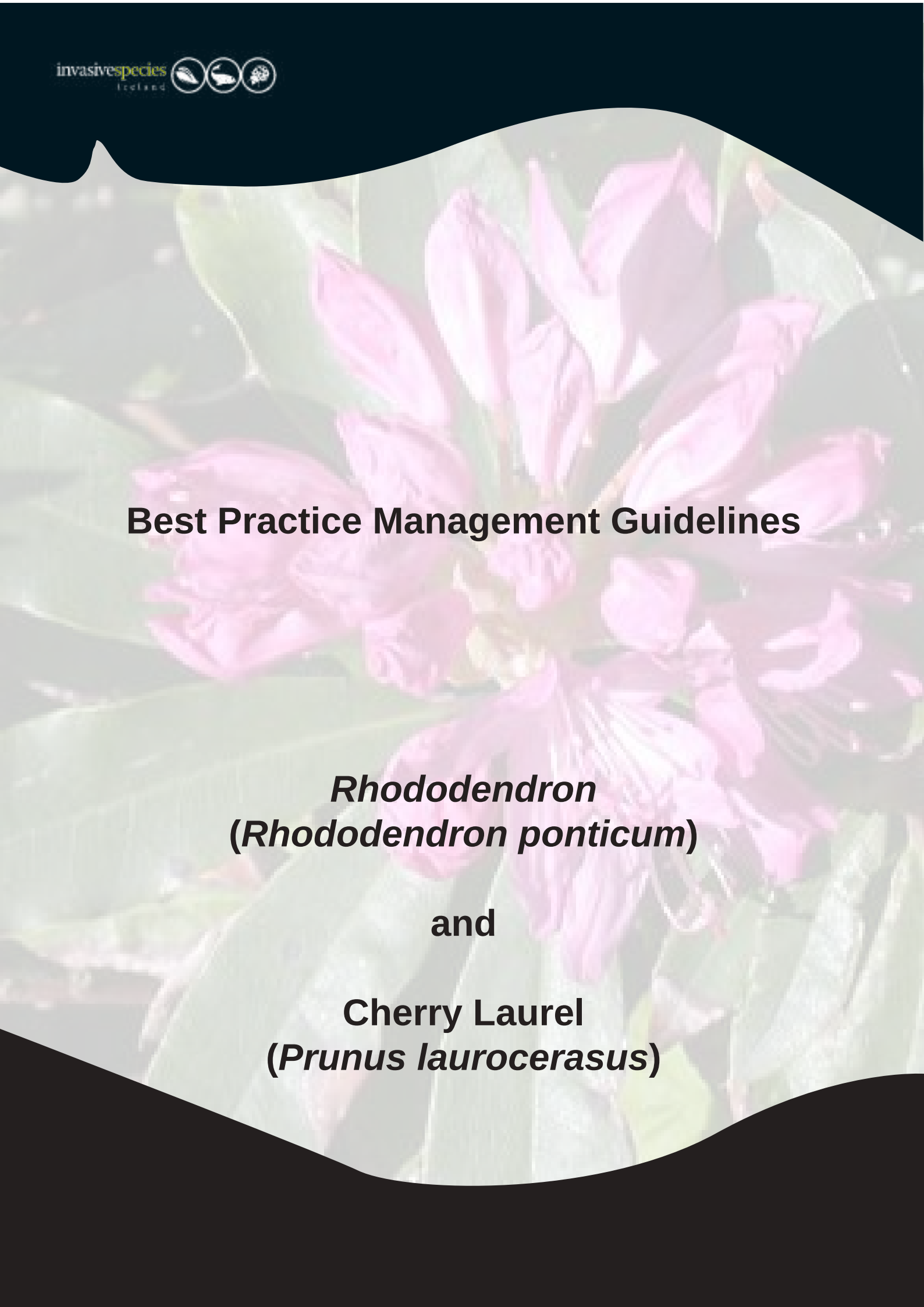
Title: Drainage Details 2

Figure No: 502

Drawing No: P1320--2-0221-A1-502-00A	
Sheet Size: A1	Project No.: P1320-2
Scale: as shown (A1)	Drawn By: M.Gill
Date: 17/02/21	Checked By: M.G.

APPENDIX 5

BEST PRACTICE GUIDELINES FOR THE CONTROL OF INVASIVE SPECIES



Best Practice Management Guidelines

Rhododendron (*Rhododendron ponticum*)

and

Cherry Laurel (*Prunus laurocerasus*)

1. Aim of this advice

This document provides best practice management guidelines on the control of *Rhododendron ponticum* and Cherry Laurel (*Prunus laurocerus*) on the island of Ireland.

2. Introduction

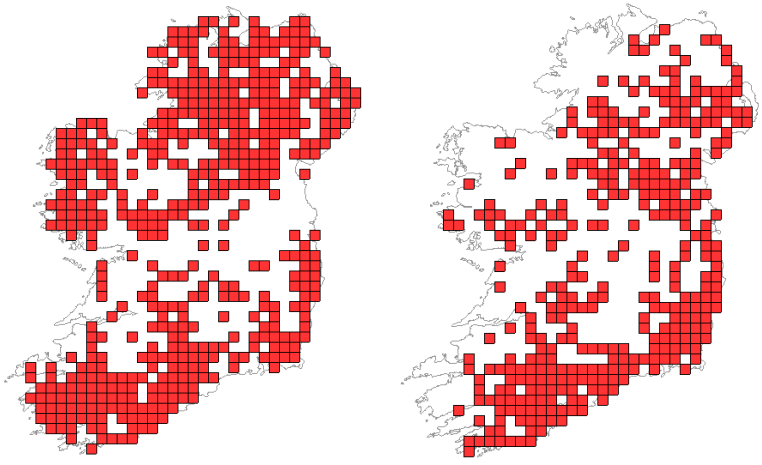
2.1. *Rhododendron*

Rhododendron is a large evergreen shrub (growing up to 8m tall) that was introduced to Ireland as an ornamental plant in the 18th Century from Asia and north-west China. There are more than 900 species of *Rhododendron*, but only one type, *Rhododendron ponticum* is invasive in Ireland. It has dark green waxy, oblong leaves and conspicuous pinkish purple or lilac flowers on 2-4cm stalks although hybrids and cultivated varieties can vary in colour. Flowering occurs in spring and summer with plants capable of producing large quantities of viable seed, which can persist to create a seed-bank in the soil. *Rhododendron* can also propagate itself by vegetative means, both by suckering from roots and by layering wherever branches touch the ground.

Rhododendron thrives on peaty, sandy and acidic soils and is extremely hardy. It is a very popular garden ornamental plant and has been extensively planted as game cover along the edges of fields and within woodlands. Its popularity, adaptability to Irish climate and soils along with its highly successful and multiple methods of reproduction and dispersal means that it has become naturalised and widespread. As *Rhododendron* is very shade tolerant, it has become widely established in several habitats, notably heathlands and woodlands from adjacent gardens.

2.2. Cherry Laurel

Cherry Laurel is a dense thicket forming invasive ever-green shrub of gardens, parks and woodlands from South West Asia. The leaves are thick and laurel-like, poisonous with cyanide, the white flowers are produced on upright spikes and are succeeded in autumn by blackish cherry-like fruits which should not be eaten.



Distribution of *Rhododendron ponticum* in Ireland (right) and Cherry Laurel (left). Source of data: National Biodiversity Network; accessed 07 April 2008.

2. Impacts

Rhododendron and Cherry Laurel are extremely invasive plant species, particularly in the more humid western parts of Ireland forming dense impenetrable thickets. Both species are unpalatable and likely toxic to mammals and probably invertebrates due to the presence of 'free' phenols and diterpenes in *Rhododendron* and cyanide in Cherry Laurel. They are both avoided by grazing animals, thus giving them significant advantages over native species. The deep shadow cast by the plants and toxic leaf litter accumulating underneath *Rhododendron* produces a dark sterile environment, which suppresses regeneration of native species and supports little wildlife. Changes in soil chemistry induced by *Rhododendron* have also been reported. Animal populations can also be negatively influenced by *Rhododendron* e.g. bird numbers are lower in mature oak woodlands dominated by *Rhododendron*.

In Ireland, *Rhododendron* has invaded three habitats of international importance under the EC Habitats Directive: upland oak woods, bogs and heath. For example, it is now a widespread invasive species in Killarney, where >650 acres of the Killarney National Park are completely infested.

Rhododendron in Ireland hosts a serious plant health pathogen *Phytophthora ramorum.* This is a fungus that has the potential to attack a wide variety of native woody plants and is the causative agent of 'Sudden Oak Death'. On *Rhododendron*, the first indication of the disease is wilting of shoots. These develop a brown/black colour that spreads along the twig and can move onto the leaves, where the leaf bases and tips blacken. The fungus has been recorded in Northern Ireland and DARD has identified this species as likely to cause significant damage to trees and landscapes if it establishes widely. Consequently, *Rhododendron* is one of the biggest conservation issues facing Irish woodlands today.

There are reported cases of human poisoning by 'toxic' honey from *Rhododendron*. The severity of the reaction probably relates to the amount of affected honey digested and the health and susceptibility of the individual concerned.

3. Legal status

There are no specific legal provisions associated with growing of *Rhododendron* or Cherry Laurel on the island of Ireland. However, all management methods described here should be carried out with due care and attention, with particular consideration to health and safety requirements and, where necessary, by trained and competent personnel. All waste not dealt with on site should be taken to a licensed landfill site.

Under the EU Plant Health Directive, emergency legislation was introduced in 2002 to prevent the introduction and spread of *Phytophthora ramorum* within the EU. If suspicious symptoms are observed on *Rhododendron* or any other tree species, the Forest Service (ROI) / DARD (NI) should be informed.

4. Managing *Rhododendron* and Cherry Laurel

The management and eradication of *Rhododendron* and Cherry Laurel is challenging. Understanding the ecology of the species and carefully planning clearance work will ensure success. Clearance can be expensive and time consuming, and should be well planned before any action is taken.

5. Control and eradication

Three main issues must be considered when planning management/control. These are:

• *Rhododendron* in Ireland is a prolific seed producer. However, a naturally seeded plant does not flower and produce seed until at least 10-12 years old. This provides a window of opportunity to prevent serious infestation, through the immediate removal of young plants.

• *Rhododendron* regrows vigorously when cut. As a result, some method of stump killing or removal is always necessary. Any untreated cut stump will regrow and in most cases flower within 3-4 years.

• The scale and nature of the site infestation. Adjacent garden/land owners should be encouraged to control *Rhododendron* at the same time as clearance on your site.

6. Rhododendron and Cherry Laurel on adjacent sites

It is important to consider populations in the wider environment around the site. If *Rhododendron* is growing profusely on adjacent land, or upstream, then recolonisation of recently cleared sites is possible. Discussion with neighbouring land owners on the issues involved and your intended actions, may help encourage them to remove or not plant *Rhododendron* and Cherry Laurel as ornamental or hedging species.

For all sites, the following six steps may be usefull to ensure success:

1. Find out how much *Rhododendron* and/or Cherry Laurel there is on the property and map it if possible.

2. Note the age, condition and previous treatments at your site. Use this information to guide your control programme.

3. Areas should be prioritised. It may be easier to clear less heavily infested areas to begin with or sites where seed production has not yet occurred. Also, ideally work with prevailing wind direction, rather than against it, to help minimise seed dispersal into recently cleared areas.

4. Create suitable conditions for the recovery of native ground flora. This will reduce open areas for recolonisation.

5. Write a Management Plan to guide your work. Including timeframes for planned clearance and repeated treatments.

6. Follow-up work will be necessary to ensure that any small plants and seedlings have not been missed.

7. Treatment options

Treatment programmes can be divided into 3 main stages: initial removal, control of stems and roots, and follow up. The following treatment options have been widely tested and measured for effectiveness across Ireland. In almost all cases, failures can be accredited to poor application of a particular technique and/or logistical difficulties, rather than the control method itself. Care should be taken when embarking on a control programme and resources should be identified and allocated for repeated treatments.

8. Successfully managing *Rhododendron*

Cut and remove stems by hand or chainsaw, cutting as close to the ground as possible to remove above ground growth. Chip or remove the cut material from the area to allow for effective follow-up work and prevent regrowth. Chipped material can provide good weed barrier around ornamental garden areas. Flailing has also been effectively used in Ireland to treat young or immature growth. Although not suitable on all sites and locations, especially steeply sloping or wet sites, it is very effective as it breaks up woody stems upon contact.

The removal of above ground growth will not prevent regrowth as *Rhododendron* will regrow from cut stems and stumps. There are four recommended methods to achieve successful management after the initial cut and removal:

1. Digging the stumps out. The effectiveness of this technique is increased by removing all viable roots. This can be done manually or with a tractor and plough. To avoid regrowth, stumps should be turned upside down and soil should be brushed off roots.

2. Direct stump treatment by painting or spot spraying freshly cut low stumps with a herbicide immediately after been cut. Glyphosate (20% solution), tryclopyr (8% solution) or ammonium sulphate (40% solution) are known to be effective during suitable weather conditions i.e. dry weather. The herbicide concentrations used and timings of applications vary according to which chemical is used. Use of a vegetable dye is recommended to mark treated stumps and all stumps should be targeted. A handheld applicator will help avoid spray drift onto surrounding non-target species. Always read the label and follow the manufacturers guidelines when using herbicides. Remember that using

3. A variation on the stump treatment method is stem injection, using a ‘drill and drop’ methodology, whereby, if the main stem is cut and is large enough for a hole to be drilled into it, the hole can be used to facilitate the targeted application of glyphosate (25% solution). The main drawback is that the dead *Rhododendron* may persist in situ for 10-15 years.

4. Stump regrowth and seedlings can be effectively killed by spraying regrowth with a suitable herbicide, usually glyphosate. Best practice spraying protocols should be carefully followed. General broadcast spraying is not as effective as stump spot treatment and has the potential to impact on surrounding non-target species. Rhododendron leaves are thick and waxy. For herbicide treatment to be effective **each individual leaf needs be thoroughly wetted with herbicide to kill the plant**.

Remember: If the initial infestation was of flowering age or a seed source is nearby, then follow-up seedling removal work will be necessary. The intensity of this work will vary according to the severity and duration of infestation.

See also: Higgins, G.T. (2006) *Rhododendron ponticum*: A guide to management on nature conservation sites. Irish Wildlife Manuals, No. XX. National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland.

9. Rhododendron/Cherry Laurel Management Plan Template

Use this template to help formulate your own management plan outlining how you are going to proceed and what you will need.

Site Name: _____
Site Manager/Owner: _____

Site details

Address:	
Telephone:	
Email:	
Agencies/persons involved:	
Date:	

Date of introduction:	
Total site area:	
Total area colonised:	
Previous site management:	

Designation	**On site**	**Near site**	**None present**
Details: Establish if there is a requirement to apply for a license/notify before proceeding with plan.			

Actions and resources

Management options	**Responsibility**	**Date to undertake**

Resources needed	**Responsibility**	**Date to undertake**

Monitoring and evaluation

Name of person/s	**Date to undertake**	**Report to**	**Additional treatments date (if required)**

10. Summary of actions needed for effective management

1. Confirm *Rhododendron*/Cherry laurel identification.

2. Carry out a survey and produce a distribution map indicating the location across the site.

3. Consider surrounding properties and potential for reintroduction. Talk to adjacent land owners. Identify potential contamination routes to your site and mitigate against these.

4. Decide should the programme aim for continuous control on a yearly basis or eradication from the site. Base your decision on an understanding of the biology, size of infestation, potential for reintroduction and other relevant sensitivities in the area. Once management has begun, do not allow any plant to flower and set seed within areas that have undergone initial clearance.

5. Consider if you can successfully and safely carry out the work or if professional practitioners, with relevant training and certificates should undertake the work.

6. Identify if sufficient resources are/will be available to complete the work within the planned timescale. If work will take more than 1 year to complete, ensure you have sufficient funds to complete the work.

7. Ensure disposal options for plant material are in place prior to work commencing.

8. Develop and produce a site specific control/management plan. Use the template provided in this document to guide you.

9. Monitor for regrowth and/or reintroduction during site visits. If applicable, ensure new members of staff are aware of your *Rhododendron*/Cherry Laurel plan and report sightings.

12. *Rhododendron* and Cherry Laurel treatment times

Cutting	J	F	M	A	M	J	J	A	S	O	N	D
Glyphosate	J	F	M	A	M	J	J	A	S	O	N	D
Tryclopyr*	J*	F*	M*	A*	M*	J*	J*	A*	S*	O*	N*	D*
Ammonium sulphate	J	F	M	A	M	J	J	A	S	O	N	D

Optimum treatment time. Remember to consider breeding birds before embarking on a programme.

Suboptimum treatment time but can be effective. In the case of glyphosate based herbicides consider higher concentrations 25--100% during this time period.

* Suitable for treatment any time after cutting and appearance of new growth.

Please consider sharing your experience undertaking a management plan with others. The Invasive Species Ireland website will feature case studies to help guide others under taking similar work.

The Invasive Species Ireland Project is undertaken, in partnership, by EnviroCentre and Quercus.

www.envirocentre.co.uk

www.quercus.ac.uk

and is funded by the National Parks and Wildlife Service and the Northern Ireland Environment Agency.

www.ni-environment.gov.uk

www.npws.ie

For more information on the Invasive Species Ireland Project please see the website at www.invasivespeciesireland.com

Recommended citation: Maguire, C.M., Kelly, J. and Cosgrove, P.J. (2008). Best Practice Management Guidelines Rhododendron *Rhododendron ponticum* and Cherry Laurel *Prunus laurocerasus.* Prepared for NIEA and NPWS as part of Invasive Species Ireland.

APPENDIX 6

INLAND FISHERIES IRELAND BIOSECURITY PROTOCOL FOR FIELD SURVEY WORK

IFI Biosecurity Protocol for Field Survey Work

December 2010

Iascach Intíre Éireann
Inland Fisheries Ireland

Biosecurity Protocol for Field Survey Work

Invasive species are an ever present threat in our aquatic and riparian systems and it is imperative that none of our field operations exacerbate the risks to the environment and to the economy that are posed by these species. Fish parasites, pathogens and diseases also represent a significant threat to the health status of our watercourses. The introduction or transfer of such pathogens or diseases has the potential to wipe out large populations of fish in affected waters or catchments. Vigilance is required if we are to stop the spread of invasive species and fish diseases, and it is imperative that we in IFI lead by example in the ongoing struggle against these significant threats to our fishery watercourses.

The need for basic biosecurity in our fisheries operations must become ingrained in the psyche of our staff if we are to do our part to stop the spread of hazardous invasive species and fish pathogens. Much to do with biosecurity involves awareness, common sense and agreed procedures. Listed below are some basic procedures that must be implemented when conducting field survey work.

Each field vehicle must carry a 'disinfection box'. This should contain Virkon Aquatic or another proprietary disinfectant, a spray bottle, cloths or sponges, a scrubbing brush and protective gloves.

On completion of any field operation, all equipment used must be treated according to the procedures listed below. Equipment in this respect includes the following:
boats, trailers, outboard motors, anchors and rope, weights, tanks, buckets and bins, all PPE (including boots, wellingtons, waders, wetsuits, dry suits, waterproof clothing, life jackets, diving apparatus, etc.) and any technical or sampling apparatus used as part of the survey. Protective gloves must be worn when using any disinfectant solution in any of the procedures listed below.

- Visually inspect all equipment that has come into contact with the water for evidence of attached plant or animal material, or adherent mud or debris. This should be done before leaving the site.

- Remove any attached or adherent material (fish, fish scales, vegetation and debris) before leaving the site of operation.

- Ensure that all water is drained from boats, live wells and other water retaining compartments, outboard motors, tanks and other equipment before transportation elsewhere.

- High-pressure steam cleaning, with water > 40 degrees C, is recommended for boats (including oars, row locks, attachment ropes, anchors and buoys), trailers and outboard motors that are being moved from one watercourse to another. Many roadside garages provide these facilities. If it is not possible to steam clean the equipment, a normal power hose must be used. After cleaning visually inspect the equipment to ensure that all adherent material and debris has been removed.

- It is recommended to apply disinfectant, using the spray bottle from the 'disinfection box', to the undercarriage and wheels of the vehicle and trailer after steam cleaning or power hosing.

- Wet or live wells and other water retaining compartments in survey boats must be cleaned, rinsed or flushed with a 1% solution of Virkon Aquatic or another proprietary disinfection product. Alternatively, a 5% solution (100 ml / 20 litre solution) of chlorine bleach should be used. Rinse thoroughly with clean water.

- Tanks that are used to stock or transfer live fish should be thoroughly washed with a 1% solution of Virkon Aquatic or another proprietary disinfection product. Alternatively, a 5% solution (100 ml / 20 litre solution) of chlorine bleach should be used. All disinfected equipment must be thoroughly rinsed with clean water.

- Outboard motors should be flushed with a 1% solution of Virkon Aquatic or another proprietary disinfection product, or with water > 40 degrees C. Alternatively, a 5% solution (100 ml / 20 litre solution) of chlorine bleach should be used. Facilities will be provided at IFI stores countrywide to accommodate this operation.

- Nets (to include monofilament and braided gill nets, fyke nets and seine nets) must be cleaned of all vegetation and debris before returning to base. The clean nets must then be placed in a freezer for a period of four days (3 days will suffice for monofilament nets). Following this treatment the nets must be soaked in a 1% solution of Virkon Aquatic or a proprietary disinfectant for a period of not less than 15 minutes and thoroughly rinsed thereafter. Where these proprietary disinfectants are not available the nets must be soaked in a 5% solution (100 ml / 20 litre solution) of chlorine bleach for 1 hour and thoroughly rinsed after.
  An SOP on 'Management and Disinfection of Survey Nets' is available on request from IFI Swords.

- Footwear should be dipped in or scrubbed with a disinfectant solution (e.g. 1% solution of Virkon Aquatic or another proprietary disinfection product) and thoroughly dried afterwards.

- All PPE should be visually inspected and any attached vegetation or debris removed. Where appropriate, the gear should be wiped down with a cloth soaked in 1% solution of Virkon Aquatic or another proprietary disinfection product. Alternatively, a 5% solution (100 ml / 20 litre solution) of chlorine bleach should be used. Rubber gloves must be worn when undertaking this procedure.

- Sampling equipment (e.g. electrofishing electrodes and cable, grab samplers, meter sticks, buckets and bins, etc.) must be cleaned, rinsed or wiped down with or dipped in a suitable disinfectant solution.

- Landing nets and hand nets must be dipped in disinfectant solution and rinsed in clean water.

- All field equipment must be suitably disinfected before being returned to the IFI Swords warehouse for storage. Staff will be requested to sign a prepared form detailing the nature of the disinfection process carried out and the date on which this was conducted.

Note
Disinfectants must be used with care and in strict accordance with the manufacturer's instructions. They must be disposed of safely and never in close proximity to open waters,

For additional information, please contact:

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APPENDIX 3

AQUATIC SURVEYS

Coole Wind Farm

Aquatic Ecology Assessment

July 2016

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TABLE OF CONTENTS

1 AQUATIC ECOLOGY AND FISHERIES

1.1 Introduction

This chapter addresses the potential impact of the proposed Coole Wind Farm project on aquatic ecology and fisheries. This document provides an appraisal of the impact of the proposed development on aquatic habitats, aquatic ecological communities, individual aquatic species, and recreational fisheries. The aims of the aquatic ecology and fisheries assessment are: -

- To carry out a desktop study in order to determine the surface water features affected by the proposed development and surrounding area;
- To carry out a fisheries and aquatic ecological assessment of the affected aquatic areas;
- To predict the potential direct, indirect and cumulative impacts of the proposed development on aquatic species and habitats.
- To propose mitigation measures in the construction and operation of the wind farm so as to minimise potential impacts on fisheries and aquatic ecology receptors.

Field survey work to inform the current appraisal was undertaken during June 2016. Survey work was also carried out during August 2013 in relation to a larger windfarm development. Electrical fishing results from the 2013 survey were used in the current appraisal, since the current proposal is located within the area of the larger development. Figure 1 gives the location of the proposed Coole Wind Farm with respect to water regions (Hydrometric Area and catchment). This report has been prepared by ECOFACT Environmental Consultants Ltd.

1.2 Methodology

1.2.1 Relevant Guidance

The current appraisal has been prepared taking account of relevant guidance published by the Environmental Protection Agency (EPA) including '*Guidelines on the Information to be contained in Environmental Impact Statements'* (EPA, 2002) and '*Advice Notes on Current Practice (in the Preparation of Environmental Impact Statements)'* (EPA, 2001). In addition, the impact appraisal also takes account of the '*Guidelines for Ecological Impact Assessment*' (Institute of Ecology and Environmental Management, 2005). The Heritage Council publication '*Best Practice Guidance for Habitat Survey & Mapping'* (Smith *et al*., 2010) is also referenced.

Relevant guidance published by the National Roads Authority (NRA), and applicable to assessing watercourses in Ireland was also followed, including '*Guidelines for the Assessment of Ecological Impacts of National Road Schemes – Revision 2*' (NRA 2009a), '*Ecological surveying techniques for protected flora and fauna during the planning of National Road Schemes – Version 2*' (NRA 2009b), '*Environmental Impact Assessment of National Road Schemes – A practical guide*' (NRA 2008) and '*Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes*' (NRA 2005). IFI (2016) *'Guidelines on Protection of Fisheries during Construction Works in and Adjacent to Waters*' was also consulted in relation to mitigation.

1.2.2 Legislative context

A diversity of flora and fauna, rare at a national level, are protected under the provisions of the Wildlife Act, 1976 and Wildlife (Amendment) Act, 2000; which includes the Flora Protection Order (1999). The Habitats Directive 1992 has been transposed into Irish legislation as the European Union (Natural Habitats) Regulations SI 94/1997 and amended in 1998 and 2005. The Habitat Regulations have been updated in 2011 as the European Communities (Birds and Natural Habitats) Regulations (2011) to bring the Irish transposition of these regulations into line with the requirements of the EU Habitats Directive (1992).

Under the Fisheries (Consolidation) Act, 1959, it is an offence to disturb the bed of a river; therefore, it will be necessary to get written permission from Inland Fisheries Ireland to proceed with the works in any areas where disturbance to the spawning and nursery areas of both salmonids and lampreys will occur as a result of the proposed development. Salmon, all lamprey species and their habitats are further protected under the EU Habitats Directive, 1992.

Under Section 3 of the Local Government (Water Pollution) Act, 1977 (as amended by Sections 3 and 24 of the 1990 Act) it is an offence to cause or permit any polluting matter to enter waters. Suspended solids would be a key parameter here. Likewise, any visual evidence of oil/fuel in the river would constitute an offence.

Section 171 of the Fisheries (Consolidation) Act 1959 creates the offence of throwing, emptying, permitting or causing to fall onto any waters deleterious matter. Deleterious matter is defined as not only as any substance that is liable to injure fish but is also liable to damage their spawning grounds or the food of any fish or to injure fish in their value as human food or to impair the usefulness of the bed and soil of any waters as spawning grounds or other capacity to produce the food of fish.

These European Communities Environmental Objectives (Surface Waters) Regulations 2009 (S.I. 272 of 2009) and (Amendment) Regulations 2012 (S.I. No. 327 of 2012) establish legally binding quality objectives for all surface waters and environmental quality standards for pollutants for purposes of implementing provisions of E.U. legislation on protection of surface waters. These regulations clarify the role of public authorities in the protection of surface waters also concern the protection of designated habitats.

1.2.3 Selection of watercourses for appraisal

All watercourses / water bodies which could be affected directly (i.e. within the site) or indirectly (i.e. lie within 500 m of the site boundary) were considered as part of the current appraisal. Generally only streams and other watercourses shown on the 1:50,000 Discovery Series Maps were examined, as watercourses smaller than this are not normally of fisheries or aquatic ecological significance. The River Inny is the largest and most important watercourse in the study area. This river was assessed at several locations within the study area.

The watercourses selected for appraisal are given in Table 1 and are shown in Figure 2.

The surveys completed at each site were at a level required to make an evaluation of biological water quality, fisheries value, aquatic habitat value, and presence of rare / protected / notable aquatic species at each site. Surveying was carried out on the 9th June 2016.

1.2.4 Desktop review

A desktop review was carried out to collate information on fish and protected aquatic species in and to identify features of aquatic ecological importance within the study area. Natura 2000 sites and records of protected species in the vicinity of the proposed development were identified. This information was obtained by accessing the website of the National Parks & Wildlife Service (NPWS) of the Department of the Environment, Heritage and Local Government. The database of the National Biodiversity Data Centre (NBDC) was also consulted to assess the presence of rare plant and faunal species and records of protected species from records of the study area. The websites of the Environmental Protection Agency (EPA) and Inland Fisheries Ireland (IFI) were accessed to collate information on surface water quality and fish respectively.

1.2.5 Aquatic habitat appraisals

Habitat appraisal was carried out at the selected watercourses on the site using the methodology given in the Environment Agency's *'River Habitat Survey in Britain and Ireland Field Survey Guidance Manual 2003'* (EA, 2003) and the Irish Heritage Council's *'A Guide to Habitats in Ireland'* (Fossitt, 2000). In June 2016, all the affected watercourses were assessed in terms of:

- Stream width and depth and other physical characteristics;
- Substrate type, listing substrate fractions in order of dominance, i.e. large rocks, cobble, gravel, sand, mud etc;
- Flow type, listing percentage of riffle, glide and pool in the sampling area;
- Instream vegetation, listing plant species occurring and their percentage coverage of the stream bottom at the sampling site (as applicable) and on the bankside;
- Estimated cover by bankside vegetation, giving percentage shade of the sampling site.

Table 1: Location of the aquatic sites assessed for the proposed Coole wind farm site during June 2016.

Site	EPA code	River	Tributary	Segment code	Location
1	26I01	Inny	-	26_892	Bridge near Shrubbywood
2			-	26_625 13281	Float Bridge
3			-	26_1160	Camagh Bridge
4	26M92	Inny	Mayne	26_2450	Ballin
5	26G02	Inny	Glore	26_2976	Doon (d/s Monktown Stream confluence)
6			Glore	26_13411	Newcastle (u/s Monktown Stream confluence)
7			Glore	26_3579	Bridge at Rockbrook
8	26M78	Inny, Glore	Monktown	26_2975	Newcastle

1.2.5.1 Aquatic invertebrates

Qualitative sampling of benthic (or bottom dwelling) macroinvertebrates was undertaken at survey sites using kick-sampling (Toner *et al.*, 2005) in 2013. All samples of invertebrates were combined for each site and live sorted on the river bank and fixed in ethanol for subsequent laboratory identification. The relative abundance of macroinvertebrates was recorded on-site at each site. This procedure involved the use of a 'D' shaped hand net (mesh size 0.5 mm; 350 mm diameter) which was submerged on the river bed with its mouth directed upstream. The substrate upstream of the net was then kicked for one minute in order to dislodge invertebrates, which were subsequently caught in the net. Where possible, this procedure was undertaken at three points along/across the watercourse. Stone washings and vegetation sweeps were also undertaken to ensure a representative sample of the fauna present at each site was collected.

An appraisal of the occurrence of rare protected species (e.g. white-clawed crayfish) and of non-native invasive species was assessed at sampling sites using underwater visual observation (bathyscopes and snorkeling - see section 1.2.6.3). Methodology for White-clawed Crayfish surveying followed recognised procedures given in the manual 'A technical manual for monitoring white-clawed crayfish *Austropotamobius pallipes* in Irish lakes' by Reynolds *et al.* (2010).

1.2.6 Fish appraisals

Habitat and watercourse size has a key influence on fish communities. Electrical fishing results (Ecofact, 2013) were used in combination with physical habitat appraisals to evaluate the watercourses affected by the proposed development.

1.2.6.1 Visual surveys

Habitat suitability for salmonids was assessed in 2016 with reference to the leaflet 'The Evaluation of habitat for Salmon and Trout' (DANI Advisory Leaflet No. 1) and 'Ecology of the Atlantic Salmon' (Hendry & Cragg-Hine, 2003). An opinion of lamprey habitats was formed at survey sites and at Salmon Point with reference to Ecology of the River, Brook and Sea Lamprey by Maitland (2003).

1.2.6.2 Electrical fishing surveys

An electrical fishing survey was undertaken in 2013 at all selected sites under authorisation from the Department of Communication, Energy and Natural Resources under Section 14 of the Fisheries Act (1980). It is noted that some of the watercourses were too small to complete a full survey, but all were checked for presence / absence of fish. Sites were surveyed following the methodology outlined in the CFB (2008) guidance "*Methods for the Water Framework Directive - Electric fishing in wadable reaches*". A portable electrical fishing unit (Smith Root-LR 24 backpack or Marine Electrics Safari Researcher 660D) was used during the assessments. Fishing was carried out continuously for 20 minutes at each of the sites located on the larger watercourses, and for at

least 5 minutes at the smaller stream sites. Stop nets were used at suitable sites. Captured fish were collected into a container of river water using dip nets. On completion of the survey fish were then anaesthetised using a solution of 2-phenoxyethanol, identified, and measured to the nearest mm using a measuring board. Subsequent to this the fish were allowed to recover in a container of river water and were the released alive and spread evenly over the sampling area. No mortalities were recorded.

Electrical fishing for juvenile lampreys was carried out in the most suitable juvenile lamprey habitats that could be found habitat taking cognisance of habitat suitability outlined in O'Connor (2006). Identification followed the manual 'Identifying Lamprey. A Field key for Sea, River and Brook Lamprey' by Gardiner (2003).

1.2.6.3 Snorkeling surveys

Snorkel surveys are widely used to monitor fish populations in streams and to estimate both relative and total abundance (Slaney and Martin, 1987). Snorkeling was carried out in June 2016 with the aid of a snorkel and face mask to qualitatively assess fish and macroinvertebrate distribution, presence/absence, species assemblages (i.e., diversity) and habitat use. A wet suit and diving boots were worn during this survey to provide insulation. A waterproof camera was used to capture underwater images.

Snorkeling is often feasible in places where other methods are not; for example, deep clear water with low conductivity makes electrofishing prohibitive (Johnson *et al*., 2007). In the current assessment, snorkeling was suitable in the River Inny and River Glore with respect to depth and soft substrates. Snorkeling was not feasible in the remainder of the watercourses due to poor visibility (peat stained water) and extent of shading.

Fish were identified with reference to the 'Key to British Freshwater Fish with notes on their ecology and distribution' by Maitland (2004).

1.2.7 Biological Water Quality

Benthic macroinvertebrates, or aquatic insects were used as an indicator of water quality at the study sites using the Quality Rating (Q) System (Toner *et al*, 2005). This is the standard biotic index which is used by the Environmental Protection Agency. This method categorises invertebrates into one of five groups, depending on their sensitivity to pollution. Where possible, Q-ratings were derived for sites. Further details on the Q-rating system and its relationship to the European Communities Environmental Objectives (Surface Waters) Regulations 2009 (S.I. 272 of 2009) are provided in Table 2.

Table 2: Relationship between Q-Value and ecological status for macroinvertebrates.

Q Value*	WFD Status	Pollution Status	Condition**
Q5, Q4-5	High	Unpolluted	Satisfactory
Q4	Good	Unpolluted	Satisfactory
Q3-4	Moderate	Slightly polluted	Unsatisfactory
Q3, Q2-3	Poor	Moderately polluted	Unsatisfactory
Q2, Q1-2, Q1	Bad	Seriously polluted	Unsatisfactory

** These values are based primarily on the relative proportions of pollution sensitive to tolerant macroinvertebrates (the young stages of insects primarily but also snails, worms, shrimps etc.) resident at a river site.*

*** "Condition" refers to the likelihood of interference with beneficial or potential beneficial uses*

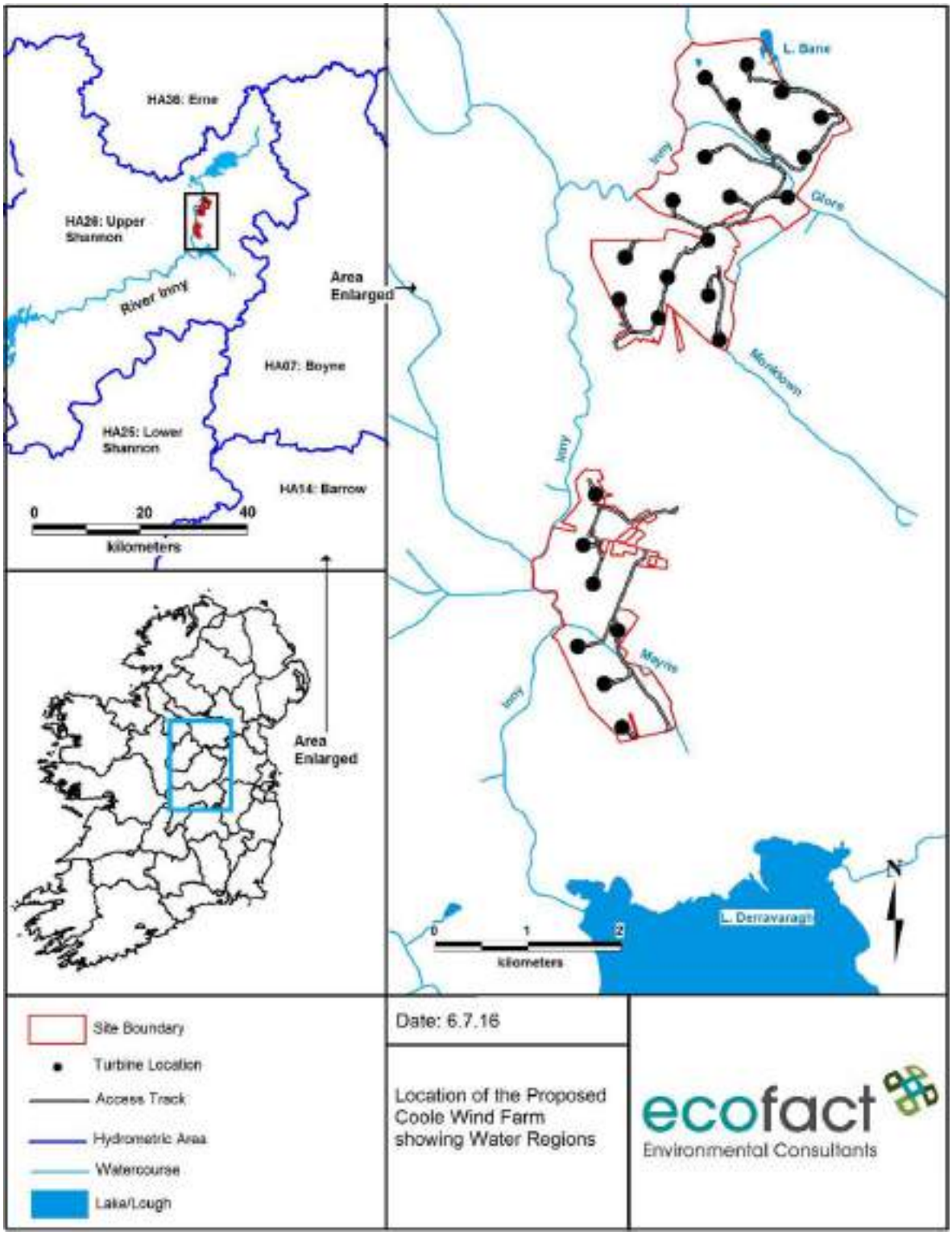

Figure 1 Location of the proposed Coole Wind Farm showing water regions.

1.2.8 Evaluation Criteria

The evaluation criteria used in the current appraisal follows the '*Guidelines for the Assessment of Ecological Impacts of National Realignments – Revision 2*' (NRA, 2009). The evaluation of impact significance is a combined function of the value of the affected feature (its ecological importance), the type of impact and the magnitude of the impact. It is therefore necessary to identify the value of ecological features within the study area in order to evaluate the significance and magnitude of possible impacts.

Following the guidance set out by the NRA (2009) the study area has been evaluated based on an identified zone of influence with regard to the potential for pathways for impacts affecting aquatic ecological features of interest (habitats, flora and fauna).

Ecological features are assessed on a scale ranging from international-national-county-local (see Table 3). The local scale is taken as corresponding to the zone of influence of the development and extending to a parish area. The evaluation criteria are presented below. Watercourses, evaluated following the NRA (2009) criteria were evaluated on the basis of a number of characteristics and features defined as follows:

- Aquatic habitat refers to the in-water conditions of any watercourse; including substrate and stream structure (i.e. proportion of riffles, runs and pools).
- The fisheries value of a watercourse refers to its suitability for fish, primarily salmonids (salmon and trout), and to the associated value for recreational angling purposes.
- Annex II species are those that are listed under the EU Habitats Directive (92/43/EEC).
- Annex I habitats are those that are listed under the EU Habitats Directive, including Priority Habitats.
- The evaluation of water quality uses a five-point biotic index (Q-value) based on the presence and relative abundance of various invertebrates using the Environmental Protection Agency's (EPA) standard technique.

Table 3: Criteria used to determine the value of ecological resources (NRA 2009)

Importance	Criteria
International Importance	'European Site' including Special Area of Conservation (SAC), Site of Community Importance (SCI), Special Protection Area (SPA) or proposed Special Area of Conservation. Proposed Special Protection Area (SPA). Site that fulfils the criteria for designation as a 'European Site' (see Annex III of the Habitats Directive, as amended). Features essential to maintaining the coherence of the Natura 2000 Network Site containing 'best examples' of the habitat types listed in Annex I of the Habitats Directive. Resident or regularly occurring populations (assessed to be important at the national level) of the following: Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; and/or Species of animal and plants listed in Annex II and/or IV of the Habitats Directive. Ramsar Site (Convention on Wetlands of International Importance Especially Waterfowl Habitat 1971). World Heritage Site (Convention for the Protection of World Cultural & Natural Heritage, 1972). Biosphere Reserve (UNESCO Man & The Biosphere Programme) Site hosting significant species populations under the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals, 1979). Site hosting significant populations under the Berne Convention (Convention on the Conservation of European Wildlife and Natural Habitats, 1979). Biogenetic Reserve under the Council of Europe. European Diploma Site under the Council of Europe. Salmonid water designated pursuant to the European Communities (Quality of Salmonid Waters) Regulations, 1988, (S.I. No. 293 of 1988).

Importance	Criteria
National Importance	Site designated or proposed as a Natural Heritage Area (NHA). Statutory Nature Reserve. Refuge for Fauna and Flora protected under the Wildlife Acts. National Park. Undesignated site fulfilling the criteria for designation as a Natural Heritage Area (NHA); Statutory Nature Reserve; Refuge for Fauna and Flora protected under the Wildlife Act; and/or a National Park. Resident or regularly occurring populations (assessed to be important at the national level) of the following: Species protected under the Wildlife Acts; and/or Species listed on the relevant Red Data list. Site containing 'viable areas' of the habitat types listed in Annex I of the Habitats Directive.
County Importance	Area of Special Amenity. Area subject to a Tree Preservation Order. Area of High Amenity, or equivalent, designated under the County Development Plan. Resident or regularly occurring populations (assessed to be important at the County level) of the following: Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; Species of animal and plants listed in Annex II and/or IV of the Habitats Directive; Species protected under the Wildlife Acts; and/or Species listed on the relevant Red Data list. Site containing area or areas of the habitat types listed in Annex I of the Habitats Directive that do not fulfil the criteria for valuation as of International or National importance. County important populations of species; or viable areas of semi-natural habitats; or natural heritage features identified in the National or Local BAP; if this has been prepared. Sites containing semi-natural habitat types with high biodiversity in a county context and a high degree of naturalness, or populations of species that are uncommon within the county. Sites containing habitats and species that are rare or are undergoing a decline in quality or extent at a national level.
Local Importance (higher value)	Locally important populations of priority species or habitats or natural heritage features identified in the Local BAP, if this has been prepared; Resident or regularly occurring populations (assessed to be important at the Local level) of the following: Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; Species of animal and plants listed in Annex II and/or IV of the Habitats Directive; Species protected under the Wildlife Acts; and/or Species listed on the relevant Red Data list. Sites containing semi-natural habitat types with high biodiversity in a local context and a high degree of naturalness, or populations of species that are uncommon in the locality; Sites or features containing common or lower value habitats, including naturalised species that are nevertheless essential in maintaining links and ecological corridors between features of higher ecological value.
Local Importance (lower value)	Sites containing small areas of semi-natural habitat that are of some local importance for wildlife; Sites or features containing non-native species that are of some importance in maintaining habitat links.

- *SAC = Special Area of Conservation; SPA = Special Protection Area; NHA = Natural Heritage Area.

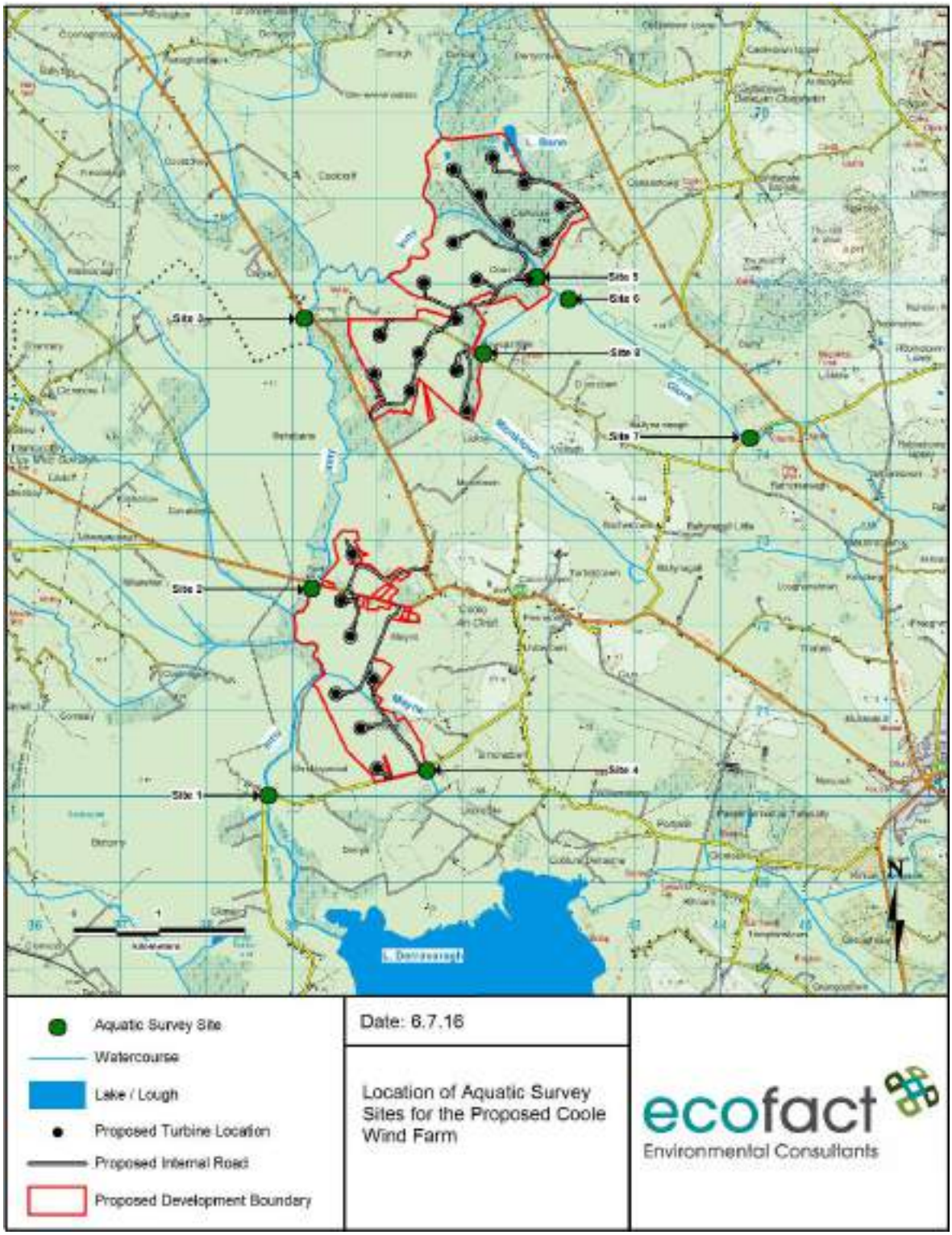

Figure 2 Coole aquatic ecology and fish survey sites.

1.3 Existing Environment

A variety of sites were evaluated with regard to their potential to support protected aquatic species, fish and macroinvertebrates using a combination of visual surveys and instream surveying. Table 3 presents the results of the physical habitat appraisals at survey sites, Table 4 presents the results of the River Corridor Survey appraisals, Table 5 presents the results of the fisheries habitat appraisals and Table 6 presents the biological water quality and WFD status at the survey sites. The results of the aquatic ecology and fisheries survey are also presented on Figure 4.

The study area is described below in section 1.3.1 and 1.3.2 in terms of surface water hydrology, designated sites with aquatic dependant key conservation interests, waterbody types in the study area, protected aquatic flora and fauna, fish communities and fisheries, biological water quality.

1.3.1 Overview of watercourses in the study area

The proposed development is located in Hydrometric Area 26 - the upper Shannon catchment.

Only one sub-catchment, the Inny sub-catchment, is affected by the current proposal. This major tributary of the River Shannon flows from Lough Sheelin to join the Shannon at Lough Ree. The catchment is generally underlain by calcareous limestone and also drains large areas of midlands peat bogs, many of which are still being worked commercially.

The Inny River itself is almost 90km long and drains a catchment area of 782 km^2. It rises near Oldcastle. Co Meath, and drains several important midland lakes, including Lough Sheelin. It has a number of tributaries including the Tang which joins the Inny downstream of Ballymahon, Co. Westmeath; the Rath River, which joins it upstream of Ballymahon; and its largest tributary is the River Glore which feeds the River Inny upstream of Lough Derravaragh.

As with many other Irish river catchments, the Inny catchment was also subjected to a major arterial drainage programme in the 1960s. This scheme resulted in the channelisation of the main channels such as the Inny and Glore, and the lowering of water levels in the lakes in the catchment.

1.3.2 Description of watercourses in the study area

Figures 1-3 show the principal watercourses in the study area. These water features correspond with rivers and streams shown on the EPA map viewer and OSI mapping. The 4th order River Inny is the largest and most important watercourse in the study area. Much of the western boundary of the proposed development site is formed by the River Inny and all components of the proposed development are within the Inny catchment (to the east of the main channel of the Inny). The Inny catchment includes numerous lakes. From upstream to downstream, these include Lough Sheelin, Lough Kinale, Lough Derragh, Lough Derravaragh and Lough Iron. The River Inny discharges into Lough Ree (River Shannon).

The southern extent of the proposed development is drained by the Mayne Stream. The Mayne Stream is a minor 1st order low gradient watercourse. It is a highly modified channel with a bed consisting almost entirely of peat silt. It has a channel length of ca. 2km and flows into the River Inny ca. 3.5km upstream of Lough Derravaragh.

The 3rd order River Glore drains part of the northern extent of the proposed development. The River Glore rises ca. 6km east of Castlepollard in Co. Westmeath and flows northwest over a distance of ca. 12.3km. Lough Glore is a small waterbody of ca. 0.24km^2 that occurs in the upper part of the Glore sub-catchment. It is noted that only the lower reach of the River Glore, a stretch of ca. 1.8km downstream of the Monktown Stream confluence could be affected by the proposed development. The River Glore has been drained and channelised. It has a medium gradient with the exception of the lower reach where gradient is low.

The Monktown Stream is a 2nd order watercourse with a channel length of ca. 4.6km. The Monktown Stream drains a portion of the proposed development. It flows into the River Glore from the south ca. 1.8km upstream of the River Inny - Glore confluence.

The Mayne and Monktown Streams are highly modified waterbodies corresponding to the habitat 'Drainage ditch' (FW4) and/or 'Depositing river' (FW2). These channels have been subjected to severe modifications in part as a result of arterial drainage schemes and some stretches appear to be regularly maintained and entirely artificial. A long stretch of the River Glore has been channelised upstream of the proposed Coole Wind Farm, as evident by deepening and straightening.

Lough Bane and its feeder stream occurs at the northern extent of the proposed development. This waterbody has no efferent stream.

Table 3: Results of the physical habitat appraisals of the aquatic ecology and fisheries survey sites at proposed Coole wind farm site.

Site	Watercourse Name	Wetted width (m)	Mean Depth (cm)	Max Depth (cm)	Instream vegetation (%)	Bank Height (m)	Bank slope (°)	Bank Cover (%)	Canopy Cover (%)	Riffle (%)	Glide (%)	Pool (%)	Flow Velocity (m/s)	Rock (%)	Cobble (%)	Gravel (%)	Fine (%)	Shade (%)
1-3	Inny	28	1	2.5	40	1	75	95	0	0	20	80	0.2	0	0	20	80	10
4	Mayne	1.5	20	25	10	0.7	90	100	70	0	100	0	0.01	0	0	0	100	90
5	Glore	3	20	60	50	3	45	80	10	40	30	30	0.4	0	10	70	20	10
6	Glore	2.5	20	25	90	0.5	80	100	0	10	90	0	0.05	0	0	20	80	0
7	Glore	2.5	35	50	40	0.9	55	100	5	30	40	30	0.1	20	30	25	25	0
8	Monktown	1.5	10	30	15	1	80	80	45	25	25	50	0.2	0	0	0	100	45

1.3.3 Designated sites

1.3.3.1 SACs designated for aquatic organisms

The location of the proposed development in relation to water quality dependent Natura 2000 sites is indicated in Figure 3. The proposed development is located in the surface water catchment of the Inny sub-catchment within the upper Shannon catchment. The only Natura 2000 sites with aquatic interests potentially affected are those within the Inny sub-catchment. There is no Natura 2000 river system in the study area. Lough Derravaragh SPA (4043) is located approximately 1.3km to the south of the proposed development. Lough Derravaragh is connected to the proposed development via the River Inny and its tributaries within and bordering the proposed development.

Lough Derravaragh SPA is located ca. 3.4km and 11.3km downstream of the Mayne Stream and River Glore confluence with the River Inny respectively. The River Inny is the main inflowing and outflowing river. Lough Derravaragh is a medium to large-sized lake of relatively shallow water (maximum depth 23 m). It extends along a SE-NW axis for approximately 8 km. It is a typical limestone lake with water of high hardness and alkaline pH. It is classified as a mesotrophic system. A notable feature is the range of charophytes that occur in the lake. The features of interest of Lough Derravaragh are: Whooper Swan *Cygnus cygnus* [A038], Pochard *Aythya ferina* [A059], Tufted Duck *Aythya fuligula* [A061], Coot *Fulica atra* [A125] as well as Wetland and Waterbirds [A999] (NPWS, 2015).

Enrichment of the lake, mainly by agricultural run-off, is listed as a threat and could affect the bird populations and especially diving ducks.

Lough Iron SPA is another waterbody on the Inny located downstream of the proposed development where the features of interest are dependent on water quality. This site is located ca. 8.2km downstream of Lough Derravaragh, or ca. 13.5km downstream of the proposed development.

Lough Ree SAC (00440) is located over 40km southwest of the proposed development and a considerably longer distance via the surface water pathway i.e. via the River Inny and its lakes. Lough Ree is an excellent example of a natural eutrophic system. The Otter *Lutra lutra* is the only species listed as a conservation interest of this site. There are no designated salmonid waters within 40km downstream of the proposed development.

Table 4: Results of the River Corridor Survey appraisals of survey sites at proposed Coole wind farm site.

Site	River	Tributary	Segment code	EPA code	Order	Wetted width (m)	Drained (Y/N)	Gradient (Low/Med/High)	Siltation (Heavy/Moderate/Normal/Free)	Filamentous algae (Y/N)	Eroding banks (Y/N)	Braided channel (Y/N)
1-3	Inny	-	07_1712	07M03	4	28	Y	L	H	Y	N	N
4	Inny	Mayne	26_2450	26M92	1	1.5	Y	L	H	Y	N	N
5	Inny	Glore	26_2976	26G02	3	3	Y	L	M	Y	Y	N
6	Inny	Glore	26_13411	26G02	3	2.5	Y	M	M	Y	Y	N
7	Inny	Glore	26_3579	26G02	3	2.5	Y	M	N	Y	Y	N
8	Inny	Glore, Monktown	26_2975	26M78	2	1.5	Y	L	H	Y	N	N

Table 5: Results of the aquatic ecological appraisals of survey sites for proposed Coole wind farm site (P=present, L=likely, A=absent).

Site	Watercourse Name	Salmonid nursery (Y/N)	Salmonid fishery (Y/N)	Coarse nursery (Y/N)	Coarse fishery (Y/N)	Salmon (P/A)	Trout (P/A/L)	Coarse fish (P/A)	Eel (P/A/L)	Juvenile lamprey habitat (P/A)	Lamprey (P/A)	Crayfish (P/A)	FPM (P/A)	Floating river vegetation (Y/N)
1-3	Inny	A	A	Y	Y	A	A	A	A	P	A	A	A	A
4	Mayne	A	A	N	A	A	L	L	P	P	P	A	A	A
5	Glore	A	A	Y	A	A	P	A	P	P	L	A	A	A
6	Glore	Y	A	Y	A	A	P	P	P	P	P	A	A	Y
7	Glore	Y	A	Y	A	A	P	P	P	P	P	A	A	A
8	Monktown	A	A	A	A	A	L	L	A	A	A	A	A	A

Table 6: Biological water quality and WFD status at survey sites (High / Good / Moderate / Poor / Bad).

Site	Watercourse Name	Q-value	Biological Status (Macroinvertebrates)	Morphological Status	Fish Status
1-3	Inny	Q4/Q3-4	G/M	P	P/B
4	Mayne	Q3	P	P	B
5	Glore	Q3-4	M	P	P/B
6	Glore	Q3-4	M	M	P/B
7	Glore	Q3-4	M	M/P	P
8	Monktown	Q3	P	P/B	B

1.3.4 Protected aquatic flora and fauna

1.3.4.1 Atlantic salmon

The Atlantic salmon (*Salmo salar*) is listed under Annexes II and V of the EU Habitats Directive and Appendix III of the Bern Convention. It an economically important species and salmon recreational and commercial fisheries occur throughout Ireland. Atlantic salmon are an anadromous species, meaning they are spawned in freshwater habitats and then migrate to the sea. Salmon habitats are usually fast flowing riffle and glide habitats with cobble or gravel substrates. The gravels at these sites must be clean and well oxygenated for successful hatching. Crisp (2000) notes that salmon spawning site selection is governed by a complex of environmental factors including intra-gravel flow, gravel size, water depth as well as stream velocity and cover, which are all essential for successful spawning, egg survival and hatching. One of the most important factors for salmon egg survival is oxygen supply, which is dependent upon dissolved oxygen concentration and inter-gravel flow. High concentrations of suspended solids in the river are undesirable as they are likely to result in infilling of the gravel pores with fine material (Cowx and Fraser, 2003). Juvenile salmon require fast flowing clean water and the cover of instream rocks, plants and banks to thrive. Adult salmon require pool habitat to rest before in the interval between entering the river and reaching spawning grounds and the act of spawning. Salmon angling areas are usually located on main river channels or small rivers in deep glides of 1.5m depth or more.

The dams on the lower reaches of the River Shannon (Ardnacrusha hydroelectric station, Parteen Weir) represent obstacles for upstream migrating adult salmon. In McGinnity *et al.* (2005), which gives the distribution of salmon in Ireland, the reaches of the River Shannon and its tributaries above the aforementioned barriers, including the River Inny, are indicated as non-self sustaining with regard to salmon. This is because salmon cannot negotiate the dams on the river downstream of Lough Derg. Salmon populations in the River Inny, Brosna and Little Brosna catchments are supported primarily by stocking of juvenile salmon produced in the ESB's Parteen salmon hatchery. The Inny catchment was formerly an important salmon fishery, but currently very few salmon occur. Any salmon populations in this catchment are now the progeny of stocking programmes. Up to the early 1990's naturally spawned salmon did occur on the River Inny and its tributary the Rath River (ESB, 1994). During the most recent Inland Fisheries Ireland survey of the main Inny channel at Shrule Bridge (IFI Code 26I011350) no 0+ (young of the year) salmon were recorded and 1+ and older salmon were recorded at a very low density (0.001/m^2) (Kelly *et al.* 2015).

With the exception of the River Glore, the watercourses in the study area of the proposed Coole Wind Farm are unsuitable / marginal with regard to the requirements of the early life stages of salmon due to the peaty nature of their substrates and low gradient. Parts of the River Glore

upstream of the proposed development site are considered suitable for salmon spawning and as salmonid nursery areas.

Atlantic salmon populations in Ireland have been recently assessed as being 'unfavourable - inadequate' by NPWS in the 2013 Article 17 Conservation Status Assessments (2013).

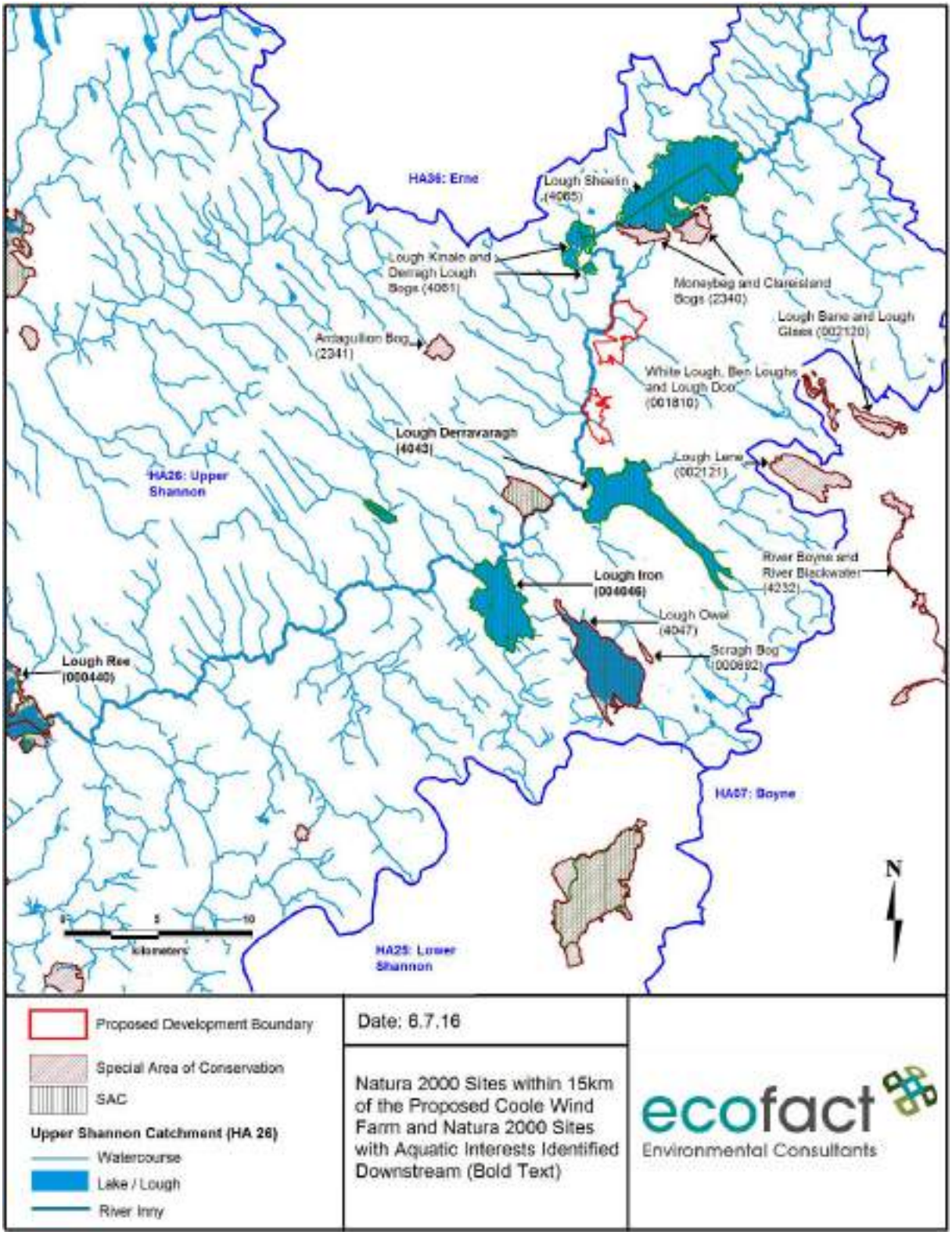

Figure 3 Special Areas of Conservation with aquatic interests within the study area of the proposed Coole Wind Farm.

1.3.4.2 Freshwater Pearl Mussel

The freshwater pearl mussel (*Margaritifera margaritifera* (L.)) is a large bivalve species found in oligotrophic, soft to neutral waters of rivers and, occasionally, in lakes. In Ireland, the species is concentrated along the western sea-board, but also occurs in the south and east where geology allows. The biology and ecology of the species are particularly notable in that individuals can grow to very large sizes relative to other freshwater molluscs, building up thick calcareous valves, in rivers with relatively soft water and low levels of calcium. Their shell building is consequently very slow, and individuals in natural conditions live to over a hundred years of age.

The Freshwater Pearl Mussel does not occur in the study area and there are no previous records from Hydrometric Area 26 (Upper Shannon). The nearest freshwater pearl mussel catchment is the Erne -Annalee catchment located in excess of 20km northeast of the proposed development.

Freshwater Pearl Mussel populations in Ireland have been recently assessed as being 'unfavourable - bad' by NPWS in the 2013 Article 17 Conservation Status Assessments (2013).

1.3.4.3 White-clawed crayfish

The white-clawed crayfish is the only freshwater crayfish recorded in Ireland. Populations of the species in the rest of Europe have declined dramatically and Ireland is seen as a unique stronghold for this species in a European context (Reynolds 1998).

The white-clawed crayfish is protected under both European and Irish legislation. It is protected by the Wildlife Act, 1976 and has been classified as endangered in the IUCN Red List. It is also listed under Appendix III of the Bern Convention and Annexes II and V of the EU Habitats Directive (1992). The white-clawed crayfish is Ireland's only crayfish species. Ireland is understood to hold some of the best European stocks of this species, under least threat from external factors. Irish stocks are therefore of substantial conservation importance (Reynolds, 1998). Throughout its natural range across Western Europe, the distribution and abundance of white-clawed crayfish has been dramatically reduced in the last 150 years due to human disturbances such as overfishing, habitat destruction, pollution and the introduction of foreign crayfish species (Reynolds, 1998). In Britain, the North American signal crayfish (*Pacifastacus leniusculus*) was introduced for aquaculture and subsequently escaped into the wild, where it has had a devastating effect on white-clawed crayfish populations. While this species has not been recorded in Ireland, there is a real threat that this alien crayfish species will reach this country. The crayfish plague, which was transmitted by introduced crayfish species and is caused by the fungus *Aphanomyces astaci*, has been found in Ireland since the late 1980s.

White-clawed crayfish is widespread in areas which are underlain by Carboniferous limestone, or its derivative - glacial drift (Reynolds, 1998). It is generally considered to be widespread in lowland rivers such as the Kells, Blackwater, Boyne, and tributaries. Demers *et al.* (2005) reported that white-clawed crayfish are still widespread in the rivers of the Irish midlands, where the geology is predominantly limestone. However, these authors also report that the distribution of white-clawed crayfish in rivers has been restricted since the mid-1980s. This was attributed in part to an outbreak of the crayfish plague. Demers *et al*. (2005) also reported that crayfish populations in the lakes and rivers of the Boyne catchment were likely to have been affected by crayfish plague. However, this effect is geographically isolated (Gallagher *et al*., 2006). Large unexplained mortalities of crayfish have occurred in waterbodies including Lough Owel (Demers *et al*., 2005). Recent data from the EPA suggests a decline in crayfish populations in the north midlands (Reynolds, 2006).

According to Reynolds (1998), the main threats to the White-clawed Crayfish in Ireland are stream drainage, pollution and the introduction of predators, competitors or diseases. Ongoing drainage maintenance on arterially drained rivers in Ireland has also been identified as having a significant adverse effect of this species (O'Connor & McDonnell, 2008).

White-clawed crayfish were recorded in the study area during (Ecofact, 2013) when it was concluded that this species occurs in the River Glore in low densities. This species was not recorded in the River Glore adjacent to the proposed development site during hand searching carried out in 2016. White-clawed Crayfish is considered likely to occur in the River Inny.

White-clawed crayfish populations in Ireland have been recently assessed as being 'inadequate' by NPWS in the 2013 Article 17 Conservation Status Assessments (2013).

1.3.4.4 Brook lamprey

The brook lamprey is the smallest of the three lampreys native to Ireland and it is the only one of the three species that is non-parasitic and spends all its life in freshwater (Maitland & Campbell 1992). Brook lamprey is listed in Annex II of the EU Habitats Directive (92:43: EEC) and in Appendix III of the Bern Convention. Brook lampreys are the most common and widespread of the three Irish lamprey species (Kurtz & Costello, 1999). Brook Lampreys live for up to five years burrowed into silt deposits in rivers. They metamorphose into adults and spawn in the early spring in fast flowing streams with gravel substrates. Unlike the other two Irish lamprey species they are not parasitic as adults, and undertake only localised migrations.

Although still common in Ireland they are under significant threat from drainage and navigation maintenance works and also from water quality deterioration. Brook lampreys are also doing less well across the rest of the European Union. In this regard Irish populations of Brook Lampreys are of International Importance in Ireland. Ireland has failed to protect lampreys with a close season for instream works during their spawning season so they are vulnerable due to the lack of this type of protection. Responsibility for protecting lampreys in Ireland falls within the remit of Inland Fisheries Ireland; although there are none and never have been any fisheries for this species in Ireland.

Brook Lamprey occurs in the River Inny and River Glore as well as in the Mayne Stream as observed in 2013 (Ecofact, 2013). Based on recent visual observations, habitat for juvenile lampreys in these watercourses is considered to support the species in these watercourses. The general lack of suitable spawning areas in the subject watercourses is considered a limiting factor with regard to Brook Lamprey populations in the study area.

Brook lamprey populations in Ireland have been recently assessed as being 'favourable' by NPWS in the 2013 Article 17 Conservation Status Assessments (2013).

1.3.4.5 River and Sea Lamprey

The River Lamprey *Lampetra fluviatilis* and Sea Lamprey *Petromyzon marinus* are larger in size than the brook lamprey and exhibit an anadromous life cycle. Both species are listed in Annex II and IV of the Habitats Directive (92:43: EEC), and also in Appendix III of the Bern Convention. Lampreys are poor swimmers and cannot jump or climb (Reinhardt *et al.*, 2009), so are considered limited to the lower reaches of the River Shannon - well downstream of the study area of the currently proposed wind energy development.

River lamprey populations in Ireland have been recently assessed as being 'favourable' by NPWS in the 2013 Article 17 Conservation Status Assessments (2013). However, this has been based on the fact that they have been grouped together with Brook lamprey populations due to identification difficulties. Sea Lamprey populations in Ireland have been recently assessed as being 'unfavourable' by NPWS in the 2013 Article 17 Conservation Status Assessments.

1.3.4.6 Floating river vegetation

The plants characteristic of this habitat includes a number of *Ranunculus* species and all *Callitriche* species, including other submerged aquatic plants. The community Callitricho–Batrachion includes species of the *Ranunculus* subgenus *Batrachium* and two species of *Callitriche*, *C. hamulata* and *C. platycarpa* as diagnostic species. There are few published records for descriptions of this habitat in Ireland and no comprehensive island-wide descriptions.

According to NPWS (2013) the EU definition of this habitat is very broad, especially when the presence of aquatic mosses is taken into account. Using this broad definition, the habitat will be found in most watercourses in Ireland. There is to date no satisfactory definition of the habitat and its sub-types or their distribution in Ireland. Consequently, there is a lack of relevant monitoring data concerning the habitat. What is clear is that the habitat can occur over a wide range of physical conditions, from acid, oligotrophic, flashy upland streams dominated by bryophytes to more eutrophic, slow flowing streams dominated by *Ranunculus* and *Callitriche* species. While the

former will be sensitive to diffuse pollution the latter, especially in shallow streams, will be relatively more resistant.

Flora associated with the Annex I habitat 'Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation' (3260) includes *Ranunculus saniculifolius, Ranunculus trichophyllus, Ranunculus fluitans, Ranunculus penicillatus ssp. penicillatus, Ranunculus penicillatus* ssp. *Pseudofluitantis, Ranunculus aquatilis, Myriophyllum* spp., *Callitriche* spp., *Sium erectum* (or *Berula erecta*), *Zannichellia palustris, Potamogeton* spp., and the moss *Fontinalis antipyretica*. *Groenlandia densa* (Opposite leaved pondweed) is also included in the list.

The plant communities in the watercourses within the proposed development mainly comprises of low diversity emergent vegetation which limits instream growth during the growing season owing to its luxuriant growth, driven by eutrophication. No plants characteristic of the habitat floating river vegetation were recorded during the current study. Channel maintenance, siltation and competition from higher plants reduces the chances of such plants establishing in these watercourses.

The habitat 'Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation' in Ireland has been recently assessed as being 'inadequate' by NPWS in the 2013 Article 17 Conservation Status Assessments (2013).

1.3.5 Fish communities

Two sites on the River Inny were surveyed by Inland Fisheries Ireland (IFI) as part of Water Framework Directive (WFD) fish surveillance monitoring in 2014 (Kelley *et al.*, 2015). One site was located on the upper reach of the river at Oldcastle (upstream of Lough Sheelin) and the other was located at Shrule Bridge near Ballymahon on a lower reach of the river.

The Oldcastle survey site was located close to its source, on the downstream side of Tubride Bridge, just south of Oldcastle, Co. Meath. Three electric-fishing passes were conducted using one bank-based electric fishing unit on the 9th of September 2014, along a 40m length of channel. Glide and riffle dominated the habitat, over a mixed substrate largely composed of cobble, gravel and boulder. Brown trout density fluctuated over the three sampling occasions; the 0+ age class was dominant in 2008 and 2011, while 1+ & older fish dominated in 2014. Juvenile lamprey and Three-spined Stickleback *Gasterosteus aculeatus* were also present at the site. Table 7 and Table 8 gives the results of the IFI investigations at Oldcastle and Shrule Bridge respectively.

Table 7: Density of fish (no./m^2), River Inny (Bridge 1 km S of Oldcastle). From Kelly *et al.*, (2015).

Species	Total minimum density		
	2008	2011	2014
Brown Trout	0.492	0.346	0.468
0+ Brown Trout	0.331	0.208	0.190
1+ & older Brown Trout	0.161	0.138	0.278
Lamprey sp.	-	0.023	-
3-spined Stickleback	0.018	0.154	0.008
All fish	0.510	0.523	0.476

The Shrule Bridge survey site was located downstream of Shrule Br., about 3km upstream of Ballymahon, Co. Longford. One electric-fishing pass was conducted using four boat-based electric fishing units (two boats electric fished parallel to each bank separately) on the 8th of September 2014, along a 380m length of channel. Glide dominated the habitat, over a mixed substrate of sand, cobble and gravel. Minnow and perch were the two most abundant species encountered. Perch density was higher in 2014 than in 2008, with a wide range of length classes present. Brown trout were also recorded across a wide range of length classes but their density was lower in 2014. Roach x bream hybrids and chub were absent from the latest survey.

This site was located at Boyne Bridge, close to the river's source, approximately 1.5km north of Edenderry. Three fish species were recorded in the River Boyne at Boyne Bridge: Brown Trout (0.0089/m^2), Three-spined Stickleback (0.004/m^2) and Stone Loach (0.002/m^2). It is noted that

the stretch of the River Boyne surveyed during 2014 (Kelley *et al.*, 2015) was drained, corresponding to channel characteristics of some watercourses in the current survey area. The growth category of Brown Trout at this site was rated 'Moderate' based on a new classification scheme developed using length at age data (Matson and Kelly, in prep). With respect to fish, the ecological status of the sites at Oldcaslte and Shrule Bridge were rated 'Good and Moderate' based on the results obtained by IFI, in that order.

The drained nature of all watercourses within and adjoining the proposed Coole Wind Farm site has significantly reduced the ecological and fisheries value of these watercourses, with deepening and channelisation leading to reduced cover for young fish, excessive instream vegetation growth and deposition of fine material.

A number of watercourses in the study area were investigated during 2013 by Ecofact (Ecofact, 2013). At this time, the Glore River was surveyed at two locations upstream of the proposed development site, the River Inny was surveyed at two locations within the study area (Float Bridge and Camagh Bridge) while the upper reach of the Mayne Stream was surveyed. These locations and the fish species recorded are illustrated in Figure 4 and listed in Table 9.

Fish species recorded at both locations were Brown Trout and Brook Lamprey, with European Eel *Anguilla anguilla* and Salmon *S. salar* also recorded at the upstream location. During the 2016 study, Three-spined Stickleback *Gasterosteus aculeatus* were recorded in all watercourses with the exception of the Rossmeen Stream and the Drakerath Stream. Stone Loach *Barbatula barbatula* were also recorded during the 2016 survey (Site 1, 2, 7, 16).

The Inny River is evaluated as being of county importance with regard to its fisheries value and presence of European eel. It is noted that European eel is listed as 'Critically endangered' and is now 'Red Listed' according to the recently published '*Red List No. 5: Amphibians, Reptiles & Freshwater Fish*' (King *et al*., 2011). The River Glore is evaluated as being of local importance (higher value) due to the presence of salmonid spawning and nursery areas.

The minor watercourses within the study area (Mayne and Monktown Streams) are first and second order channels found to be modified and generally evaluated as being of poor ecological and hydrogeomorphological status; these are evaluated as being of local importance (lower - value).

Table 8: Density of fish (no./m²), River Inny (Shrule Bridge). From Kelly *et al.*, (2015).

Species	Total minimum density	
	2008	2014
Brown Trout	0.014	0.006
0+ Brown Trout	0.009	0.001
1+ & older brown trout	0.006	0.005
Chub	0.0001	-
European Eel	0.001	-
Gudgeon	0.007	0.003
Minnow	0.011	0.007
Perch	0.002	0.007
Pike	0.001	0.001
Roach	0.004	0.004
Roach x bream hybrid	0.0001	-
Salmon	-	0.001
+ salmon	-	-
1+ & older salmon	-	0.001
Stone loach	0.001	0.0004
All Fish	0.041	0.029

Table 9: Fish and notable macroinvertebrate species recorded during surveys carried out on watercourses draining the proposed Coole Wind Farm. Based on electrical fishing assessments from Ecofact (2013) and snorkeling surveys (2016).

Species		Watercourse			
		River Inny	River Glore	Monktown Stream	Mayne Stream
Fish	Brown trout	✓	✓	✓	✓
	European eel	✓	✓		✓
	Brook lamprey	✓	✓		✓
	Pike	✓	✓		
	Perch	✓			
	Roach	✓			
Macro-invertebrate	*Anodonta* sp.	✓			
	Zebra Mussel	✓			
	White-clawed Crayfish	✓	✓		

1.3.5.1 Salmonid habitats and fisheries

Atlantic salmon are discussed in detail in Section 1.3.4.1. As well as salmon, brown trout also occur in the study area. Brown trout occur in virtually every catchment in Ireland with suitable water quality and spawning grounds, and are one of the most common and recognisable fish species in Ireland. Indeed, they have less protection in Ireland from anglers than non-native invasive cyprinid fish species such as the dace and roach, presumably due to their abundance.

Brown trout occur as resident 'brown trout' and also as an anadromous form, the 'sea trout'. In many catchments throughout Ireland trout make extensive migrations between spawning grounds in streams and feeding grounds in lakes or larger rivers.

The Inny catchment and its major tributaries were severely affected by drainage which degraded habitats for species such as trout. In many cases trout populations were more affected than salmon, with the removal of features such as undercut banks and large woody debris etc. from these channels. Ongoing peat harvesting in the study area is considered a persistent impact on salmonid habitats due to accumulations of peat silt in watercourse beds and thereby reducing available spawning areas and habitats for the macroinvertebrates upon which juvenile salmoids feed.

The River Inny is still considered an important trout fishery, especially the lower reaches of the river and the lakes it flows through, e.g. Lough Sheelin is still noted for the quality and size of brown trout that it produces. As for salmon, the habitats for Brown trout in the study area are limited by lack of suitable habitat (low gradient), water quality problems and drainage maintenance.

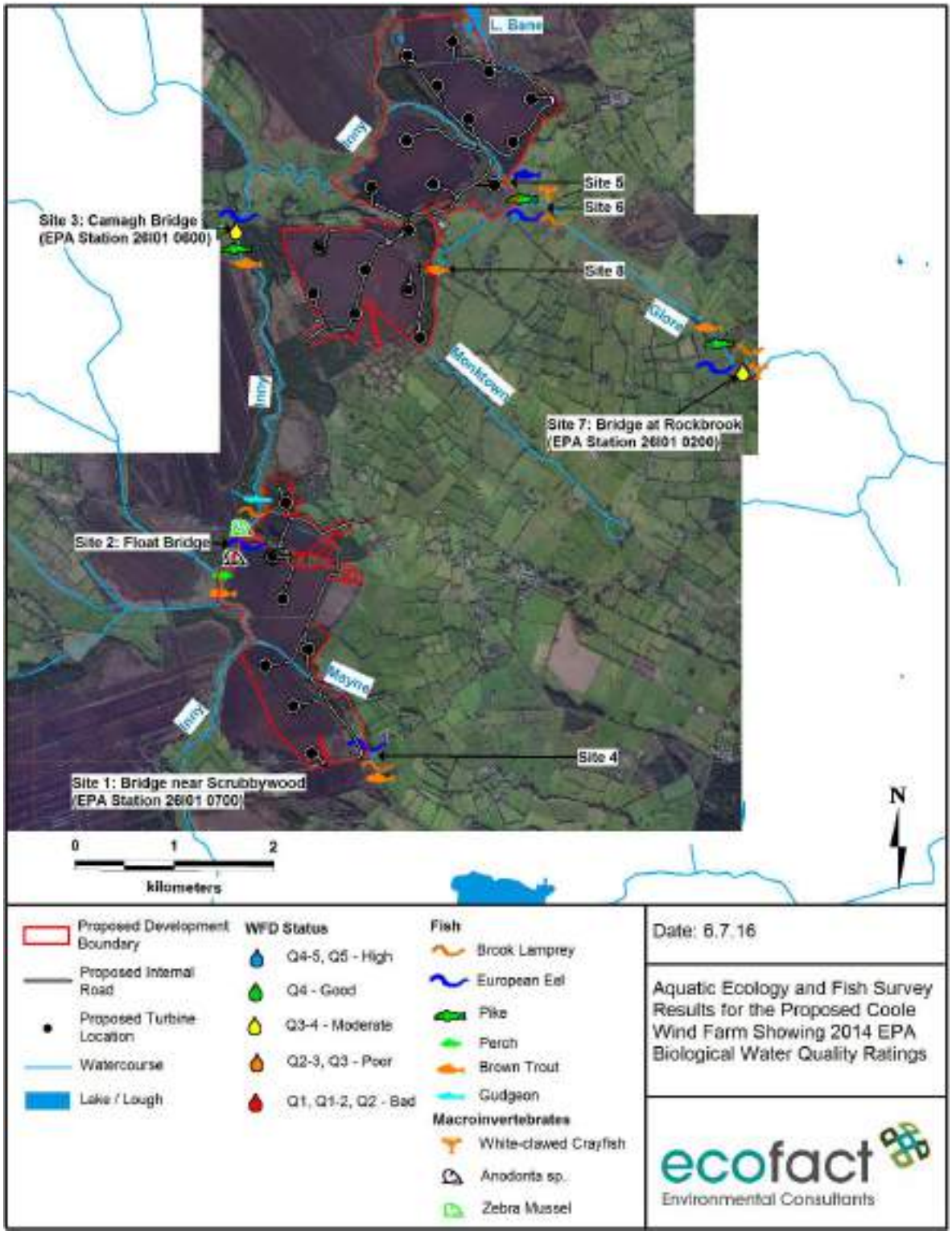

Figure 4 Coole Wind Farm aquatic ecology and fisheries survey results.

1.3.5.2 Coarse fish habitats and fisheries

Coarse fish are essentially any freshwater fish other than salmon and trout and generally include members of the cyprinidae family (i.e. roach, dace, rudd, bream, and tench), pike and perch. The term coarse fishing originated in the United Kingdom in the early 19th century. Prior to that time, recreational fishing was a sport of the gentry, who fished for salmon and trout which they called game fish. Other fish were disdained as coarse fish.

Almost all coarse fish in Ireland are considered to be non-native species. However, there is recent evidence that pike may be native to Ireland (Pedreschi *et al.*, 2013). Coarse fish in Ireland are afforded a higher level of protection in Ireland than native brown trout, with strict limits on the number and sizes of these fish that can be killed by anglers.

Coarse fisheries are of significant economic value in Ireland, particularly for tourist angers. Coarse fisheries and coarse fish spawning areas are generally located in large lowland rivers and lakes. The main channel of Inny is important in this regard. From upstream of Lough Derravaragh to Lough Ree, IFI note that the river varies in depth from approximately 1.5 metres to over 3 metres in normal water levels. The best fishing stretches are at Coolnagun, Inny Bridge and Ballycorkey Bridge. Lough Iron is fringed with dense weed beds and holds large Pike. Angling access is provided at the bridges and in most cases extensive bank fishing is available upstream and downstream from the bridges. There is a large stock of Pike in many locations throughout the length of the River with numerous hot spots.

Lough Derraravagh is regarded as a mixed fishery - it supports brown trout population but is better known for its very good pike fishing.

1.3.5.3 Eel habitats

The European eel *Anguilla anguilla* is a native fish of significant ecological importance. In recent decades, this species has undergone a dramatic decline throughout its range. In response to the decline in European eel populations European Council Regulation 1100/2007 “Establishing measures for the recovery of the stock of European eel” has now been adopted in member states. European eel is listed as ‘Critically endangered’ and is now ‘Red Listed’ according to the recently published ‘Red List No. 5: Amphibians, Reptiles & Freshwater Fish’ (King *et al.*, 2011).

Eels are considered present throughout the study area, but are generally only found in larger watercourses, rivers and lakes. Eels have a catadromous life cycle, which means they spawn in the sea and migrate into freshwater to feed and grow. This is opposite of the life cycle of the salmon, for example. The upstream migration of eels in rivers is restricted by weirs and their obstacles. However unlike lampreys they are able to climb over weirs. Despite the international decline in this species, they occur in the Inny and Glore Rivers in the study area.

1.3.5.4 Lamprey habitats

Lampreys are discussed above in Sections 1.3.4.4, 1.3.4.5, and 1.3.4.6. The study area is considered to support only Brook lamprey. This species is generally common throughout Ireland.

1.3.5.5 Others

The majority of the watercourses within the proposed wind farm site are small fish populations dominated by species such as the Three-spined stickleback and Gudgeon. These small fish communities are not of significant ecological or economic importance. These small fish populations, and particularly ones dominated by sticklebacks, can be present in even small drains that have permanent water.

1.3.6 Aquatic macroinvertebrates

The River Inny and the River Glore are evaluated as being of local value (higher importance) with regard to macroinvertebrates, due to the presence of *Anodonta* sp. and White-clawed Crayfish, respectively.

Based on the physical characteristics of the watercourses in the study area, the habitat suitability for macroinvertebrates is by and large suboptimal in the case of the Inny and Glore Rivers and marginal with respect to the Monktown and Mayne Streams. All watercourses within / adjacent to the proposed development site score low on the range of physical attributes that contribute to favourable conditions for macroinvertebrate diversity and abundance, including bottom substrate (substrates dominated by silt), habitat complexity (monotonous habitat with little diversity), pool quality (pools small/shallow and/or absent), bank stability (banks unstable and contributing sediment to the stream/denuded areas eroded during high floods) and shading.

Biological/kick sampling carried out on watercourses in the study area and the results are discussed hereunder. The mayflies *Baetis* spp., *Ephemerella ignita*, and *Caenis* spp. were found to be generally common. The Trichopterans were a well represented group with cased caddisfly larvae of. and *Agapetus* spp. inhabiting faster flowing areas with stony substrates in the River Glore. Case building families (classified as Group B, less tolerant) such as Limnephilidae, Lepidostomatidae, and Sericostomatidae along with *Phryganea bipunctata* were mostly confined to the slower parts of rivers in the study area (River Inny). Caseless caddisfly larvae (Group C, pollution tolerant) of *Hydropsyche* spp., *Rhyacophila* spp., and *Polycentropus* spp. were also found in the study area.

The most common Coleopterans in the study area were *Haliplus* spp., whirligig beetle *Gyrinus* sp., *Ilybius quadriguttatus* and *Brychius elevatus*. Hemipterans such as water boatman (*Notonecta* sp., *Sigara* sp.), bugs *(Hydrometra stagnorum*, *Velia caprai, Nepa cinerea, Notonecta* sp. *Gerris sp.*) were found in slow areas, particularly at the margins of the River Inny. Other slow-flowing fauna in the study area included dragonflies such as *Aeshna* spp. and damselfly larvae of *Calopteryx* spp.

The macroinvertebrates communities in the study area were dominated by pollution tolerant taxa. Other macroinvertebrates signifying polluted conditions that were recorded included Bloodworm *Chironomous sp*., Freshwater shrimp *Gammarus duebeni, Asellus aquaticus* and *Erpobdella testacea.*

The only large bivalve recorded was *Anodonta* sp*.* This species was recorded in the River Inny at Float Bridge. *A. anatina* is typically a lowland species (Kerney, 1999). Its habitat in Ireland is lowland lake, slow moving rivers and canals. Microhabitat for this species in Ireland comprises muddy or silty beds in areas of still or slow flow. There are a total of 31 Irish non-marine molluscan species that either have a threat status or are important Irish populations (Moorkens, 2006), including *Anodonta*. The IUCN status of *Anodonta* is 'Vulnerable' (Byrne *et al*., 2009) and its threat status is 'Vulnerable' (Moorkens, 2006).

1.3.7 Biological water quality

The River Inny (28I01) and its tributaries were most recently surveyed by the EPA in 2014. Good ecological condition was found at four out of eleven sites surveyed on the Inny in 2014. Sites in the upper reaches (0060-0600) are not reaching their ecological potential, with sensitive macroinvertebrate taxa noticeably absent. Ballinrink Bridge (0300) returned to unsatisfactory condition after an improvement in 2011. The lower reaches exhibited high macroinvertebrate diversity and were of satisfactory ecological condition in 2014 with the exception of site 0800 which had deteriorated to moderate ecological condition.

The Glore (Westmeath) was once again found to be slightly polluted/eutrophic below Glore lake (0100), as characterised by a paucity of sensitive macroinvertebrate fauna. The lower reaches (0200) were in moderate condition in 2014 after previously returning to highly satisfactory ecological condition in 2011.

1.3.8 Aquatic plant communities

Plants recorded during the current surveys consisted of *Sparganium erectum*, *Apium nodiflorum*, *Rorippa nasturtium-aquaticum*, *Glyceria maxima*, *Phragmites australis, Phalaris arundinacea, Mentha aquatica*, *Myosotis scorpioides, Iris pseudacorus, Schloenoplectus lacustris, Nuphar lutea, Callitriche* spp., *Lemna* spp. and *Potamegeton* sp. The filamentous green algae *Cladophora glomerata* was common in the enriched lower reaches of the Glore River and also in the River Inny.

1.3.9 Amphibians

The Mayne and Monktown Streams as well as Lough Bane and its feeder stream may support a small population of frog and/or newt.

Aquatic baseline report for Coole wind farm, Co. Westmeath

Prepared by Triturus Environmental Ltd. for McCarthy Keville O'Sullivan

October 2022

Please cite as:

Triturus (2022). Aquatic baseline report for Coole wind farm, Co. Westmeath. Report prepared by Triturus Environmental Ltd. for McCarthy Keville O'Sullivan. October 2022.

Table of contents

1. Introduction

1.1 Background

Triturus Environmental Ltd. were commissioned by McCarthy Keville O'Sullivan Ltd. to prepare a baseline assessment of the aquatic ecology in the vicinity of Coole wind farm, located in the lands between Carnagh, Coolcraff, Derragh, Monktown, Clonsura, Doon, Derrycrave, Newcastle, Mullagh, Carlanstown, Clonrobert, Co. Westmeath. The report includes an assessment of fisheries, biological water quality, protected aquatic species and habitats.

The surveys were undertaken to inform a Further Information request issued by An Bord Pleanála dated the 21st April 2022 (ABP ref: 309110-21) and is in respect of the submission made by the Development Applications Unit (DAU), presented in the FI request as item 2.5. In their FI request, the Board (referencing the DAU submission on the application) have requested that the Aquatic Surveys for the site be updated. In this respect the previous aquatic surveys that were completed by Ecofact (2016) inclusive of all previously surveyed sites were repeated and updated.

Surveys focused on aquatic habitats in relation to fisheries potential (including all fish of high conservation value), white-clawed crayfish (*Austropotamobious pallipes*), macro-invertebrates, macrophytes, aquatic bryophytes and aquatic invasive species which may be present in the watercourses in the vicinity of the proposed project.

1.2 Project description

A full description of the proposed project is provided in the accompanying Environmental Impact Assessment Report (EIAR). The proposed Coole wind farm project comprises the following elements:

i. Up to 15 No. wind turbines with a tip height of up to 175 metres and all associated foundations and hardstanding areas;
ii. 1 no. onsite electrical substation including a control building, associated electrical plant and equipment, welfare facilities and a wastewater holding tank;
iii. 1 no. temporary construction compound;
iv. Provision of new site access roads, upgrading of existing access roads and hardstand areas;
v. Excavation of 1 no. borrow pit;
vi. All associated underground electrical and communications cabling connecting the turbines to the proposed onsite substation;
vii. Laying of approximately 26km of underground electricity cabling to facilitate the connection to the national grid from the proposed onsite substation located in the townland of Camagh to the existing 110kV Mullingar substation located in the
viii. townland of Irishtown;
ix. Upgrade works to the existing 110kV Mullingar substation consisting of the construction of an additional dedicated bay to facilitate connection of the cable;
x. Construction of a link road between the R395 and R396 Regional Roads in the townland of Coole to facilitate turbine delivery;
xi. Junction improvement works to facilitate turbine delivery, at the N4 junction with the L1927 in the townland of Joanstown, on lands along the L1927 in the townland of Culvin, the L1927 and L5828 junction in the townland of Boherquill and the L5828 and R395 junction in the townland of Corralanna;

xii. Site drainage;
xiii. Forestry felling;
xiv. Signage, and;
xv. All associated site development works.

2. Methodology

2.1 Selection of watercourses for assessment

The current survey was undertaken at the same 8 no. survey sites as per Ecofact (2016) (**Table 2.1, Figure 2.1**). Furthermore, to reflect the addition of a proposed grid connection route (GCR) to the project design, an additional 6 no. sites were included in the current survey (i.e. watercourse crossings). This resulted in a total of *n*=14 aquatic survey sites. The nomenclature for the watercourses surveyed is per the Environmental Protection Agency (EPA).

Aquatic survey sites were present on the River Inny (EPA code: 26I01), Mayne Stream (26M92), Glore River (26G02), Monktown River (26M78), Froghanstown Stream (25F41), Ballynafid Stream (26B36), River Brosna (north) (26B28), an unnamed stream and a drainage channel (**Table 2.1**). The *n*=14 aquatic survey sites were located within the Inny_SC_020 and Inny_SC_030 river sub-catchments. The proposed wind farm and associated infrastructure were not located within a European site.

Please note this aquatic report should be read in conjunction with the final EIAR prepared for the proposed project by McCarthy Keville O'Sullivan.

2.2 Aquatic site surveys

Aquatic surveys of the watercourses within the vicinity of the proposed wind farm project were conducted on Thursday 18th and Friday 19th August 2022. Survey effort focused on both instream and riparian habitats at each aquatic sampling location (**Table 2.1 & Figure 2.1**). Surveys at each of these sites included a fisheries habitat appraisal, electro-fishing survey (where possible), white-clawed crayfish survey, macrophyte & aquatic bryophyte survey and biological water quality sampling (Q-sampling) or macro-invertebrate sweep sampling. The survey approach ensured that any habitats and species of high conservation value would be detected to best inform mitigation for the wind farm project.

In addition to the ecological characteristics of the site, a broad aquatic and riparian habitat assessment was conducted utilising elements of the methodology given in the Environment Agency's 'River Habitat Survey in Britain and Ireland Field Survey Guidance Manual 2003' (EA, 2003) and the Irish Heritage Council's 'A Guide to Habitats in Ireland' (Fossitt, 2000). This broad characterisation helped define the watercourses' conformity or departure from naturalness. All sites were assessed in terms of:

- Physical watercourse/waterbody characteristics (i.e. width, depth etc.) including associated evidence of historical drainage
- Substrate type, listing substrate fractions in order of dominance (i.e. bedrock, boulder, cobble, gravel, sand, silt etc.)
- Flow type by proportion of riffle, glide and pool in the sampling area
- An appraisal of the macrophyte and aquatic bryophyte community at each site
- Riparian vegetation composition

Table 2.1 Location of *n*=14 aquatic survey sites in the vicinity of Coole wind farm, Co. Westmeath

Site no.	Watercourse	EPA code	Location	X (ITM)	Y (ITM)
1	River Inny	26I01	Coolnagun Bridge	638678	770052
2	River Inny	26I01	Float Bridge	639188	772506
3	River Inny	26I01	Carnagh Bridge	639122	775632
4	Mayne Stream	26M92	Ballin	640517	770359
5	Glore River	26G02	Doon	641798	776069
6	Glore River	26G02	Newcastle	642220	775848
7	Glore River	26G02	Bridge at Rockbrook	644300	774205
8	Monktown River	26M78	Newcastle	641180	775185
B1	Unnamed stream	n/a	GCR crossing, Clonava	638616	769821
B2	Drainage channel	n/a	GCR crossing, Clonava	638615	769557
B3	River Inny	21I01	Inny Bridge	638805	766735
B4	Froghanstown Stream	26F41	GCR crossing, L1819	640562	763362
B5	Ballynafid Stream	26B36	GCR crossing, N4	641296	760577
B6	Brosna North River	26B28	GCR crossing, L1773	642540	756035

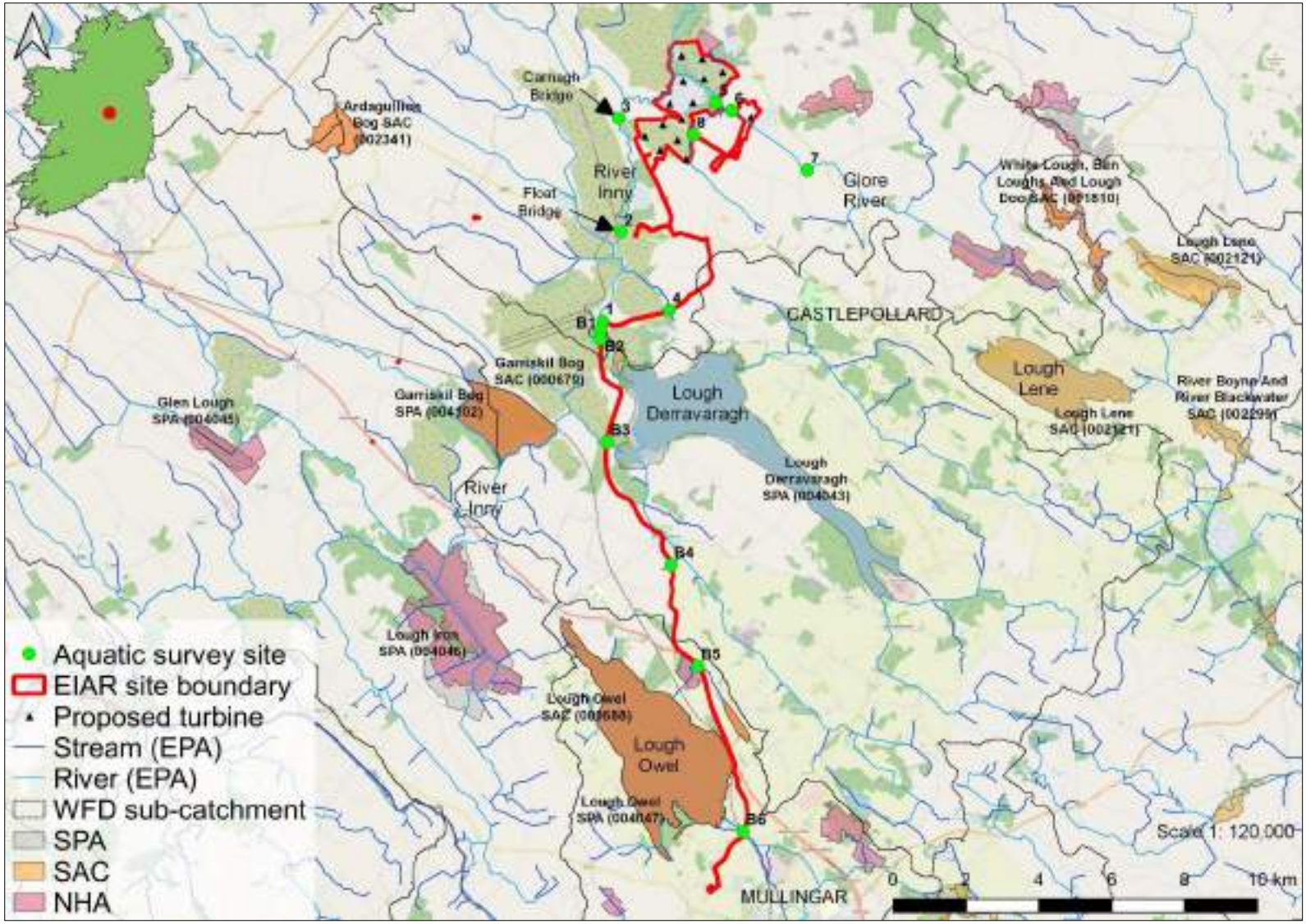

Figure 2.1 Overview of the *n*=14 aquatic survey site locations for Coole wind farm, Co. Westmeath

2.3 Fish stock assessment (electro-fishing)

A single anode Smith-Root LR24 backpack (12V DC input; 300V, 100W DC output) was used to electro-fish sites on watercourses in the vicinity of the proposed Coole wind farm in August 2022, following notification to Inland Fisheries Ireland and the National Parks and Wildlife Service, under the conditions of a Department of the Environment, Climate and Communications (DECC) licence. Electro-fishing was undertaken at all aquatic survey sites with the exception of sites 1, 2 and 3 on the River Inny and site 5 on the Glore River due to prohibitive depths of >1.5m. Therefore, a total of *n*=10 sites were surveyed via electro-fishing (**Table 2.1, Figure 2.1**). The survey was undertaken in accordance with best practice (CEN, 2003; CFB, 2008) and Section 14 licencing requirements.

Furthermore, a fisheries habitat appraisal of the aquatic survey sites (**Figure 2.1**) was undertaken to establish their importance for salmonid, lamprey, European eel and other fish species. The baseline assessment also considered the quality of spawning, nursery and holding habitat for salmonids and lamprey within the vicinity of the survey sites.

2.4 White-clawed crayfish survey

White-clawed crayfish (*Austropotamobius pallipes*) surveys were undertaken at the aquatic survey sites in August 2022 under a National Parks and Wildlife (NPWS) open licence (no. C31/2022), as prescribed by Sections 9, 23 and 34 of the Wildlife Act (1976-2021), to capture and release crayfish to their site of capture, under condition no. 6 of the licence. As per Inland Fisheries Ireland recommendations, the crayfish sampling started at the uppermost site(s) of the wind farm catchment/sub-catchments in the survey area to minimise the risk of transfer invasive propagules (including crayfish plague) in an upstream direction.

Hand-searching of instream refugia and sweep netting was undertaken according to Reynolds et al. (2010). An appraisal of white-clawed crayfish habitat at each site was conducted based on physical channel attributes, water chemistry and incidental records in mustelid spraint. Additionally, a desktop review of crayfish records within the wider Coole wind farm survey area was completed.

2.5 Otter signs

The presence of otter (*Lutra lutra*) at each aquatic survey site was determined through the recording of otter signs, if encountered incidentally during surveys. Notes on the age and location (ITM coordinates) were made for each otter sign recorded, in addition to the quantity and visible constituents of spraint (i.e. remains of fish, molluscs etc.).

2.6 Biological water quality (Q-sampling)

The 14 no. aquatic survey sites were assessed for biological water quality through Q-sampling in August 2022 (**Figure 2.1).** All samples were taken with a standard kick sampling hand net (250mm width, 500µm mesh size) from areas of riffle/glide utilising a 2-minute kick sample, as per Environmental Protection Authority (EPA) methodology (Feeley et al., 2020). Large cobble was also washed at each site for 1-minute (where present) to collect attached macro-invertebrates (as per Feeley et al., 2020). Samples were elutriated and fixed in 70% ethanol for subsequent laboratory identification. Samples were converted to Q-ratings as per Toner et al. (2005) and assigned to WFD

status classes. Any rare invertebrate species were identified from the NPWS Red List publications for beetles (Foster et al., 2009), mayflies (Kelly-Quinn & Regan, 2012), stoneflies (Feeley et al., 2020) and other relevant taxa (i.e. Byrne et al., 2009; Nelson et al., 2011).

Table 2.4 Reference categories for EPA Q-ratings (Q1 to Q5)

Q Value	WFD status	Pollution status	Condition
Q5 or Q4-5	High status	Unpolluted	Satisfactory
Q4	Good status	Unpolluted	Satisfactory
Q3-4	Moderate status	Slightly polluted	Unsatisfactory
Q3 or Q2-3	Poor status	Moderately polluted	Unsatisfactory
Q2, Q1-2 or Q1	Bad status	Seriously polluted	Unsatisfactory

2.7 Aquatic ecological evaluation

The evaluation of aquatic ecological receptors contained within this report uses the geographic scale and criteria defined in the 'Guidelines for Assessment of Ecological Impacts of National Road Schemes' (NRA, 2009).

2.8 Biosecurity

A strict biosecurity protocol following IFI (2010) and the Check-Clean-Dry approach was adhered to during surveys for all equipment and PPE used. Disinfection of all equipment and PPE before and after use with Virkon™ was conducted to prevent the transfer of pathogens or invasive propagules between survey sites. Surveys were undertaken at sites in a downstream order to minimise the risk of upstream propagule mobilisation. Particular cognisance was given towards preventing the spread or introduction of crayfish plague (*Aphanomyces astaci*) given the known distribution of white-clawed crayfish (*Austropotamobius pallipes*) in the wider survey area. Equipment was also thoroughly dried (through UV exposure) between survey areas by using duplicate equipment. Any aquatic invasive species or pathogens recorded within or adjoining the survey areas were geo-referenced.

3. Receiving environment

3.1 Coole wind farm catchment and survey area description

The proposed Coole wind farm is located in an area of cutover blanket bog approximately 8km north-west of Castlepollard, Co. Westmeath (**Figure 2.1**), whilst the proposed grid connection route (GCR) runs from the site along the R396, a number of local roads and the N4 to the Mullingar 110kV substation. The proposed wind farm site is within the Shannon River Basin District and within hydrometric area 26 (Inny). The aquatic survey sites were located within the Inny_SC_020 and Inny_SC_030 river sub-catchments (**Figure 2.1**). The proposed wind farm site is drained by the River Inny (26I01), Monktown River (26M78) and Glore River (26G02), with the proposed GCR crossing the River Inny, Mayne Stream (26M92) Froghanstown Stream (25F41), Ballynafid Stream (26B36), River Brosna (north) (26B28), an unnamed stream and a drainage channel (**Figure 2.1**).

The watercourses and aquatic surveys sites in the vicinity of Coole wind farm are typically small, lowland depositing channels (FW2; Fossitt, 2000) which have been historically modified as part of drainage works (see **section 4** for more details). The Inny catchment, including the Inny and Glore rivers, was arterially drained in the 1960-68 period (OPW data). Predominantly, the watercourses flow over areas of Visean limestone & calcareous shale (Geological Survey of Ireland data). Land use practices in the wider survey area are peat bogs (CORINE 412), transitional woodland scrub (CORINE 324), land principally occupied by agriculture with significant areas of natural vegetation (CORINE 243), coniferous forests (CORINE 312) and pastures (CORINE 231).

3.2 Fisheries asset of the survey area

The River Inny flows for some 90km from Oldcastle, Co. Meath, through Loughs Sheelin, Kinale, Derragh, Derravaragh and Ree, draining an area of 782km^2 (Caffrey et al., 2018). The upper reaches are known to support brown trout (*Salmo trutta*), lamprey (*Lampetra* sp.) and three-spined stickleback (*Gasterosteus aculeatus*) (Kelly et al., 2012, 2015). The lower reaches, which are deeper, wider and more depositing habitat (having been arterially drained) support a community dominated by coarse fish species including bream (*Abramis brama*), roach (*Rutilus rutilus*), roach x bream hybrid, perch (*Perca fluviatilis*), gudgeon (*Gobio gobio*), minnow (*Phoxinus phoxinus*), stone loach (*Barbatula barbatula*) and European eel (*Anguilla anguilla*), in addition to brown trout (Delanty et al., 2016; Kelly et al., 2010). Atlantic salmon (*Salmo salar*) are also known occasionally from the Inny (Kelly et al., 2015; Maguire et al., 2011). Lamprey (*Lampetra* sp.) are known to be present from the River Inny at Coolnagun Bridge (survey site 1) according to Inland Fisheries Ireland (OES, 2020). Chub (*Squalius cephalus*), a non-native cyprinid, are also known from the River Inny (Caffrey et al., 2008, 2018: Maguire et al., 2011; IFI, 2020).

The Glore River rises 6km east of Castlepollard. Co. Westmeath and flows north-west for a distance of approx. 12km before joining the River Inny along the proposed wind farm site boundary. The Glore is known to support brown trout, *Lampetra* sp., European eel and pike (Ecofact, 2016).

The Mayne Stream, a short tributary of the River Inny, is known to support brown trout (Ecofact, 2016). The Monktown River, a tributary of the Glore River, is known to support brown trout, European eel and *Lampetra* sp. (Ecofact, 2016)

Fisheries data for the other watercourses within the survey area (i.e. Froghanstown Stream, Ballynafid Stream, Brosna North River and unnamed stream) was not available at the time of survey.

3.3 Protected aquatic species

A comprehensive desktop review of available data (NPWS, NBDC & BSBI data) for 10km grid squares adjoining the project (i.e. N36, N37, N45, N46 and N47) identified a low number of records for rare and or protected aquatic species within the vicinity of the proposed wind farm.

A low number of records for Annex II white-clawed crayfish (*Austropotamobius pallipes*) were available for the Glore River, ≥2km upstream of the proposed wind farm (**Figure 3.1**). These records were from the 1977-2011 period. Crayfish were also recorded from the Glore River at survey site 7 in 2013 (Ecofact, 2016). A low number of records were also available for the Gaine River, Lough Sheever Stream, Brosna North River and River Brosna in the vicinity of Mullingar (Figure 3.1). Available records on the River Inny were confined to upstream of the proposed wind farm (i.e. near Loughs Sheelin and Kinale). Whilst not hydrologically linked to the proposed wind farm project, Lough Owel is known to support a very large population of white-clawed crayfish (Gammell et al., 2021; pers. obs.).

A low number of Annex II otter (*Lutra lutra*) records were available in the vicinity of the proposed wind farm on the River Inny and River Glore, with scattered records from the respective 10km grid squares (NPWS & NBDC data).

A single brook lamprey (*Lampetra planeri*) record was available for the Lough Owel outflow (aka. canal feeder or Brosna North River) (NPWS data, no date), approximately 0.7km upstream of survey site B6 (**Figure 3.1**). Brook lamprey were also recorded on the River Inny (survey site 2), Mayne Stream (site 4) and River Glore (sites 6 & 7) in 2013 (Ecofact, 2016).

Common frog (*Rana temporaria*) records were widespread in the wider N36, N37, N45, N46 and N47 10km grid squares, including in the vicinity of Rathangan (not within study area, however). A single historical record for smooth newt (*Lissotriton vulgaris*) was available in the vicinity of Crokedwood.

3.4 EPA water quality data (existing data)

The following outlines the available water quality data for the watercourses in context of the proposed wind farm project. Only recent water quality is summarised below. There was no existing EPA biological monitoring data available for the Mayne Stream, Monktown River, Froghanstown Stream or Ballynafid Stream.

Please note that biological water quality analysis was undertaken as part of this study, with the results presented in the **section 4** and **Appendix A** of this report.

3.4.1 River Inny

A number of contemporary EPA biological monitoring stations were located on the River Inny in the vicinity of the survey area. The River Inny achieved **Q3-4 (moderate status)** at Carnagh Bridge (station RS26I010600, survey site 3) in 2020. Downstream, the river achieved **Q3 (poor status)** at Inny Bridge (station RS26I010700, survey site 1). At Ballinalack Bridge (station RS26I010800), approx. 6.8km downstream of survey site B3, the Inny achieved **Q3-4 (moderate status)** in 2020.

Upstream of and adjoining the proposed wind farm boundary, the River Inny (Inny_050 river waterbody) achieved moderate status in the 2013-2018 period and was considered 'at risk' of not achieving target good status water quality. Between Carnagh Bridge and Coolnagun Bridge, the Inny_060 river waterbody achieved good status in the same period and was considered 'not at risk' of achieving good status water quality. Downstream of Coolnagun Brudge, the Inny_070 river waterbody (as far as Ballinalack Bridge) was also of good status in the 2013-2018 period, but the river waterbodies risk was under review at the time of reporting. The primary risk to water quality within these river water bodies is peat extraction (EPA, 2019).

3.4.2 Glore River

The Glore River achieved Q4 (good status) at survey site 7 (station RS26G020200) in 2020. This monitoring station is located c.2km upstream of the wind farm boundary. The Glore receives large volumes of spring flow derived from Lough Lene and White Lough in the Boyne catchment and is a good example of a karst inter-catchment water transfer (EPA, 2018).

Upstream of and within the proposed wind farm boundary, the Glore River (Inny_050 river waterbody) achieved moderate status in the 2013-2018 period and was considered 'at risk' of not achieving target good status water quality. This is due to hydromorphological issues (channelisation) caused by peat harvesting (EPA, 2019).

3.4.3 Brosna North River (Royal Canal feeder)

There is a single contemporary EPA biological water quality monitoring station on the Brosna North River. The stream achieved **Q2-3 (poor status)** at station RS25B280390 in 2021, approx. 1.4km downstream of survey site B6.

The Brosna North River is located within the Brosna_010 river waterbody, which achieved 'poor status' in the 2013-2018 period and was considered 'at risk' of not achieving target good status water quality.

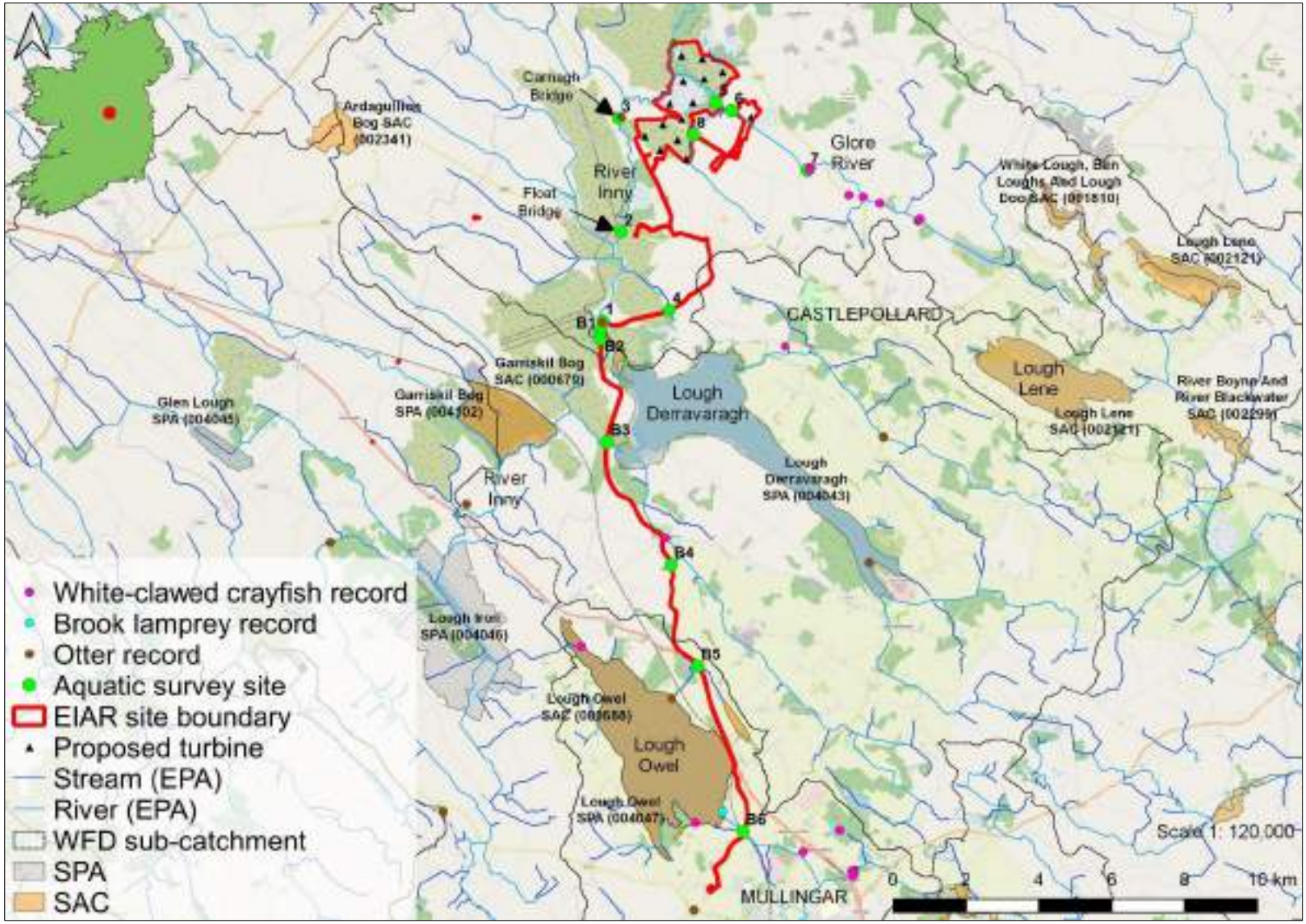

Figure 3.1 Distribution of white-clawed crayfish, otter and brook lamprey in the vicinity of the proposed Coole wind farm (source: NPWS & NBDC data)

4. Results of aquatic surveys

The following section summarises each of the *n*=14 survey sites in terms of aquatic habitats, physical characteristics and overall value for fish, white-clawed crayfish and macrophyte/aquatic bryophyte communities. Biological water quality (Q-sample) results are also summarised for each sampling site (*n*=7) and in **Appendix A**. Habitat codes are according to Fossitt (2000). Scientific names are provided at first mention only. Sites were surveyed in August 2022. Site numbering for sites 1-8 is as per Ecofact (2016). An evaluation of the aquatic ecological importance of each survey site based on these aquatic surveys is provided and summarised in **Table 4.1**.

4.1 Aquatic survey site results

4.1.1 Site 1 – River Inny, Coolnagun Bridge

Site 1 was located on the River Inny (EPA code: 26I01) at Coolnagun Bridge at a local road crossing, approx. 1.7km upstream of Lough Derravaragh. The large lowland depositing watercourse (FW2) had been straightened and deepened historically (arterial drainage), with a deep U-shaped channel and bankfull heights of 3-4m. Old embankments were evident on the east bank. The canalised channel averaged a homogenous 15-20m wide and 1.8-2.5m deep. The profile was 100% slow-flowing depositional glide which shelved quickly from the margins. The bed was comprised of silt over compacted cobble and gravels with occasional boulder (mostly near the bridge). Given the site profile and low flow rates, the site was heavily vegetated with a diverse range of macrophytes. Heterophyllus[1] arrowhead (*Sagittaria sagittifolia*) was abundant instream, with frequent branched bur-reed (*Sparganium erectum*) and yellow lily (*Nuphar lutea*). Non-native Canadian pondweed (*Elodea canadenis*) was also frequent. Frogbit (*Hydrocharis morsus-ranae*) and curled pondweed (*Potamogeton crispus*) were occasional along channel margins. Water forget-me-not (*Myosotis scorpioides*), floating sweet-grass (*Glyceria fluitans*), water starwort (*Callitriche* spp.) and amphibious bistort (*Persicaria amphibia*) were occasional along the river margins. Water plantain (*Alisma plantago-aquatica*), river water dropwort (*Oenanthe fluviatilis*) and common clubrush (*Schoenoplectus lacustris*) were present but rare. Stands of common reed (*Phragmites australis*) were occasional, being more frequent upstream of the bridge. Filamentous algal mats were present, indicating enrichment (more prevalent than at upstream sites). The moss *Fontinalis antipyretica* was locally frequent on the bridge abutments and occasional marginal structure, with *Leptodictyum riparium* frequent on marginal cobble and boulder. The riparian zone supported mature treelines of grey willow (*Salix cinerea*) with a nitrophilous community dominated by reed canary grass (*Phalaris arundinacea*), nettle (*Urtica dioica*) and hedge bindweed (*Calystegia sepium*), with scattered iris (*Iris psuedacorus*). The site was bordered by improved (intensive) pasture (GA1).

Electro-fishing was not undertaken at site 1 given prohibitive depths (i.e. fisheries appraisal only). The Inny in the vicinity of Coolnagun Bridge was of high coarse fish value, with suitability for a range of species including pike (*Esox lucius*), perch (*Perca fluviatilis*), roach (*Rutilus rutilus*), bream (*Abramis brama*) and European eel. The site was of high value as a coarse fish nursery and spawning area given a profusion of instream vegetation in addition to frequent overhanging willow (and associated roots). Juvenile roach, for example, were visible abundant during the site visit. The River Inny is also known

[1] heterophyllus refers to the presence of foliage leaves of more than one form on the same plant or stem

to support brown trout, although salmonid habitat is typically poor, including at this site (i.e. deep, depositional glide). Given poor flow rates and paucity of suitable nursery habitat (clay-dominated silt beds), suitability for lamprey was low. However, *Lampetra* sp. are known from the site according to Inland Fisheries Ireland (OES, 2020). White-clawed crayfish habitat was good overall although no records are available for the river in the vicinity of the site. Despite high suitability for otter, no signs were recorded in the vicinity of the bridge.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix A**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the presence good quality European eel and coarse fish habitat, in addition to high otter suitability and value as an ecological corridor, the aquatic ecological evaluation of site 1 was of **local importance (higher value) (Table 4.1).**

Plate 4.1 Representative image of site 1 on the River Inny at Coolnagun Bridge, August 2022 (facing upstream from bridge)

4.1.2 Site 2 – River Inny, Float Bridge

Site 2 was located on the River Inny at Float Bridge, approx. 3km upstream of site 1. The large lowland depositing watercourse (FW2) had been straightened and deepened historically (arterially drained), with a deep U-shaped channel and bankfull heights of 2-3m. The canalised channel averaged a homogenous 25-30m wide and 2-3m deep. The profile was 100% slow-flowing depositional glide which shelved quickly from the margins. With the exception of an artificial slipway (gravels) and occasional boulder near the bridge, the bed was comprised of silt atop compacted cobble and gravels. As per site 1, given the site profile the river at this location was heavily vegetated. Heterophyllus arrowhead was abundant instream, with frequent branched bur-reed, yellow lily and frogbit. Canadian pondweed (*Elodea canadensis*) and river water dropwort were locally frequent instream. Water

forget-me-not, water mint, water starwort (*Callitriche* sp.) and amphibious bistort were occasional along the river margins. Mare's-tail (*Hippurus vulgaris*) was also occasional. Flowering rush (*Butomus umbellatus*) grew amongst branched bur-reed beds. The river margins were fringed with common reed and reed canary grass. Filamentous algae was frequent, indicating enrichment. The moss *Fontinalis antipyretica* was locally frequent on the bridge abutments and occasional marginal structure. Freshwater sponge (likely *Porifera* sp.) was present on boulder and cobble near the bridge. The riparian zone supported intermittent mature treelines of alder (*Alnus glutinosa*) and willow species (*Salix* spp.) with a nitrophilous community dominated by reed canary grass and hedge bindweed. The site was bordered by cutover bog (PB4) and coniferous afforestation (WD3).

Electro-fishing was not undertaken at site 2 given prohibitive depths (i.e. fisheries appraisal only). The Inny in the vicinity of Float Bridge was of high coarse fish value, with suitability for a range of species including pike, perch, roach, bream and European eel. The site was of high value as a coarse fish nursery and spawning area given a profusion of instream vegetation in addition to frequent overhanging willow (and associated roots) downstream. The River Inny is also known to support brown trout, although salmonid habitat is typically poor, including at this site (i.e. deep, depositional glide). Given poor flow rates and paucity of suitable nursery habitat (clay-dominated silt beds), suitability for lamprey was low. White-clawed crayfish habitat was good overall although no records are available for the river in the vicinity of the survey site. Despite high suitability for otter, no signs were recorded in the vicinity of the bridge.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix A**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the presence good quality European eel and coarse fish habitat, in addition to high otter suitability and value as an ecological corridor, the aquatic ecological evaluation of site 2 was of **local importance (higher value) (Table 4.1).**

Plate 4.2 Representative image of site 2 on the River Inny at Float Bridge, August 2022 (facing upstream from bridge)

4.1.3 Site 3 – River Inny, Carnagh Bridge

Site 3 was located on the River Inny at Carnagh Bridge, approx. 3.7km upstream of site 2 and 1.7km downstream of the proposed site boundary. The large lowland depositing watercourse (FW2) had been straightened and deepened historically (arterially drained), with a deep trapezoidal channel and bankfull heights of up to 8m (with old embankments present). The canalised channel averaged a homogenous 18-20m wide and 1.8-≥3m deep. The profile was 100% slow-flowing depositional glide which shelved quickly from the margins. With the exception of an artificial slipway (gravels) and occasional boulder underneath the bridge arch, the bed was comprised of silt and clay atop compacted cobble and gravels. Excavated clay banks were present along the channel. As per site 1 and 2 downstream, given the site profile the river at this location was heavily vegetated. Heterophyllus arrowhead was abundant instream, with frequent submerged lesser water parsnip (*Berula erecta*) in addition to frogbit and heterophyllus yellow lily. Water starwort (*Callitriche* sp.), river water dropwort and amphibious bistort were occasional along the river margins. Extensive marginal stands of reed canary grass were present along the margins (deeply undercut), with common reed locally frequent upstream of the bridge. The moss *Fontinalis antipyretica* was locally frequent on the bridge abutments and marginal structure. Freshwater sponge (likely *Porifera* sp.) was also present on the bridge abutments. Filamentous algae (*Vaucheria* sp.) was frequent, indicating enrichment. The riparian zone supported mature treelines of alder, willow species (*Salix* spp.), hawthorn (*Crataegus monoygna*) and ash (*Fraxinus excelsior*) with a nitrophilous community dominated by reed canary grass, hedge bindweed and bramble (*Rubus fruticosus* agg.). The site was bordered by improved pasture (GA1) and coniferous plantations (WD3).

Electro-fishing was not undertaken at site 3 given prohibitive depths (i.e. fisheries appraisal only). The Inny in the vicinity of Carnagh Bridge was of high coarse fish value, with suitability for a range of

species including pike, perch, roach, bream and European eel. The site was of high value as a coarse fish nursery and spawning area given a profusion of instream vegetation in addition to frequent overhanging willow (and associated roots) downstream. The River Inny is also known to support brown trout, although salmonid habitat is typically poor, including at this site (i.e. deep, depositional glide). Given poor flow rates and paucity of suitable nursery habitat (clay-dominated silt beds), suitability for lamprey was low. White-clawed crayfish habitat was good overall although no records are available for the river in the vicinity of the survey site. Despite high suitability for otter, no signs were recorded in the vicinity of the bridge.

Biological water quality, based on Q-sampling, was calculated as **Q3-4 (moderate status)** (**Appendix A**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the presence good quality European eel and coarse fish habitat, in addition to high otter suitability and value as an ecological corridor, the aquatic ecological evaluation of site 2 was of **local importance (higher value) (Table 4.1).**

Plate 4.3 Representative image of site 3 on the River Inny at Carnagh Bridge, August 2022 (facing downstream from bridge)

4.1.4 Site 4 – Mayne Stream, Ballin

Site 4 was located on the uppermost reaches of the Mayne Stream (26M92) at a local road crossing, approx. 1.8km upstream of the River Inny confluence. The lowland depositing watercourse (FW2) had been extensively straightened and deepened historically and suffered from very low flows at the time of survey (i.e. a semi-dry channel with an imperceptible flow). The stream was contained in a shallow U-shaped channel that averaged 2.5-3m wide and <0.05m deep. The profile was of stagnant glide and pool (ponding of water). The stream at this location featured a bed of deep anoxic silt (peat-derived) up to 1m in depth with no hard substrata. Macrophyte coverage was very high (>75%) with abundant

fool's watercress (*Apium nodiflorum*) and frequent branched bur-reed. Bryophytes were not recorded. The channel was heavily shaded in the vicinity of the road crossing with mature grey willow and downy birch (*Betula pubescens*) growing from peat banks. An area of nitrophilous herb vegetation was present in the vicinity of the bridge, with abundant hedge bindweed, nettle, marsh woundwort (*Stachys palustris*) and bramble.

With the exception of three-spined stickleback (*Gasterosteus aculeatus*) (low density recorded via electro-fishing), site 4 was not of fisheries value given gross siltation and poor seasonal flows. Furthermore, the location of the site in the uppermost reaches of the river and poor connectivity with downstream-connecting habitats (due to gross siltation and poor flows) reduced the fisheries potential of the channel. There was no suitability for white-clawed crayfish. No otter signs were recorded in the vicinity of the site and suitability was very poor.

Biological water quality, based on Q-sampling, was calculated as **Q2 (bad status)** (**Appendix A**). However, it should be noted that this is a tentative rating given poor flows and lack of suitable riffle areas for sampling (as per Toner et al., 2005). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given Q2 (bad status) water quality and the poor-quality fisheries habitat present, the aquatic ecological evaluation of site 4 was of **local importance (lower value)** (**Table 4.1**).

Plate 4.4 Representative image of site 4 on the Mayne Stream, August 2022

4.1.5 Site 5 – Glore River, Doon

Site 5 was located on the Glore River approx. 0.2km downstream of the Monktown River confluence and 0.5km downstream of site 6. As per upstream, the river had been extensively straightened and deepened (arterial drainage) and featured a trapezoidal channel with 3-4m bankfull heights. The significant hydromorphological modifications resulted in poor flows and a depositing habitat

dominated by very slow-flowing glide and occasional pool (no riffle). The substrata were dominated by deep silt with only localised mixed gravels in shaded areas (also heavily silted). The site was very heavily vegetated, with abundant broad-leaved pondweed (*Potamogeton natans*) (>50% cover). River water dropwort, water cress (*Nasturtium officinale*), common duckweed (*Lemna minor*), water mint and water forget-me-not were frequent. Branched bur-reed was occasional. Bryophytes were not recorded. The river margins supported abundant nitrophilous community dominated by reed canary grass, nettle and hedge bindweed with angelica (*Angelica sylvestris*) and meadowsweet (*Filipendula ulmaria*). Mature, overhanging grey willow were frequent along the channel, providing high shading locally. The site was bordered by improved agricultural grassland (GA1) to the north and coniferous afforestation (WD3) to the south.

Electro-fishing was not undertaken at site 5 given prohibitive depths (i.e. fisheries appraisal only). Site 5 was considered a poor-quality salmonid and lamprey habitat due to evident siltation and historical drainage pressures, including low flows. However, some good quality holding habitat for adult salmonids was present. The heavily vegetated, depositional habitat was of highest value for a range of coarse fish species, with abundant nursery and spawning habitat throughout. Suitability for European eel and white-clawed crayfish was also high given the presence of amble instream refugia. Despite good suitability for otter, no signs were recorded in the vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix A**). However, it should be noted that this is a tentative rating given poor flows and lack of suitable riffle areas for sampling (as per Toner et al., 2005). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given suitability for salmonids, European eel, white-clawed crayfish and otter, the aquatic ecological evaluation of site 5 was of **local importance (higher value)** (**Table 4.1**).

Plate 4.5 Representative image of site 5 on the Glore River, August 2022

4.1.6 Site 6 – Glore River, Newcastle

Site 6 was located on the Glore River approx. 0.3km upstream of the Monktown River confluence and 0.5km upstream of site 5. The river had been arterially drained (straightened and deepened) historically, with a typical trapezoidal channel and bankfull heights of 3-4m (old embankments present). However, some good instream recovery was evident. The open water width of the fast-flowing lowland depositing watercourse (FW2) averaged 3m wide but often featured a channel of up to 6m wide, with up to 50% covered by floating aquatic vegetation. The depth varied from 0.3-0.8m in fast glide areas to 1.2-1.8m in deeper glide and pool. The profile was dominated by glide habitat with very localised riffle and frequent pool. The substrata comprised cobble and coarse gravels with occasional boulder. These were compacted due to high flow rates and also partially calcified. Siltation was high overall although much was deposited in association with instream macrophyte beds (likely mobilises during winter). The clear-water site supported a high diversity of aquatic vegetation. Narrow-fruited watercress (*Nasturtium microphyllum*) was abundant along channel margins and formed extensive floating mats, with the abundant submerged form also present. Water mint was also abundant with frequent water forget-me-not and occasional pink water speedwell (*Veronica catenata*), water starwort (*Callitriche* spp.) and branched bur-reed. Ivy-leaved duckweed (*Lemna trisulca*) was also locally frequent. The pondweed species *Potamogeton crispus* and *Stuckenia pectinata,* in addition to mare's-tail and floating sweet-grass were present but localised. The moss species *Fontinalis antipyretica* was present occasionally. Filamentous algal cover (*Vaucheria* sp.) was high (20%), indicating significant enrichment. The sloping banks supported lush herbaceous vegetation comprising abundant reed canary grass with iris, great willowherb (*Epilobium hirsutum*), lesser water parsnip, angelica, water mint, pink water speedwell and water forget-me-not. Given the presence of numerous indicator species (EC, 2013; Devaney et al., 2013), this community was considered representative of the Annex I habitat 'Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels [6430]'. The bank top supported scattered hawthorn and bramble scrub (much of which had been cleared historically). The site was bordered by improved pasture (GA1) with frequent livestock access and considerable poaching.

Brown trout (*Salmo trutta*), gudgeon (*Gobio gobio*) and stone loach (*Barbatula barbatula*) were recorded via electro-fishing at site 6. Site 6 was of good value for salmonids, despite evident hydromorphological and siltation pressures. However, the site supported only a low density of brown trout. Primarily, this was considered to reflect considerable siltation pressures which reduced the quality of available spawning habitat. The site was, however, of excellent value as a holding habitat for large adults with abundant undercut banks/overhanging vegetation providing valuable cover in an otherwise open channel. Excellent quality nursery habitat was also present given abundant instream refugia. The high-energy site provided moderate (at best) lamprey ammocoete and spawning habitat - none were recorded via targeted electro-fishing. The site was of high suitability for European eel and white-clawed crayfish but neither species was recorded. No otter signs were recorded in the vicinity of the survey site, despite high foraging suitability.

Biological water quality, based on Q-sampling, was calculated as **Q3-4 (moderate status)** (**Appendix A**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the presence of salmonids and excellent quality nursery habitat, in addition to the presence of Annex I habitat 'Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels [6430]', the aquatic ecological evaluation of site 6 was of **local importance (higher value) (Table 4.1).**

Plate 4.6 Representative image of site 6 on the Glore River, August 2022

4.1.7 Site 7 – Glore River, bridge at Rockbrook

Site 7 was located on the Glore River at a local road crossing approx. 2.7km upstream of site 6. The river had been straightened historically but not deepened with low-lying banks of 1-1.5m height. The fast-flowing, spring-fed (EPA, 2018) alkaline river (FW2) averaged 3m wide and 0.2-0.4m deep. The profile was of very fast flowing glide with occasional small pool and localised riffle. A shallow farm ford crossing was present immediately upstream of the bridge (riffle habitat). The substrata were dominated by cobble but this was compacted given high flow rates and featured high levels of calcification (cementation). Boulder was occasional. Sands were present in pool slacks. Soft sediment deposits were present in association with instream macrophyte beds and adjoining pool areas. Macrophyte coverage was relatively high with abundant heterophyllus narrow-fruited watercress and fool's watercress along the channel margins and submerged instream. Water mint was frequent along the margins. The site also supported localised water starwort (*Callitriche* sp.), ivy-leaved duckweed and common duckweed. Branched bur-reed was present but rare. The site was dominated by the calcicolous liverwort *Pellia endiviifolia* (>30% cover) (a result of the highly calcified/compacted bed). The moss species *Rhynchostegium riparioides* and *Fissidens crassipes* were also present locally. The riparian zone supported a mature ash, sycamore (*Acer psuedoplatanus*) and hawthorn treeline along the south bank with a bramble and ivy (*Hedera* sp.) understorey. The north bank was open and supported a herbaceous community of abundant reed canary grass, frequent great willowherb and occasional bittersweet (*Solanum dulcamara*) and meadowsweet. The site was bordered by amenity grassland (GA2, lawns) and improved pasture (GA1).

Brown trout and *Lampetra* sp. were the only two fish species recorded via electro-fishing at site 7 (**Appendix B**). Site 7 was of high value to salmonids, supporting a high density of mixed-cohort brown trout. The site was of most value as a nursery habitat, with high numbers of juvenile trout amongst abundant instream vegetation in fast glide. Scoured banks and, more importantly, overhanging macrophyte vegetation (e.g. watercress) provided valuable holding habitat for adult salmonids. Deeper holding pools were absent. Good quality spawning habitat was present by way of fine and medium gravels but such areas were small in extent and of reduced value due to calcification. These areas also provided suitability for lamprey spawning. Good quality larval lamprey habitat was present adjoining the ford crossing and supported a low density of ammocoetes (1.5 per m^2 targeted habitat). Despite some good suitability for European eel and white-clawed crayfish, none were recorded (poorly accessible refugia with the exception of macrophyte beds). However, crayfish remains were identified in two otter spraint sites recorded on boulders adjoining the bridge abutments (ITM 644297, 774199 and 644301, 774202).

Biological water quality, based on Q-sampling, was calculated as **Q3-4 (moderate status)** (**Appendix A**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the presence of salmonids and Annex II *Lampetra* sp. and white-clawed crayfish (identified in otter spraint), in addition to utilisation by otter, the aquatic ecological evaluation of site 7 was of **local importance (higher value)** (**Table 4.1**).

Plate 4.7 Representative image of site 7 on the Glore River, August 2022 (upstream of bridge) showing high riverbed cover of *Pellia endiviifolia*

4.1.8 Site 8 – Monktown River

Site 8 was located on the Monktown River (26M78) at a local road crossing approx. 0.25km south-east of proposed turbine T9. The river had been extensively straightened and deepened historically in vicinity of the road crossing. The river crossed under the local road via a masonry arch bridge with a rendered apron. The river suffered from near imperceptible flows at the time of survey and averaged 2-2.5m wide and 0.2m deep. The profile comprised near-stagnant glide with no riffle areas in a shallow U-shaped channel. The site suffered from gross siltation upstream of the road crossing, with flocculent anoxic (peat-dominated) deposits of up to 0.5m deep on top of heavily compacted cobble and mixed gravels (none of which were exposed). Downstream of the bridge, a short section of channel was exposed to heavy livestock poaching which had created a small area of over-widened cobble and boulder habitat. This also supported very limited and heavily silted beds of fine gravels and sand. Macrophyte growth was limited to marginal stands of fool's watercress with more occasional lesser water parsnip and common duckweed. Bryophytes were not recorded. The riparian zone supported scattered mature sycamore, hawthorn, elder (*Sambucus nigra*) and ash with abundant great willowherb, reed canary grass, nettle and bramble. A mature beech (*Fagus sylvatica*) treeline lined the channel downstream. The site was bordered by improved pasture (GA1).

Three-spined stickleback and *Lampetra* sp. were the only species recorded via electro-fishing at site 8. Despite gross siltation and very low seasonal flows, site 8 was of moderate value for lamprey (*Lampetra* sp.), with flocculent silt deposits supporting a low density of relatively large ammocoetes (c.2 per m^2). The site was unsuitable for salmonids given siltation and flow pressures. However, very low densities of brown trout were observed in the lower reaches of the stream during the survey period, c. 0.5km downstream. Three-spined stickleback, a species highly tolerant of poor water quality and low dissolved oxygen, were abundant. A debris dam located at the downstream side of the culvert/bridge was a significant barrier to flow and fish passage. Suitability for white-clawed crayfish was low and none were recorded. No otter signs were recorded in the vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q2-3 (poor status)** (**Appendix A**). However, it should be noted that this is a tentative rating given poor flows and lack of suitable riffle areas for sampling (as per Toner et al., 2005). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the presence of Annex II *Lampetra* sp., the aquatic ecological evaluation of site 8 was of **local importance (higher value)** (**Table 4.1**).

Plate 4.8 Representative image of site 8 on the Monktown River, August 2022 (facing upstream from bridge)

4.1.9 Site B1 – unnamed stream

Site B1 was located on a drainage channel at a local road and proposed GCR crossing, approx. 0.2km south-west of site 1. The drainage channel (FW4) emanated from a coniferous block and had been recently excavated prior to the survey as part of road resurfacing works (new pipe culvert installed). The trapezoidal shaped channel featured bankfull heights of 2-2.5m and contained localised pools of <0.05m deep stagnant water only, i.e. no flow, rainwater fed. There was no connectivity with the adjacent River Inny given an earthen berm of 0.75m high at the end of the channel. However, the channel would hold water during periods of high water levels in the adjacent River Inny, i.e. a back-channel. The substrata comprised excavated sand and clay (marl). Despite evident recent clearance works, the margins supported occasional watercress, water forget-me-not, brooklime (*Veronica* beccabunga) and very occasional water starwort (*Callitriche* sp.). Common duckweed was present locally. Common reed also grew in the lower reaches of the channel with a dense stand fringing the River Inny. Whilst the south bank had been recently cleared of vegetation, the north bank supported flailed grey willow, sycamore and hawthorn. The site was bordered by improved pasture (GA1).

Site B1 was not of fisheries value given its evident ephemeral nature (rainwater fed) and extensive modifications. No fish were recorded via electro-fishing (**Appendix B**). However, given the proximity to the River Inny, the channel likely conveys flood water and thus may serve as a very low value coarse fish habitat, seasonally. No otter signs were recorded in vicinity of the survey site.

Biological water quality, based on Q-sampling, was calculated as **Q1-2 (bad status)** (**Appendix A**). However, it should be noted that this is a tentative rating given poor flows and lack of suitable riffle areas for sampling (as per Toner et al., 2005). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the absence of fisheries value and absence of species or habitats of high conservation value in the ephemeral channel, in addition to Q1-2 (bad status) water quality, the aquatic ecological evaluation of site B1 was of **local importance (lower value)** (**Table 4.1**).

Plate 4.9 Representative image of site B1 on a drainage channel, May 2022 (facing downstream from road crossing)

4.1.10 Site B2 – drainage channel

Site B2 was located on an unmapped drainage channel (FW4) at a local road and proposed GCR crossing approx. 0.1km upstream of the River Inny confluence. The drainage channel (FW4) emanated from an adjacent coniferous plantation (WD3) and had been straightened and deepened historically. The deep trapezoidal channel featured bankfull heights of 2m and averaged 2m wide and 0.5-0.7m deep. There was no flow in the channel at the time of survey, i.e. stagnant channel. The substrata comprised compacted (excavated) cobble and boulder which were heavily silted. The drain was heavily encroached by common reed on both banks and instream. Ivy-leaved duckweed and common duckweed were abundant instream. Greater bladderwort (*Utricularia vulgaris*) was present but rare. Yellow lily was present at the River Inny confluence. Aquatic bryophytes were not recorded. The narrow riparian zones supported abundant common reed with frequent meadowsweet, reed canary grass and occasional common valerian. The site was bordered by wet improved grassland (GA1) and coniferous plantation (WD3) with downy birch borders.

With the exception of three-spined stickleback (recorded via electro-fishing; **Appendix B**), site B2 was not of fisheries value given gross siltation and poor hydromorphology. However, the confluence with the River Inny provided some suitability for European eel and as a coarse fish nursery, particularly during periods of high-water levels. Suitability for white-clawed crayfish was poor and none were recorded. No otter signs were recorded in the vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix A**). However, it should be noted that this is a tentative rating given poor flows and lack of suitable riffle areas for sampling (as per Toner et al., 2005). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the low fisheries value and absence of species or habitats of high conservation value, in addition to Q3 (poor status) water quality, the aquatic ecological evaluation of site B2 was of **local importance (lower value)** (**Table 4.1**).

Plate 4.10 Representative image of site B2 on an unmapped drainage channel, August 2022 (facing downstream from road crossing to River Inny confluence)

4.1.11 Site B3 – River Inny, Inny Bridge

Site B3 was located on the River Inny at Inny Bridge, a proposed GCR crossing, approx. 0.5km downstream of the Lough Derravaragh outflow. The lowland depositing river (FW2) had not been historically modified in the vicinity of the bridge, with mature banks, meandering profile and an adjoining flood plain. The river averaged 20m wide and 2.5-3m deep, with a centrally deeper channel and steeply sloping margins. The profile was of slow-flowing depositional glide with a bed dominated by silt and localised silted cobble and boulder. Some exposed gravels and cobble were present in the vicinity of the bridge abutments, which supported the invasive zebra mussel (*Dreissena polymorpha*). The depositional glide was heavily vegetated with abundant long-leaved pondweed (*Potamogeton x angustifolius*) and heterophyllus arrowhead. Beds of yellow lily and frogbit were frequent. Common duckweed (*Lemna minuta*) and greater duckweed (*Spirodela polyrhiza*) were both frequent. Non-native Canadian pondweed was occasional. The moss *Fontinalis antipyretica* and *Leptodictyum riparium* were both locally frequent on hard substrata near the bridge and submerged structure. The margins were lined by mature linear stands of common reed and branched bur-reed with frequent water mint and occasional lesser water parsnip, amphibious bistort, water forget-me-not and bog

bean (*Menyanthes trifoliata*). These stands graded into reed swamp (FS1) habitat along the south bank, particularly downstream of the bridge. Great yellow cress (*Rorippa amphibia*) was present but rare. Floating filamentous algal mats were frequent with *Cladophora* sp. abundant instream. The river was lined by a mature overhanging willow (*Salix* spp.) treeline on the north bank. The site was bordered by reed swamp habitat and wet grassland (GS4).

Electro-fishing was not undertaken at site B3 given prohibitive depths (i.e. fisheries appraisal only). Site B3 was of high coarse fish value, known to support a range of species including pike, perch, roach, bream and European eel. Mature overhanging willows on the north bank provided especially valuable holding habitat for a range of fish species. The site was of high value as a coarse fish nursery and spawning area given a profusion of instream vegetation in addition to frequent overhanging willow (and associated roots). Juvenile roach, for example, were visible abundant during the site visit. The River Inny is also known to support brown trout, although salmonid habitat is typically poor, including at this site. White-clawed crayfish habitat was good overall although no records are available for the river in the vicinity of the site. An old otter spraint site was recorded on an old stanchion under the southernmost arch of the bridge (ITM 638807, 766724). The undercut bridge structure also had some suitability as an otter resting (couch) area although none were identified.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix A**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the presence good quality European eel and coarse fish habitat, in addition to high otter suitability and value as an ecological corridor, the aquatic ecological evaluation of site 2 was of **local importance (higher value) (Table 4.1).**

Plate 4.11 Representative image of site B3 on the River Inny at Inny Bridge, August 2022 (facing downstream from bridge)

4.1.12 Site B4 – Froghanstown Stream, L1819 road crossing

Site B4 was located on the Froghanstown Stream (26F41) at a local road and proposed GCR crossing. The stream had been extensively straightened and deepened downstream of the road crossing, where it had been realigned to emanate from a twin culvert headwall (Plate 4.12). Bank revetment was present in the vicinity of the culverts. The original channel was still present at the road crossing but this was dry and evidently did not convey water except perhaps after rainfall events. The trapezoidal channel featured bankfull heights of 2m. The realigned stream averaged 1.5m wide and <0.1m deep. The stream suffered from low seasonal flows at the time of survey. The profile comprised slow flowing, very shallow glide and riffle with a low frequency of small pools. The substrata were dominated by compacted mixed gravels and small cobble, with only occasional boulder. These were heavily calcified (tufa-like formations on culvert outfall) and also heavily silted given very low flow rates and historical modifications. The site was very heavily vegetated with abundant cover of narrow-fruited watercress and fool's watercress (>90% cover). Common duckweed was also present in stagnant areas. Aquatic bryophytes were limited to *Rhynchostegium riparoides* and the liverwort *Chiloscyphus polyanthos*. The liverwort *Lunularia cruciata* grew on bank revetment and the culvert structure. The modified channel was lined on the south bank by a mature treeline of sycamore and hawthorn with bramble scrub. The north bank was open with a very narrow scrubby riparian zone. The site was bordered by improved agricultural grassland (GA1).

With the exception of ten-spined stickleback (*Pungitius pungitius*), site B4 was not of fisheries value given poor seasonal flows, poor hydromorphology and siltation pressures. Furthermore, the location of the site in the uppermost reaches of the stream and poor connectivity with downstream-connecting habitats (e.g. Gaine River) reduced the fisheries potential of the channel. There was no suitability for white-clawed crayfish at this location and none were recorded. No otter signs were recorded in vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix A**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the low fisheries value and absence of species or habitats of high conservation value, in addition to Q3 (poor status) water quality, the aquatic ecological evaluation of site B4 was of **local importance (lower value)** (**Table 4.1**).

Plate 4.12 Representative image of site B4 on the Froghanstown Stream, August 2022

4.1.13 Site B5 – Ballynafid Stream, N4 road crossing

Site B5 was located on the Ballynafid Stream (26B36) at the N4 road and proposed GCR crossing, approx. 120m upstream of the confluence with Ballynafid (Ballinafid) Lake. The lower reaches of the stream are located within Ballynafid Lake And Fen pNHA (000673), a calcareous fen site noted as very important for rare invertebrates and insects some of which are internationally rare (NPWS, 2009). The stream (FW2) had been realigned and modified historically in vicinity of the N4 road crossing, being straightened from the road culvert to the lake. The stream suffered from very low water levels at the time of survey, with no flow present in a semi-dry trapezoidal channel that averaged 2m wide and <0.05m deep. The substrata were dominated by cobble with occasional boulder and some localised mixed gravels but these were heavily silted. Water was restricted to stagnant pools. Due to heavy tunnelling, no aquatic macrophytes were recorded although fool's watercress was present within the channel upstream of the road crossing. Aquatic bryophytes were not recorded. The stream channel was heavily tunnelled by dense treelines of sycamore, ash, holly (*Ilex aquifolium*), elder and hawthorn with bramble and ivy understories.

Site B1 was not of fisheries value given its evident ephemeral nature and poor connectivity with the downstream Ballynafid Lake. No fish were recorded via electro-fishing (**Appendix B**). However, given the proximity to the lake, the channel likely conveys flood water and thus may serve as a very low value coarse fish and European eel habitat in its lower reaches, seasonally. No otter signs were recorded in vicinity of the survey site.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix A**). However, it should be noted that this is a tentative rating given poor flows and lack of suitable riffle areas for sampling (as per Toner et al., 2005). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Despite its ephemeral nature and low aquatic value, given the location of the lower reaches of the stream within Ballynafid Lake And Fen pNHA (000673), the aquatic ecological evaluation of site B5 was of **national importance** (**Table 4.1**).

Plate 4.13 Representative image of site B5 on the Ballynafid Stream, August 2022 (downstream of N5 road crossing)

4.1.14 Site B6 – Brosna North River, L1173 road crossing

Site B6 was located on the Brosna North River (26B28) (aka Lough Owel outflow) at a local road and proposed GCR crossing near Levington railway crossing. The artificial channel was dug in 1806 to supply the Royal Canal and had a straightened and deepened profile. The swift-flowing lowland depositing watercourse (FW2) averaged 2.5-3m wide and 0.4-0.8m deep, with locally deeper pool to 1.2m. The profile comprised deep glide habitat with only occasional pool (this was the same upstream of the bridge also). The substrata were dominated by mixed gravels and small cobble, with only localised boulder. Shells of deceased zebra mussels (*Dreissena polymorpha*) were abundant on the bed. Soft sediment deposits were frequent along the channel margins (east bank) and were largely flocculent in nature. Siltation was light overall although livestock poaching of the narrow riparian zone on the eastern bank was excessive and contributing to sedimentation. Macrophytes were limited to very occasional spiked water-milfoil (*Myriophyllum spicatum*) and Canadian pondweed (*Elodea canadensis*) with water mint and yellow iris. More extensive beds of macrophytes were observed further upstream near Lough Owel. Aquatic bryophytes were absent. Freshwater sponges were frequent on the bed. The river was heavily shaded by scattered mature ash, hawthorn, dog rose (*Rosa canina*) and fuchsia (*Fuchsia magellanica*) with scrubby understories dominated by ivy, bramble and hedge bindweed. The invasive Himalayan knotweed (*Persicaria wallichii*) was present c.5m downstream of the bridge. The site was bordered by a rail line and improved pasture (GA1).

Despite some good physical suitability for salmonids and other fish species, site B6 supported a very low density of fish, with only a single brown trout and a single juvenile roach recorded via electro-fishing. This unusually low density was at odds with the presence of good quality suitable spawning, nursery and holding habitat for salmonids. The presence of invasive zebra mussels and calcification of the bed reduced the availability and quality of salmonid and lamprey spawning habitat but suitable areas were nevertheless present. Similarly, despite some apparent suitability for lamprey in terms of both spawning and nursery habitat, none were recorded during targeted electro-fishing. Habitat for European eel was considered of good quality given ample accessible hard refugia and an abundant prey resource. In more open glide areas upstream (near Lough Owel), low densities of roach (*Rutilus rutilus*) and perch (*Perca fluviatilis*) were observed instream during the survey period. A high density of white-clawed crayfish (*Austropotamobius pallipes*) were recorded via sweep netting and hand-searching, with a total of 42 crayfish recorded from 45 refugia (very high density; Peay, 2003). No otter signs were recorded in the vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix A**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the location of the site within the Royal Canal NHA (002103), the aquatic ecological evaluation of site B5 was of **national importance** (**Table 4.1**). The site (and wider channel) supported abundant Annex II white-clawed crayfish, in addition to a low density of salmonids.

Plate 4.14 Representative image of site B6 on the Brosna North River, August 2022 (facing downstream from bridge)

Plate 4.15 White-clawed crayfish recorded from site B6, August 2022

4.2 Fisheries assessments & habitat appraisals

Electro-fishing surveys were undertaken at 9 no. sites in August 2022, with fisheries appraisals completed at the remining 5 no. sites on the River Inny and Glore River (due to prohibitive depths for electro-fishing). A summary of these results is presented in **Table 4.1** below.

Salmonids were recorded (via electro-fishing) from sites 6 and 7 on the Glore River and B6 on the Brosna North River (Lough Owel outflow). Site 7 was of especially high value to salmonids, supporting a high number of mixed-cohort brown trout (*n*=83). The site was of most value as a nursery habitat, with high numbers of juvenile trout amongst abundant instream vegetation in fast glide. Site 6 (located downstream of site 7) also provided some excellent quality salmonid habitat but supported much lower fish numbers (*n*=11; **Table 4.1**). Only a single adult trout was recorded from site B6. Deeper, more depositional survey sites such as those on the River Inny (sites 1, 2, 3, & B3) and Glore River (5) provided some low suitability for adult salmonids (holding habitat) but were not suitable as spawning or nursery areas.

Lamprey ammocoetes *(Lampetra* sp.) were recorded in low densities from site 7 on the Glore River (1.5 per m^2) and, despite poor suitability, site 8 on the Monktown River (2 per m^2). Larval lamprey were known from this location on the Glore River but not from the Monktown Stream (Ecofact, 2016). Whilst previously recorded from the Mayne Stream at site 4 (Ecofact, 2016), no lamprey ammocoetes were recorded via targeted electro-fishing at this site in 2022. Inland Fisheries Ireland data indicates that brook lamprey (*L. planeri*) are known from the River Inny at Coolnagun Bridge (site 1) (OES, 2020).

Despite some good suitability across numerous survey sites (e.g. on the River Inny, Glore River and Brosna North River), no European eel were recorded via electro-fishing in August 2022.

Table 4.1 Summary of fisheries assessments (electro-fishing) and fisheries habitat appraisals for sites in the vicinity of Coole wind farm, August 2022

			Recorded via electro-fishing				
Site	**Watercourse**	**Assessment**	**Salmonids**	***Lampetra* sp.**	**European eel**	**Other fish species**	**Fisheries summary**
1	River Inny	Fisheries appraisal	n/a	n/a	n/a	n/a	Large, deep lowland depositing river with high value as a coarse fish & European eel habitat. *Lampetra* sp. recorded at this site previously (IFI data in OES, 2020)
2	River Inny	Fisheries appraisal	n/a	n/a	n/a	n/a	Large, deep lowland depositing river with high value as a coarse fish & European eel habitat
3	River Inny	Fisheries appraisal	n/a	n/a	n/a	n/a	Large, deep lowland depositing river with high value as a coarse fish & European eel habitat
4	Mayne Stream	Electro-fishing	x	x	x	Three-spined stickleback (*n*=5)	Very heavily silted, modified channel with poor flows. Only of value for three-spined stickleback
5	Glore River	Fisheries appraisal	n/a	n/a	n/a	n/a	Deep, modified river channel with high value as coarse fish & European eel habitat, some value as adult salmonid holding habitat given nearby superior salmonid habitat upstream
6	Glore River	Electro-fishing	Brown trout (*n*=11)	x	x	Gudgeon (*n*=7), stone loach (*n*=3)	Modified, swift-flowing channel with good value for salmonids including excellent quality nursery & holding habitats.
7	Glore River	Electro-fishing	Brown trout (*n*=83)	*Lampetra* sp. (*n*=3; 1.5 per m^2)	x	x	Swift-flowing channel with good value for salmonids, lamprey & European eel
8	Monktown River	Electro-fishing	x	*Lampetra* sp. (*n*=11; 2 per m^2)	x	Three-spined stickleback (*n*=4)	Very heavily silted, modified channel with poor flows supporting a low density of ammocoetes in sub-optimal habitat
B1	Unnamed stream	Electro-fishing	x	x	x	x	Heavily modified ephemeral drainage channel with no fisheries value. No fish recorded via electro-fishing
B2	Drainage channel	Electro-fishing	x	x	x	Three-spined stickleback (*n*=16)	Modified drainage channel with low fisheries value for three-spined stickleback. Some low European eel & coarse fish potential near Inny confluence under higher flows
B3	River Inny	Fisheries appraisal	n/a	n/a	n/a	n/a	Large, deep lowland depositing river with high value as a coarse fish & European eel habitat
B4	Froghanstown Stream	Electro-fishing	x	x	x	Ten-spined stickleback (*n*=6)	Small, heavily vegetated, modified stream with poor seasonal flows, only of value for ten-spined stickleback
B5	Ballynafid Stream	Electro-fishing	x	x	x	x	Small, modified ephemeral stream with perhaps some low seasonal suitability as coarse fish & European eel habitat in its lower reaches. No fish recorded via electro-fishing
B6	Brosna North River	Electro-fishing	Brown trout (*n*=1)	x	x	Roach (*n*=1)	Artificial, mature channel with some good local suitability for salmonids, lamprey, European eel & coarse fish but supported vey low fish densities. Of very high value for white-clawed crayfish (abundant)

4.3 Biological water quality (macro-invertebrates)

No rare or protected macro-invertebrate species (according to national red lists) were recorded in the biological water quality samples taken from *n*=14 sites in August 2022 based on a full taxonomic list (**Appendix A; Tables 7.1 & 7.2**).

None of the survey sites achieved target good status (≥Q4) requirements of the European Union Environmental Objectives (Surface Waters) (Amendment) Regulations 2019 and the Water Framework Directive (2000/60/EC) (**Figure 4.1**). A comparison of biological water quality for sites 1-8 in 2016 and 2022 is provided in **Table 4.2** below.

Site 3 on the River Inny and sites 6 and 7 on the Glore River achieved **Q3-4 (moderate status)** water quality. This was given the low numbers (<5%) of group A species and a dominance of group C species such as the mayflies *Baetis rhodani* and *Serratella ignita*, the caseless caddis *Hydropsyche instabilis*, freshwater shrimp (*Gammarus duebeni*) and several molluscan species. Sites 6 and 7 were the only sites to support the group A mayfly *Ecdyonurus dispar*.

Sites 1, 2 and B3 (River Inny), 5 (Glore River), 8 (Monktown Stream), B2 (unnamed stream), B3 (drainage channel), B4 (Froghanstown Stream), B5 (Ballynafid Stream) and B6 (Brosna North River) all achieved **Q3 (poor status)** based on an absence of group A species, low numbers of group B species such as the caddis *Halesus radiatus* and the damselfly *Calopteryx splendens*, and a dominance of group C species, particularly the freshwater shrimp *Gammarus duebeni*. Group D species, chiefly *Asellus aquaticus*, were also common at most of these sites. It should be noted that due to poor flows and an absence of suitable riffle areas for sampling, the Q-ratings for sites 8, B2 and B5 are tentative.

Site 4 on the Froghanstown Stream and B1 on an unnamed stream adjacent to the River Inny achieved **Q2 (bad status)** and **Q1-2 (bad status),** respectively. This was given a dominance of highly pollution tolerant group D and E species such as *Asellus aquaticus* and *Chironomus* spp. However, the ratings for both these sites are tentative due to poor flows and an absence of suitable riffle areas for sampling.

Table 4.2 Comparison of biological water quality at sites 1-8 in 2016 and 2022

Site	Watercourse	Q-rating June2016	Q-rating Aug 2022	WFD status 2022	Pollution status
1	River Inny	Q3-4 / Q4	Q3	Poor status	Moderately polluted
2	River Inny	Q3-4 / Q4	Q3	Poor status	Moderately polluted
3	River Inny	Q3-4 / Q4	Q3-4	Moderate status	Slightly polluted
4	Mayne Stream	Q3	Q2*	Bad status	Seriously polluted
5	Glore River	Q3-4	Q3	Poor status	Moderately polluted
6	Glore River	Q3-4	Q3-4	Moderate status	Slightly polluted
7	Glore River	Q3-4	Q3-4	Moderate status	Slightly polluted
8	Monktown River	Q3	Q2-3*	Poor status	Moderately polluted

4.4 White-clawed crayfish

Annex II white-clawed crayfish were recorded from site B6 on the Brosna North River. A high density were recorded via sweep netting and hand-searching, with a total of 42 crayfish recorded from 45 refugia (very high density; Peay, 2003).

Whilst no crayfish were recorded via sweep netting or hand searching at site 7 on the Glore River, crayfish remains were identified in otter spraint recorded in vicinity of the bridge. This indicated the presence of a low density of crayfish at this site, a supposition also noted by Ecofact (2016).

Despite suitability at sites 1, 2, 3, 5, 6 and B3, crayfish were not recorded from any other survey sites via sweep netting or hand searching in August 2022.

4.5 Otter signs

The presence of otter (*Lutra lutra*) within 150m each aquatic survey site was determined through the recording of otter signs, including holts (breeding areas), couches (resting areas), spraint, latrine, prints and slides with (ITM co-ordinates) for each sign type. Two regular spraint sites (inferring frequent visitation) were identified at site 7 on the Glore River, with an old spraint site also recorded underneath Inny Bridge at site B3 (River Inny). Despite some high suitability within the survey area, otter signs were not recorded from other sites. No breeding (holts) or resting (couch) areas were identified in the vicinity of the survey sites in August 2022.

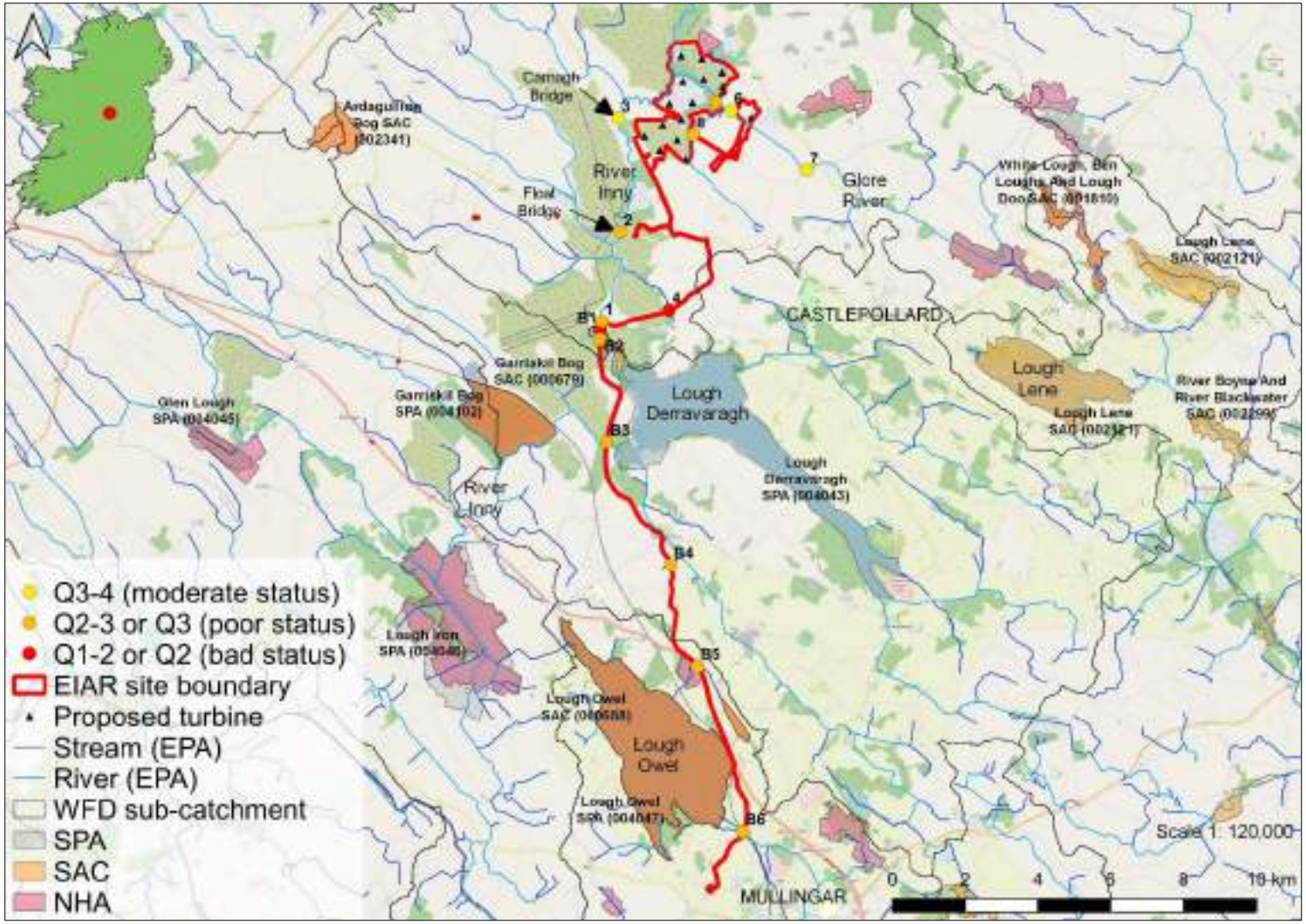

Figure 4.1 Overview of the biological water quality status in the vicinity of the proposed Coole wind farm project, Co. Westmeath, August 2022

4.6 Aquatic ecological evaluation

An aquatic ecological evaluation of each survey site was based on the results of desktop review (i.e., presence of fish of conservation value), fisheries habitat assessments, the presence of protected or rare invertebrates (e.g. white-clawed crayfish), the presence of rare macrophytes and aquatic bryophytes and or associated representations of Annex I habitats. Furthermore, biological water quality status also informed the aquatic evaluation (**Table 4.2**).

Site B5 on the Ballynafid Stream and site B6 on the Brosna North River were evaluated as **national importance** given their locations within Ballynafid Lake and Fen pNHA (000673) and Royal Canal NHA (002103), respectively.

None of the remaining 12 no. aquatic survey sites were evaluated as greater than **local importance (higher value)**. The higher value sites were present on the River Inny (sites 1, 2, 3 & B3), Glore River (sites 5, 6 & 7) and the Monktown River (site 8). Primarily, this evaluation was due to the presence of salmonids, *Lampetra* sp. and or other aquatic species or habitats of conservation value.

The remaining sites on the Mayne Stream (site 4), unnamed stream (B1), Inny drainage channel (B2) and Froghanstown Stream (B4) were evaluated as **local importance (lower value)** in terms of their aquatic ecology given an absence of species or habitats of high conservation value.

Table 4.2 Aquatic ecological evaluation summary of the Coole wind farm survey sites according to NRA (2009) criteria

Site no.	Watercourse	EPA code	Evaluation of importance	Rationale summary
1	River Inny	26I01	**Local importance (higher value)**	High value as an ecological corridor; poor quality salmonid and lamprey habitat (although lamprey known from the site - see OES, 2020), good quality European eel and coarse fish habitat given deep, vegetated glide habitat; good suitability for white-clawed crayfish but none recorded; high otter suitability but no signs recorded; Q3 (poor status) water quality; no other aquatic species or habitats of high conservation value
2	River Inny	26I01	**Local importance (higher value)**	High value as an ecological corridor; poor quality salmonid and lamprey habitat, good quality European eel and coarse fish habitat given deep, vegetated glide habitat; good suitability for white-clawed crayfish but none recorded; high otter suitability but no signs recorded; Q3-4 (moderate status) water quality; no other aquatic species or habitats of high conservation value
3	River Inny	26I01	**Local importance (higher value)**	High value as an ecological corridor; poor quality salmonid and lamprey habitat, good quality European eel and coarse fish habitat given deep, vegetated glide habitat; good suitability for white-clawed crayfish but none recorded; high otter suitability but no signs recorded; Q3-4 (moderate status) water quality; no other aquatic species or habitats of high conservation value
4	Mayne Stream	26M92	Local importance (lower value)	Site not of fisheries value given poor hydromorphology, gross siltation & poor seasonal flows, only of value for three-spined stickleback; no suitability for white-clawed crayfish, with none recorded; poor otter suitability with no signs recorded; Q2 (bad status) water quality (tentative Q-rating); no aquatic species or habitats of high conservation value
5	Glore River	26G02	**Local importance (higher value)**	Poor quality salmonid and lamprey habitat given poor hydromorphology & siltation pressures but of high value as European eel & coarse fish habitat; high suitability for white-clawed crayfish but none recorded; good suitability for otter but no signs recorded; Q3 (poor status) water quality (tentative rating); no other aquatic species or habitats of high conservation value
6	Glore River	26G02	**Local importance (higher value)**	Brown trout, gudgeon & stone loach recorded via electro-fishing; good quality salmonid habitat with excellent nursery & holding

Site no.	Watercourse	EPA code	Evaluation of importance	Rationale summary
				habitat, moderate quality lamprey habitat; high suitability for European eel and white-clawed crayfish, but none recorded; high suitability fir otter but no signs recorded; Q3-4 (moderate status) water quality; site supported the Annex I habitat 'Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels [6430]'; no other aquatic species or habitats of high conservation value
7	Glore River	26G02	**Local importance (higher value)**	Brown trout and Annex II *Lampetra* sp. recorded via electro-fishing; of good value for salmonids with high quality holding and nursery habitat; good quality lamprey spawning & nursery habitat; good suitability for European eel & white-clawed crayfish but none recorded (however, Annex II crayfish remains recorded in otter spraint, inferring likely presence); two otter spraint sites recorded; Q3-4 (moderate status) water quality; no other aquatic species or habitats of high conservation value
8	Monktown River	26M78	**Local importance (higher value)**	Three-spined stickleback and Annex II *Lampetra* sp. recorded via electro-fishing; site not of value as a salmonid habitat given gross siltation, poor hydromorphology & very low seasonal flows; moderate quality lamprey habitat with low density of ammocoetes present; low suitability for European eel & white-clawed crayfish, with none recorded; poor suitability for otter with no signs recorded; Q2-3 (poor status) water quality (tentative rating); no other aquatic species or habitats of high conservation value
B1	Unnamed stream	n/a	Local importance (lower value)	No fish recorded via electro-fishing; ephemeral, heavily modified artificial channel with no fisheries value & poor aquatic value; Q1-2 (bad status) water quality (tentative rating); no suitability for white-clawed crayfish or otter; no aquatic species or habitats of high conservation value
B2	Drainage channel	n/a	Local importance (lower value)	Site not of fisheries value given poor hydromorphology, gross siltation & poor seasonal flows, only of value for three-spined stickleback; very poor suitability for white-clawed crayfish, with none recorded; poor otter suitability with no signs recorded; Q3 (poor status) water quality (tentative Q-rating); no aquatic species or habitats of high conservation value

Site no.	Watercourse	EPA code	Evaluation of importance	Rationale summary
B3	River Inny	21I01	**Local importance (higher value)**	High value as an ecological corridor; poor quality salmonid and lamprey habitat but good quality European eel and coarse fish habitat given deep, vegetated glide habitat; good suitability for white-clawed crayfish but none recorded; high otter suitability with spraint site recorded under bridge; invasive zebra mussel abundant; Q3 (poor status) water quality; no other aquatic species or habitats of high conservation value
B4	Froghanstown Stream	26F41	Local importance (lower value)	Site not of fisheries value given poor hydromorphology, siltation & poor seasonal flows, only of value for ten-spined stickleback; very poor suitability for white-clawed crayfish, with none recorded; poor otter suitability with no signs recorded; Q3 (poor status) water quality (tentative Q-rating); no aquatic species or habitats of high conservation value
B5	Ballynafid Stream	26B36	**National importance**	Site not of fisheries value and of poor aquatic value but lower reaches (including survey site) located within Ballynafid Lake And Fen pNHA (000673); Q3 (poor status) water quality (tentative rating)
B6	Brosna North River	26B28	**National importance**	Located within Royal Canal NHA (002103); brown trout and roach (Rutilus rutilus) recorded via electro-fishing; good quality salmonid and lamprey & European eel habitat but only very low densities of brown trout & no lamprey or eel recorded; abundant Annex II white-clawed crayfish; invasive zebra mussel abundant; Q3 (poor status) water quality (tentative Q-rating); no other aquatic species or habitats of high conservation value

Conservation value: Atlantic salmon (*Salmo salar*), sea lamprey (*Petromyzon marinus*), brook lamprey (L*ampetra planeri*), river lamprey (*Lampetra fluviatilis*), white-clawed crayfish (*Austropotamobius pallipes*) and otter (*Lutra lutra*) are listed under Annex II of the Habitats Directive [92/42/EEC]. Atlantic salmon, river lamprey, freshwater pearl mussel, white-clawed crayfish and otter are also listed under Annex V of the Habitats Directive [92/42/EEC]. Freshwater pearl mussel and otters (along with their breeding and resting places) are also protected under provisions of the Irish Wildlife Acts 1976 to 2021. European eel are 'critically endangered' according to most recent ICUN red list (Pike et al., 2020) and listed as 'critically engendered' in Ireland (King et al., 2011). With the exception of the Fisheries Acts 1959 to 2019, brown trout have no legal protection in Ireland.

5. Discussion

5.1 Most valuable areas for aquatic ecology

Site B5 on the Ballynafid Stream and site B6 on the Brosna North River were evaluated as **national importance** given their locations within Ballynafid Lake and Fen pNHA (000673) and Royal Canal NHA (002103), respectively. Whilst the Ballynafid Stream at this location was of very poor fisheries or aquatic value given its ephemeral nature, the Brosna North River at site B6 supported abundant Annex II white-clawed crayfish. Crayfish were visibly abundant at the time of survey throughout the river channel from site B6 as far as the Lough Owel confluence, approx. 0.6km upstream (pers. obs.). In light of ongoing national outbreaks of crayfish plague (*Aphanomyces astaci*) and resulting declines in the species (Swords, 2021), the site is of even greater importance in terms of white-clawed crayfish conservation.

None of the remaining 12 no. aquatic survey sites were evaluated as greater than **local importance (higher value)**. The higher value sites were present on the River Inny (sites 1, 2, 3 & B3), Glore River (sites 5, 6 & 7) and the Monktown River (site 8). Despite historical modifications (arterial drainage), the River Inny is an important ecological corridor and of high ecological (and recreational) value for coarse fish, in addition to Red-listed European eel. The four River Inny survey sites were also of high value for Annex II otter although signs (spraint) were only recorded at site B3. Similarly, despite extensive historical straightening and deepening (arterial drainage), the Glore River survey sites were of value for a range of species and habitats of high conservation value. Site 7 supported a high abundance of salmonids in addition to Annex II *Lampetra* sp., Annex II otter and (by proxy of remains in otter spraint), Annex II white-clawed crayfish at site 7, with high suitability for salmonids, Annex II otter and Annex I habitat 'Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels [6430]' present (downstream) at site 6. Site 5 was also of value to Annex II otter. The Monktown River at site 8, whilst heavily modified, exposed to gross siltation pressures and suffering from low seasonal flows, was of value to Annex II *Lampetra* sp., supporting a low density of lamprey ammocoetes (**Table 4.1**).

The sites on the Mayne Stream (site 4), unnamed stream (B1), Inny drainage channel (B2) and Froghanstown Stream (B4) were evaluated as **local importance (lower value)** in terms of their aquatic ecology given an absence of species or habitats of high conservation value. The unnamed stream at site B1 was evidently ephemeral and had been extensively modified in the recent past, resulting in an absence of fisheries habitat and very poor aquatic value. Sites B2 and B4 also provided poor quality aquatic and fisheries habitats given poor hydromorphology, historical modifications and or siltation pressures. In contrast to previous surveys (Ecofact, 2016), no lamprey ammocoetes were recorded from site 4 on the Mayne Stream and no suitability was identified in the grossly silted peat channel.

No rare or protected macro-invertebrate species (according to national red lists) were recorded in the biological water quality samples taken from *n*=14 riverine sites (**Appendix A**). None of the survey sites achieved target good status (≥Q4) requirements of the European Union Environmental Objectives (Surface Waters) (Amendment) Regulations 2019 and the Water Framework Directive (2000/60/EC). Siltation (via peat escapement) and alterations to hydromorphology are known to be the major pressures within the survey area (EPA, 2018, 2019) and this was supported by observations made during the aquatic surveys.

No examples of the Annex I habitat 'Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation [3260] ('floating river vegetation') were recorded in August 2022. Whilst not corresponding to Annex I habitat classifications, the River Inny and River Glore survey sites (i.e. 1, 2, 3, 5, 6, 7 & B3) supported valuable macrophyte-rich habitats of particular value to salmonids and macro-invertebrates.

5.2 Aquatic invasive species

The invasive bivalve zebra mussel (*Dreissena polymorpha*) was recorded on the River Inny at site B3 and Brosna North River at site B6. This invasive bivalve is well-established in the Shannon and Erne catchments (including the River Inny), having proliferated in the mid to late 1990's (Minchin et al., 2002). Zebra mussel is considered a high-risk impact species in Ireland (O' Flynn et al., 2014) and is subject to restrictions under Regulations 49 and 50 of the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations 2011-2021 (S.I. 477/2011).

The invasive (albeit naturalised) macrophyte Canadian pondweed (*Elodea canadenis*) was recorded at all survey sites on the River Inny (i.e. 1, 2, 3, & B3) in addition to site B6 on the Brosna North River. This very widespread invasive pondweed is also listed on the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations 2011-2021 (S.I. 477/2011) and is considered a high-risk invasive species in Ireland (O' Flynn et al., 2014).

5.3 Aquatic ecology summary

In summary, the majority of watercourses in the vicinity of the proposed Coole wind farm were of at least **local importance (higher value)** in terms of their aquatic ecology. However, historical drainage pressures and or siltation have significantly reduced the quality of aquatic habitats on the Mayne Stream, Glore River, Monktown River, Froghanstown Stream, Ballynafid Stream and the Brosna North River.

Typically, larger watercourses with higher flow rates, greater water volumes and better connectivity, such as the River Inny and Glore River, are better able to buffer against such impacts and these watercourses supported the best quality aquatic habitats within the vicinity of the proposed wind farm for aquatic receptors of conservation value, such as salmonids, *Lampetra* sp., otter and or white-clawed crayfish.

With the exception of sites 3 on the River Inny and sites 6 & 7 on the Glore River (Q3-4), biological water quality was of **≤Q3 (poor status)** across all survey sites.

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7. Appendix A – Q-sample results (biological water quality)

Table 7.1 Macro-invertebrate Q-sampling results for sites 1 to 8, August 2022

Group	Family	Species	1	2	3	4	5	6	7	8	EPA class
Ephemeroptera	Heptageniidae	*Ecdyonurus dispar*						1	3		A
Ephemeroptera	Heptageniidae	Unidentified species			3			1			A
Ephemeroptera	Baetidae	*Alainites muticus*						2			B
Ephemeroptera	Leptophlebiidae	*Paraleptoplebia cincta*						1			B
Plecoptera	Leuctridae	*Leuctra hippopus*						4	3		B
Trichoptera	Beraeidae	*Beraeodes minutus*								2	B
Trichoptera	Goeridae	*Goera pilosa*									B
Trichoptera	Hydroptilidae	*Oxyethira* sp.			1			3			B
Trichoptera	Limnephilidae	*Halesus radiatus*	4	8	4			7			B
Trichoptera	Limnephilidae	*Limnephilus flavicornis*									B
Trichoptera	Lepidostomatidae	*Lepidostoma hirtum*									B
Trichoptera	Sericostomatidae	*Sericostoma personatum*									B
Hemiptera	Aphelochiridae	*Aphelocheirus aestivalis*	1		7			81	1		B
Odonata	Calopterygidae	*Calopteryx splendens*	4	2	8		19		1		B
Odonata	Coenagrionidae	*Coenagrion* sp.	2	8							B
Ephemeroptera	Baetidae	*Baetis rhodani*	8	17	21		86	33	42		C
Ephemeroptera	Ephemerellidae	*Serratella ignita*					1	32	48		C
Trichoptera	Hydropsychidae	*Hydropsyche instabilis*					2	66	31		C
Trichoptera	Polycentropodidae	*Neureclipsis bimaculata*									C
Trichoptera	Polycentropodidae	*Polycentropus flavomaculatus*	1		1						C
Trichoptera	Polycentropodidae	*Polycentropus kingi*									C
Crustacea	Gammaridae	*Gammarus duebeni*	25	18	23	2	112	61	98	1	C
Arachnida	Hydrachnidiae	Unidentified species	1	11	15					8	C
Coleoptera	Dytiscidae	*Agabus paludosus*									C
Coleoptera	Dytiscidae	*Dytiscus marginalis*	1	3	2						C

Group	Family	Species	1	2	3	4	5	6	7	8	EPA class
Coleoptera	Dytiscidae	*Dytiscidae* larva	1	3	7						C
Coleoptera	Dytiscidae	*Hydroporus tessellatus*				6					C
Coleoptera	Dytiscidae	*Ilybius ater*									C
Coleoptera	Dytiscidae	*Ilybius fuliginosus*				3					C
Coleoptera	Dytiscidae	*Nebrioporus depressus*	1								C
Coleoptera	Dytiscidae	*Rhantus exsoletus*			1						C
Coleoptera	Dytiscidae	*Stictotarsus duodecimpustulatus*								1	C
Coleoptera	Elmidae	*Elmis aenea*						18	2		C
Coleoptera	Gyrinidae	*Gyrinidae larva*	1	2	8						C
Coleoptera	Gyrinidae	*Gyrinus substriatus*									C
Coleoptera	Haliplidae	*Haliplus ruficollis* group	11	12	16					1	C
Coleoptera	Haliplidae	*Haliplidae nymph*		1							C
Coleoptera	Noteridae	*Noterus crassicornis*									C
Diptera	Chironomidae	non-*Chironomus* spp.			9				2		C
Diptera	Culicidae	Unidentified species		1							C
Diptera	Pediciidae	*Dicranota* sp.						1			C
Diptera		Unidentified species									C
Diptera	Simuliidae	Unidentified species			1			44			C
Diptera	Thaumaleidea	Unidentified species					1				C
Diptera	Tipuliidae	Unidentified species									C
Hemiptera	Corixidae	Corixidae nymph	6	2	1						C
Hemiptera	Corixidae	*Siagara sp.*	13	28							C
Hemiptera	Gerridae	Gerridae nymph		2						2	C
Hemiptera	Gerridae	*Gerris sp.*	1				1			1	C
Hemiptera	Nepidae	*Nepa cinerea*					2				C
Hemiptera	Notonectidae	*Notonecta marmorea viridis*	1	1	1						C

Group	Family	Species	1	2	3	4	5	6	7	8	EPA class
Hemiptera	Veliidae	*Velia caprai*				1					C
Mollusca	Bithnyiidae	*Bithynia tentaculata*	29	41	68						C
Mollusca	Dreissenidae	*Dreissena polymorpha*									C
Mollusca	Lymnaeidae	*Galba truncatula*								1	C
Mollusca	Lymnaeidae	*Lymnaea stagnalis*	1	8	12						C
Mollusca	Neritidae	*Theodoxus fluviatilis*						26	8		C
Mollusca	Planorbidae	*Bathyomphalus contortum*						1			C
Mollusca	Planorbidae	*Ancylus fluviatilis*						8			C
Mollusca	Planorbidae	*Gyraulus albus*	4	11	12			1			C
Mollusca	Planorbidae	*Planorbis carinatus*	1	1							C
Mollusca	Planorbidae	*Planorbis planorbis*	1	1	10				4	15	C
Mollusca	Tateidae	*Potamopyrgus antipodarum*						112	143		C
Mollusca	Valvatidae	*Valvata piscinalis*								1	C
Hirudinidae	Piscicolidae	*Piscicola sp.*		1							C
Tricladida	Planariidae	*Polycelis* sp.	2	4	2	6					C
Crustacea	Asellidae	*Asellus aquaticus*	16	21	18	56	31	14			D
Mollusca	Lymnaeidae	*Ampullacaena balthica*	6	1							D
Mollusca	Physidae	*Physa fontinalis*								2	D
Mollusca	Sphaeriidae	Unidentified species	2		11				1	16	D
Hirudinidae	Glossiphoniidae	Unidentified species									D
Megaloptera	Sialidae	*Sialis lutaria*				1				2	D
Diptera	Chironomidae	*Chironomus* spp.		1	1	35				16	E
Annelidae	Oligochaeta	Unidentified species	2		1						n/a
Annelidae	Naididae	Unidentified species				22					n/a
Crustacea	Argulidae	*Argulus* sp.									n/a
Arachnida	Dictynidae	*Argyroneta aquatica*		1	1						n/a
Abundance			**146**	**210**	**265**	**132**	**255**	**517**	**387**	**69**	

Group	Family	Species	1	2	3	4	5	6	7	8	EPA class
Q-rating			Q3	Q3	Q3-4	Q2*	Q3	Q3-4	Q3-4	Q2-3*	
WFD status			Poor	Poor	Mod	Bad	Poor	Mod	Mod	Poor	

Table 7.2 Macro-invertebrate Q-sampling results for sites B1-B6, August 2022

Group	Family	Species	B1	B2	B3	B4	B5	B6	EPA class
Ephemeroptera	Heptageniidae	*Ecdyonurus dispar*							A
Ephemeroptera	Heptageniidae	Unidentified species							A
Ephemeroptera	Baetidae	*Alainites muticus*							B
Ephemeroptera	Leptophlebiidae	*Paraleptoplebia cincta*							B
Plecoptera	Leuctridae	*Leuctra hippopus*							B
Trichoptera	Beraeidae	*Beraeodes minutus*							B
Trichoptera	Goeridae	*Goera pilosa*						1	B
Trichoptera	Hydroptilidae	*Oxyethira* sp.							B
Trichoptera	Limnephilidae	*Halesus radiatus*			14				B
Trichoptera	Limnephilidae	*Limnephilus flavicornis*			2				B
Trichoptera	Lepidostomatidae	*Lepidostoma hirtum*			4				B
Trichoptera	Sericostomatidae	*Sericostoma personatum*				5			B
Hemiptera	Aphelochiridae	*Aphelocheirus aestivalis*			1				B
Odonata	Calopterygidae	*Calopteryx splendens*			7			5	B
Odonata	Coenagrionidae	*Coenagrion* sp.			4				B
Ephemeroptera	Baetidae	*Baetis rhodani*			16		1	97	C
Ephemeroptera	Ephemerellidae	*Serratella ignita*							C
Trichoptera	Hydropsychidae	*Hydropsyche instabilis*							C
Trichoptera	Polycentropodidae	*Neureclipsis bimaculata*						1	C
Trichoptera	Polycentropodidae	*Polycentropus flavomaculatus*							C

Group	Family	Species	B1	B2	B3	B4	B5	B6	EPA class
Trichoptera	Polycentropodidae	*Polycentropus kingi*						1	C
Crustacea	Gammaridae	*Gammarus duebeni*	2			123	6	28	C
Arachnida	Hydrachnidiae	Unidentified species			17				C
Coleoptera	Dytiscidae	*Agabus paludosus*				3			C
Coleoptera	Dytiscidae	*Dytiscus marginalis*							C
Coleoptera	Dytiscidae	*Dytiscidae* larva		1	1	2			C
Coleoptera	Dytiscidae	*Hydroporus tessellatus*							C
Coleoptera	Dytiscidae	*Ilybius ater*				2			C
Coleoptera	Dytiscidae	*Ilybius fuliginosus*	7						C
Coleoptera	Dytiscidae	*Nebrioporus depressus*							C
Coleoptera	Dytiscidae	*Rhantus exsoletus*							C
Coleoptera	Dytiscidae	*Stictotarsus duodecimpustulatus*							C
Coleoptera	Elmidae	*Elmis aenea*							C
Coleoptera	Gyrinidae	*Gyrinidae larva*							C
Coleoptera	Gyrinidae	*Gyrinus substriatus*		2					C
Coleoptera	Haliplidae	*Haliplus ruficollis* group							C
Coleoptera	Haliplidae	*Haliplidae nymph*							C
Coleoptera	Noteridae	*Noterus crassicornis*			1				C
Diptera	Chironomidae	non-*Chironomus* spp.			1	8			C
Diptera	Culicidae	Unidentified species							C
Diptera	Pediciidae	*Dicranota* sp.							C
Diptera		Unidentified species			2				C
Diptera	Simuliidae	Unidentified species						24	C
Diptera	Thaumaleidea	Unidentified species							C
Diptera	Tipuliidae	Unidentified species				1			C
Hemiptera	Corixidae	Corixidae nymph	11		1				C

Group	Family	Species	B1	B2	B3	B4	B5	B6	EPA class
Hemiptera	Corixidae	*Siagara sp.*			10				C
Hemiptera	Gerridae	Gerridae nymph							C
Hemiptera	Gerridae	*Gerris sp.*				1		1	C
Hemiptera	Nepidae	*Nepa cinerea*			1				C
Hemiptera	Notonectidae	*Notonecta marmorea viridis*			5				C
Hemiptera	Veliidae	*Velia caprai*							C
Mollusca	Bithnyiidae	*Bithynia tentaculata*		1	4				C
Mollusca	Dreissenidae	*Dreissena polymorpha*			7			14	C
Mollusca	Lymnaeidae	*Galba truncatula*			1				C
Mollusca	Lymnaeidae	*Lymnaea stagnalis*		2	11				C
Mollusca	Neritidae	*Theodoxus fluviatilis*			2			8	C
Mollusca	Planorbidae	*Bathyomphalus contortum*							C
Mollusca	Planorbidae	*Ancylus fluviatilis*							C
Mollusca	Planorbidae	*Gyraulus albus*							C
Mollusca	Planorbidae	*Planorbis carinatus*							C
Mollusca	Planorbidae	*Planorbis planorbis*		21	17				C
Mollusca	Tateidae	*Potamopyrgus antipodarum*		4				30	C
Mollusca	Valvatidae	*Valvata piscinalis*							C
Hirudinidae	Piscicolidae	*Piscicola sp.*			3				C
Tricladida	Planariidae	*Polycelis* sp.			5	32	5		C
Crustacea	Asellidae	*Asellus aquaticus*	17	37	21	9		7	D
Mollusca	Lymnaeidae	*Ampullacaena balthica*				57	3		D
Mollusca	Physidae	*Physa fontinalis*			1	1		1	D
Mollusca	Sphaeriidae	Unidentified species		2					D
Hirudinidae	Glossiphoniidae	Unidentified species			1				D
Megaloptera	Sialidae	*Sialis lutaria*		1					D
Diptera	Chironomidae	*Chironomus* spp.	53	3	3	2	6	1	E

Group	Family	Species	B1	B2	B3	B4	B5	B6	EPA class
Annelidae	Oligochaeta	Unidentified species					2		n/a
Annelidae	Naididae	Unidentified species							n/a
Crustacea	Argulidae	*Argulus* sp.						10	n/a
Arachnida	Dictynidae	*Argyroneta aquatica*			8				n/a
Abundance			**90**	**74**	**171**	**246**	**23**	**229**	
Q-rating			**Q1-2***	**Q3***	**Q3**	**Q3**	**Q3***	**Q3**	
WFD status			**Bad**	**Poor**	**Poor**	**Poor**	**Poor**	**Poor**	

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APPENDIX 4

2021-2022 BIRD SURVEY REPORTS

Bird Survey Report: March 2021 – March 2022

Coole Wind Farm

DOCUMENT DETAILS

Client:	**Statkraft**
Project Title:	**Coole Wind Farm**
Project Number:	**200445g**
Document Title:	**Bird Survey Report: March 2021 – March 2022**
Document File Name:	**200445g– F – Bird Report Mar21-Mar22 2022.10.27**
Prepared By:	**MKO** **Tuam Road** **Galway** **Ireland** **H91 VW84**

Planning and Environmental Consultants

Rev	Status	Date	Author(s)	Approved By
01	Draft	21/10/2022	PM	PC
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Table of Contents

1. INTRODUCTION

McCarthy Keville O'Sullivan (MKO) was appointed to carry out bird survey works at Coole Wind Farm during the period from March 2021 to March 2022 inclusive. This report also includes discussion of the key observations from the 2022 breeding season. It is further noted that surveys will continue this winter 2022/23, this data was not available at the time of writing this response but can be collated and made available on request. The site is located north of Coole Village in County Westmeath (53.734193, -7.3807204). The dominant habitat onsite is cutover bog, conifer plantation and improved agricultural grassland with accompanying smaller areas of wet grassland. The wider surroundings are predominantly cutover bog, to the west and north, and improved agricultural grassland, to the east and south. The total area of the wind farm site is approximately 495ha.

This report describes the ornithological survey methods employed and survey data collected at Coole for the period from March 2021 to March 2022 inclusive. The key observations from the 2022 breeding season are included in Section 3.2.9. This report also contains information compiled during desktop studies. Particular attention has been paid to species of conservation importance and identified target species.

The report is supported by Technical Appendix 1 (Survey Effort), Appendix 2 (Survey Data) and Appendix 3 (Confidential Data) which contains the raw data from the breeding bird surveys undertaken during the survey period. This includes detail on survey times, weather conditions, surveyors, survey results and other additional information. Flight line figures from surveys are included in Appendix 4. Appendix 5 contains the collision risk assessment.

The report is structured as follows:

- An introduction providing a description of the background and statement of authority regarding ornithological works.
- An update to the desktop study that was carried out as part of the EIAR.
- A comprehensive description of the ornithological surveys carried out.
- A full description of results for all ornithological surveys carried out.
- An updated impact assessment incorporating the data contained within the EIAR and this report.
- Conclusion

The following defines terms used in this report:

- "Zones of Influence" (ZOI) for potential ornithological receptors refer to the zone within which potential effects are anticipated. ZOIs were assigned following the best available guidance (SNH 2016 and McGuinness et.al 2015).

1.1 Statement of Authority

This report has been prepared by Patrick Manley (B.Sc.) Project Ornithologist with MKO. The field surveys were undertaken by Andrew O'Donoghue, Conor Rowland, Niall McHugh, Niamh Scanlon, Patrick Manley, Tom Rae, Zak O'Conor and Zuzana Erosova, all of whom are experienced, competent bird surveyors.

2. DESK STUDY & CONSULTATION

2.1 Desk Study Methods

A comprehensive desk study was undertaken to search for any changes in the relevant information on species of conservation concern which may potentially make use of the study area since the EIAR was submitted. The assessment included a thorough review of the latest ornithological data not available at the time of EIAR submission. These include:

- Review of online web-mappers with more up to date available data: Irish Wetland Bird Survey (I-WeBS).
- Review of Birds of Conservation Concern (BoCCI) in Ireland 2020-2026 (Gilbert et al., 2021)
- Review of the 2020 International Swan Census data (Burke et al., 2021).

2.2 Desk Study Results

2.2.1 Bird of Conservation Concern (BoCCI) in Ireland 2020-2026

As per Bird of Conservation Concern (BoCCI) in Ireland 2020-2026, the following key ornithological receptors from the EIAR have been added to the BoCCI red-list:

- Kestrel
- Snipe

The following key ornithological receptors from the EIAR have been moved from the BoCCI red-list to the BoCCI Amber-list:

- Black-headed Gull
- Teal
- Wigeon

2.2.2 Irish Wetland Bird Surveys (I-WeBS)

The I-WeBS data presented in the EIAR was the county population estimate based on the five year mean from 2011/12 to 2015/16. The most up to date I-WeBS data currently available is the five year mean from 2015/16 to 2019/20. It is noted that this is an estimate, based on the best available information for water bird species. The table below shows the change in county population size for each species discussed in the EIAR, where I-WeBS data was used to evaluate county importance thresholds.

Table 1 I-WeBS updated county population sizes

Species	2011/12-2015/16 Mean	2015/16-2019/20 Mean
Greenland White-fronted Goose	291	235
Golden Plover	2,610	264
Wigeon	632	248
Teal	450	221

2.2.3 2020 International Swan Census

At the time of submission of the EIAR the Swan Census 2015 (Crowe et al., 2015) was the latest available data for whooper swan. In 2021, the 2020 International Swan Census data was published (Burke et al., 2021). The EIAR referenced the Westmeath county population to be 389 whooper swan. The 2020 Swan Census estimated the Westmeath whooper swan population to be 982 birds.

2.2.4 EPA Guidelines

The Environmental Protection Agency guidelines on the information to be contained in Environmental Impact Assessment Reports were updated in May 2022 (EPA, 2022). This document was reviewed for changes compared to the EPA (2017) guidelines and the new guidelines were adhered to in this report.

3. FIELD SURVEYS

3.1 Field Survey Methods

This section of the report describes the various field survey methods employed. Field surveys were undertaken from March 2021 to March 2022 inclusive[1]. The data provided in this report is robust and allows clear, precise and definitive conclusions to be made with regard to the likely significant effects on avian receptors identified within the subject site. Field survey methodologies have been devised to survey for the bird species composition and assemblages that occur within the study area.

3.1.1 Initial Site Assessment

The likely importance of the study area for bird species was determined, based on the results of the previous surveys as reported in the EIAR, the desk study and reconnaissance site visits. Based on the collated information available from the above preliminary assessment and adopting a precautionary approach, a site-specific scope for the ornithological surveys was developed.

3.1.2 Vantage Point Surveys

Vantage point (VP) surveys were undertaken in accordance with SNH guidance (SNH, 2017) from two vantage point locations from March 2021 to September 2021 (VP4 & VP6) and from four vantage point locations from October 2021 to March 2022 (VP3, VP4, VP5 & VP6). Data on bird observations and flight activity was collected from a scanning arc of 180° and a two-kilometre radius by an observer at each fixed location for six hours per month. Surveys were timed to provide a spread over the full daylight period including at dawn and dusk to coincide with the highest peaks of bird activity.

Details on the vantage point watch survey effort are presented in Appendix 1 of this report. This appendix includes full details of dates, times, survey locations, survey duration and weather conditions for each survey. Appendix 4, Figure 1 shows the locations of vantage points and technical data is provided in Appendix 2.

Flight activity was assigned to distinct height bands. The flight bands were chosen with reference to the dimensions of likely turbine models for the site and the resulting potential collision height. Bands are split into 0-15m, 15-25m, 25m-200m and 200m+. Taking a precautionary approach 15-200m is considered potential collision height (PCH), i.e. the height of the rotating turbine blade.

3.1.2.1 Viewshed Analysis

Viewshed analysis was carried out to confirm the sufficiency of the selected fixed vantage point locations (VP3, VP4, VP5 & VP6) prior to the commencement of surveys in March 2021(or September 2022 where relevant). Viewsheds were calculated using Resoft Wind Farm ZTV (Zone of Theoretical Visibility) software in combination with Mapinfo Professional (Version 10.0) using a notional and precautionary layer suspended at 20m, which represents the lowest swept height of the turbine blades. While the relevance of being able to view as much of the site to ground level is acknowledged, the SNH guidance emphasises the importance of visibility of the 'collision risk volume' when the data is to be used to estimate the risk of collision with turbines by birds.

The viewshed analysis involved testing each VP location for its visibility coverage by creating a view shed point two metres in height (to represent the height of the observer) on a map using 10 metre contours terrain data. Using the ZTV software, a viewshed of 360 degrees was produced calculating an area 20

[1] *In addition, the key observations from the 2022 breeding season are included in Section 3.2.9 below.*

metres from ground level up to a two-kilometre radius. The resulting viewshed image was then cropped to 180 degrees to give the viewshed from each VP location in line with SNH (2017). A 500m buffer was applied to the likely maximum viable area of the site for a wind energy development in line with SNH's recommendation to conduct surveys to 500m from the outermost turbines of a proposed wind farm site (2017). The viewshed analysis offers maximum views of the study area with adequate coverage of the proposed turbine layout. As described above, the predicted collision risk height band that was used in the current assessment is considered to be precautionary and in line with previous recommended height bands advocated in SNH (2005) guidance documents. Appendix 4, Figure 1a, 1b and 1c show the viewshed analysis of the four vantage point locations at 20m, 26m and 25m, respectively.

3.1.3 Breeding Walkover Surveys

Breeding walkover surveys were undertaken to determine the presence of bird species of high conservation concern and identify areas of possible, probable, or confirmed breeding territories for bird species observed within the study area. The survey methodology followed the O'Brien and Smith method for lowland sites as outlined in Gilbert et al. (1998). The study area for these surveys was the wind farm site and a 500m survey radius of the wind farm site.

Transects were selected in order to survey all areas of suitable breeding/ foraging habitat to within 100m, where access allowed. Target species included waders, raptors, waterbirds, gulls and other birds of conservation concern. Along with target species, all additional species observed were recorded to inform the evaluation of supporting habitat.

Walkover surveys were carried out during daylight hours, during the core breeding season months of April, May, June and July (2021), with the wind farm site being visited three days per month on each occasion. Following all survey visits, the field maps were analysed to determine the number and location of breeding territories. All non-breeding individuals and species encountered were also recorded.

Survey effort, including details of survey duration and weather conditions, is presented in Appendices 1 and 2. Figure 2 in Appendix 3 shows the survey area.

3.1.4 Breeding Raptor Surveys

Breeding raptor surveys (*i.e.,* birds of prey and owls) were undertaken within the study area and its immediate surroundings. These surveys aimed to identify occupied territories and ascertain whether breeding was successful. Methodology followed Hardey *et al.* (2013). Raptor surveys were undertaken onsite and to a 2km radius from the wind farm site every month during the core breeding season period (April to July 2021).

Survey effort, including details of survey duration and weather conditions, is presented in Appendices 1 and 2. Figure 3 in Appendix 4 shows the study area extending 2km from the wind farm site.

3.1.5 Woodcock Surveys

Breeding season surveys for woodcock were undertaken in accordance with Gilbert et. al (1998). The survey area extended 500m beyond the wind farm site. All surveys were undertaken in areas of suitable breeding habitat during May and June 2021. Surveys commenced one hour before sunset and continue for an hour after sunset/ until it was too dark to see. The survey aimed to record the presence of roding (displaying) male woodcock and thereby establish the distribution and abundance of the species in the study area. This survey method also allowed the observer to survey for owls, i.e., barn owls and long-eared owls.

Survey effort undertaken for transect surveys is presented in Appendix 1, including details of survey duration and weather conditions. Figure 4 in Appendix 4 shows survey area and technical data is provided in Appendix 2.

3.1.6 Winter Walkover Surveys

Winter walkover surveys were undertaken to record the presence of bird species of high conservation concern within areas of potentially suitable habitat in the wind farm site and a 500m survey radius of the wind farm site.

Transect routes, devised to ensure coverage of different habitat complexes, were visited within the study area during the winter months. Methodology was broadly based on adapted Brown and Shepherd methods. Target species included raptors, waterbirds, gulls and ground birds of conservation interest. Along with target species, all additional species observed were recorded to inform the evaluation of supporting habitat.

Survey effort undertaken for transect surveys is presented in Appendix 1, including details of survey duration and weather conditions. Figure 5 in Appendix 4 shows the survey area and technical data is provided in Appendix 2.

3.1.7 Wildfowl Distribution Surveys

Significant wetland sites and waterbodies within eight kilometres of the study area were surveyed for waterbird populations between September 2021 and March 2022. The area surveyed exceeded the requirements of SNH (SNH, 2017), i.e., 500m for foraging wildfowl and one kilometre for roosting wildfowl. In addition, the Lough Iron waterbird population situated approximately 12.8km to the south-west of the wind farm site was monitored one day per month during the same period, with a particular focus on Greenland white-fronted goose. The count methodology was in line with survey guidelines issued by SNH (2017) and BirdWatch Ireland (2015). Counts were undertaken during daylight hours from suitable vantage points at the wetland sites.

Survey effort undertaken for transect surveys is presented in Appendix 1, including details of survey duration and weather conditions. Figure 6 in Appendix 4 shows the survey area and technical data is provided in Appendix 2.

3.1.8 Survey Justification

A comprehensive suite of bird surveys was undertaken at the site between March 2021 and March 2022, as detailed in this report. Results in this report are derived from a continuous thirteen months of surveying undertaken in accordance with SNH Guidance.

The surveys undertaken provide the information necessary to allow a complete, comprehensive and robust assessment of the potential impacts of the wind farm site on avian receptors. The survey duration and scope are considered entirely satisfactory.

3.2 Field survey results

3.2.1 Introduction

The following target species were recorded between March 2021 and March 2022 and observations are described in detail in subsequent sections below. The list is ordered in accordance with conservation significance: Annex I species, SCIs of designated sites, Red listed species and raptors:

- Common Tern (Annex I)
- Golden Plover (Annex I; SCI species of nearby SPA)
- Greenland White-fronted Goose (Annex I; SCI species of nearby SPAs)
- Hen harrier (Annex I)
- Kingfisher (Annex I)
- Little Egret (Annex I)
- Merlin (Annex I; Schedule IV of the Wildlife Act; 1976)
- Peregrine Falcon (Annex I; Schedule IV of the Wildlife Act; 1976)
- Ruff (Annex I)
- White-tailed Eagle (Annex I; Schedule IV of the Wildlife Act; 1976)
- Whooper Swan (Annex I; SCI species of nearby SPA)
- Coot (SCI species of nearby SPA)
- Shoveler (SCI species of nearby SPAs)
- Teal (SCI species of nearby SPA)
- Tufted Duck (SCI species of nearby SPAs)
- Wigeon (SCI species of nearby SPA)
- Curlew (BoCCI Red listed)
- Goldeneye (BoCCI Red listed)
- Kestrel (BoCCI Red listed)
- Lapwing (BoCCI Red listed)
- Pochard (BoCCI Red listed)
- Snipe (BoCCI Red listed)
- Woodcock (BoCCI Red listed)
- Buzzard
- Long-eared Owl
- Sparrowhawk

The following sections describe the observations of each target species under the individual survey headings. Raw data and maps are provided in Appendix 2 and Appendix 4, respectively.

3.2.2 Vantage Point Survey Results

Vantage point surveys were undertaken at the site between March 2021 and March 2022 inclusive. Summary results from vantage point surveys are presented below in Table 3-1 and discussed in further detail in Section 4 of this report.

Table 3-1 Vantage Point Survey Results

Conservation Status	Species	Total number of observations recorded during this survey type	Total Number of Bird Seconds at PCH	Number of observations on site/within 500m	Activity of note	Figure
Annex I; SCI of nearby SPA	Golden Plover	9	126,830	8	Flocks of between six and 175 birds commuting or circling over the wind farm site.	Appendix 4, Figure 1.1
Annex I; SCI of nearby SPAs	Greenland White-fronted Goose	1	1,400	1	One observation of a flock of 14 birds commuting.	Appendix 4, Figure 1.2
Annex I; BoCCI Red Listed	Hen Harrier	8	0	7	There were eight observations of hen harrier at the wind farm site. All of which were of birds commuting or landing in scrub near the River Inny.	Appendix 4, Figure 1.3
Annex I	Kingfisher	2	0	2	One observation of a bird flying from a drain and one of a bird heard calling.	Appendix 4, Figure 1.4
Annex I; Schedule IV of the Wildlife Act	Merlin	5	0	5	Four observations of an individual hunting and one observation of an individual commuting.	Appendix 4, Figure 1.5
Annex I; Schedule IV of the Wildlife Act	Peregrine	2	12	1	One observation of an individual hunting and one of an individual commuting.	Appendix 4, Figure 1.6
Annex I; SCI of nearby SPAs	Whooper Swan	25	13,704	19	All observations were of birds commuting. Flocks ranged from two to sixteen birds.	Appendix 4, Figure 1.7
SCI of nearby SPAs	Coot	4	317	4	All observations were of one or two birds commuting.	Appendix 4, Figure 1.8

Conservation Status	Species	Total number of observations recorded during this survey type	Total Number of Bird Seconds at PCH	Number of observations on site/within 500m	Activity of note	Figure
BoCCI Red Listed	Curlew	2	590	2	There were two observations of birds commuting/soaring, ranging from one to three birds.	Appendix 4, Figure 1.9
BoCCI Red Listed	Kestrel	30	5,655	25	Most observations were of birds hunting or commuting. There was one observation of a kestrel being chased by a buzzard. All observations were of individuals.	Appendix 4, Figure 1.10
BoCCI Red Listed	Lapwing	1	2,025	1	There was one observation of a flock of 25 birds commuting.	Appendix 4, Figure 1.11
BoCCI Red Listed	Snipe	18	130	15	There were four observations of one or two birds commuting. There was one observation of a bird being flushed. Additionally, there were four birds heard drumming and nine calling.	Appendix 4, Figure 1.12
BoCCI Red Listed	Woodcock	2	0	2	Two observations of birds roding in March.	Appendix 4, Figure 1.13
Schedule IV of the Wildlife Act	Buzzard	62	8,452	49	Most observations were of birds soaring, travelling or hunting. There was one observation of a buzzard chasing a kestrel in August. There were six observations of buzzards displaying between January and March 2022.	Appendix 4, Figure 1.14
Schedule IV of the Wildlife Act	Long-eared Owl	1	0	0	One observation of a bird perched in a tree and being mobbed by corvids.	Not Mapped
Schedule IV of the Wildlife Act	Sparrowhawk	7	166	7	There were three observations of sparrowhawk in April. Flying and perching at the known nest site. The remaining flights were of birds hunting or commuting.	Appendix 4, Figure 1.15

3.2.3 Breeding Walkover Survey Results

Breeding walkover surveys were carried out during the 2021 breeding season: April to July. Summary results from breeding walkover surveys are presented below in Table 3-2 and discussed in more detail in Section 4 of this report.

Table 3-2 Breeding Walkover Survey Results

Conservation Status	Species	Total number of observations recorded during survey type	Number of observations on site/ within 500m	Activity of note	Breeding Status	Figure
Annex I; SCI of nearby SPA	Golden Plover	1	1	One observation of three birds travelling at the beginning of April 2021. Likely remnant wintering birds on route north to summer breeding grounds.	**Non-breeding**	Appendix 4, Figure 2.1
BoCCI Red Listed	Lapwing	6	3	Four observations of territorial behaviour. There were three territories identified, two to the north of the wind farm site (one immediately adjacent to the wind farm site and one approx. 400m from the wind farm site). The third territory was at the historical territory, approximately 3.8km south of the wind farm site	**Confirmed – Three breeding territories**	Appendix 4, Figure 2.2
BoCCI Red Listed	Snipe	8	4	There were six observations of flushed birds, one of a bird flying and one of a bird displaying, approximately 3.8km south of the wind farm site	**Probable – One breeding territory**	Appendix 4, Figure 2.3
Schedule IV of the Wildlife Act	Buzzard	4	4	There were three observations of birds calling, and one observation of a bird flying from trees and circling	**Non-breeding**	Appendix 4, Figure 2.4
Schedule IV of the Wildlife Act	Sparrowhawk	1	1	One observation of a bird carrying nesting material to a nest site	**Confirmed – One breeding territory**	Appendix 4, Figure 2.5

3.2.4 Breeding Raptor Survey Results

Breeding raptor surveys were carried out during the 2021 breeding season: April to July. Summary results from breeding raptor surveys are presented in Table 3-3 below and discussed in more detail in Section 4 of this report.

Table 3-3 Breeding Raptor Survey Results

Conservation Status	Species	Total number of observations recorded during survey type	Number of observations on site/within 500m	Activity of note	Breeding Status	Figure
Annex I	Peregrine	2	0	Two observations of birds travelling/soaring	**Non-breeding**	Appendix 4, Figure 3.1
Annex I	White-tailed Eagle	1	0	One observation of a bird travelling, and being mobbed by buzzard	**Non-breeding**	Appendix 4, Figure 3.2
BoCCI Red Listed	Kestrel	8	1	All observations were of birds travelling or hunting	**Non-breeding**	Appendix 4, Figure 3.3
Schedule IV of the Wildlife Act	Buzzard	31	0	Most observations were of birds travelling, soaring or hunting. There was one observation of two buzzards mobbing a white-tailed eagle in July	**Non-breeding**	Appendix 4, Figure 3.4
Schedule IV of the Wildlife Act	Sparrowhawk	3	1	All observations were of birds travelling	**Non-breeding**	Appendix 4, Figure 3.5

3.2.5 Breeding Woodcock Survey Results

A number of woodcock observations were recorded during targeted breeding woodcock surveys. All observations are detailed in Table 3-4 below and discussed in further detail in Section 4 of this report.

Table 3-4 Breeding Woodcock Observations

Conservation Status	Species	Observations recorded during surveys	Number of birds within 500m of site	Activity of note	Breeding Status	Figure
BoCCI Red List (Breeding populations only)	Woodcock	30	30	All observations were of birds roding	**Probable – Seven breeding territories**	Appendix 4, Figure 4.1

3.2.6 Winter Walkover Survey Results

Winter walkover surveys were carried out during the 2021/2022 winter season: October to March. Summary results from winter walkover surveys are presented below in Table 3-5 and discussed in more detail in Section 4 of this report.

Table 3-5 Winter Walkover Survey Results

Conservation Status	Species	Total number of observations recorded during survey type	Number of observations on site/ within 500m	Activity of note	Figure
Annex I; SCI of nearby SPA	Golden Plover	4	4	Observations ranged from four to sixteen birds. There were two observations of birds commuting and two of birds roosting on the bog.	Appendix 4, Figure 5.1
Annex I; SCI of nearby SPAs	Greenland White-fronted Goose	1	1	One observation of five birds commuting over the wind farm site.	Appendix 4, Figure 5.2
Annex I	Kingfisher	1	1	One observation of an individual flying along the River Inny.	Appendix 4, Figure 5.3
SCI of nearby SPA	Teal	3	3	There was one observation of two birds commuting, one of two birds roosting and one of a flock of 22 birds foraging.	Appendix 4, Figure 5.4
SCI of nearby SPA	Wigeon	1	1	There was one observation of a flock of eight birds foraging.	Appendix 4, Figure 5.5
BoCCI Red Listed	Kestrel	1	1	One observation of an individual perched.	Appendix 4, Figure 5.6
BoCCI Red Listed	Lapwing	1	1	One observation of 4 pairs of lapwing nest building in mid-March.	Appendix 4, Figure 5.7
BoCCI Red Listed	Snipe	8	8	All observations were of birds being flushed by the observer. Numbers ranged from one to four birds.	Appendix 4, Figure 5.8

Conservation Status	Species	Total number of observations recorded during survey type	Number of observations on site/ within 500m	Activity of note	Figure
Schedule IV of the Wildlife Act	Buzzard	7	7	All observations were of one or two birds commuting.	Appendix 4, Figure 5.9

3.2.7 Wildfowl Distribution Surveys

Wildfowl distribution surveys were carried out during the 2021/22 winter season: September to March. Summary results from wildfowl distribution surveys are presented below in Table 3-6 and discussed in more detail in Section 4 of this report.

Table 3-6 Wildfowl Distribution Survey Results

Conservation Status	Species	Total number of observations recorded during survey type	Flock Size Range	Number of observations on site/ within 500m	Activity of note	Figure
Annex I	Common Tern	1	2	0	Two birds seen flying at Lough Derravaragh.	Appendix 4, Figure 6.1
Annex I; SCI of nearby SPA	Golden Plover	4	5 – 160	1	All observations were of birds commuting or circling.	Appendix 4, Figure 6.2
Annex I; SCI of nearby SPAs	Greenland White-fronted Goose	4	4 – 24	0	All observations were of birds foraging at Piercefield, near Lough Iron.	Appendix 4, Figure 6.3
Annex I	Kingfisher	1	1	0	One observation of a bird foraging along the River Inny.	Appendix 4, Figure 6.4
Annex I	Little Egret	16	1 – 2	2	All observations were of birds commuting, foraging or roosting. Birds were observed at Lough Iron, Lough Bane, Lough Sheelin, Derragh Lough and Brackragh Lough.	Appendix 4, Figure 6.5
Annex I	Ruff	1	2	1	One observation of two birds perched on peat at the wetland west of Lough Bane.	Appendix 4, Figure 6.6
Annex I	Whooper Swan	36	1 – 77	3	Birds observed at Lough Iron, Derragh Lough, River Inny, Lough Bane and Lough Sheelin.	Appendix 4, Figure 6.7

Conservation Status	Species	Total number of observations recorded during survey type	Flock Size Range	Number of observations on site/ within 500m	Activity of note	Figure
SCI of nearby SPA	Coot	167	1 – 890	0	Birds observed on Deragh Lough, Lough Iron Lough Kinale, Lough Sheelin, Lough Derravaragh, Bracklagh Lough and along the River Inny.	Appendix 4, Figure 6.8
SCI of nearby SPAs	Pochard	18	1 – 182	0	Birds observed on Lough Kinale, Lough Sheelin, Lough Derravaragh and Bracklagh Lough.	Appendix 4, Figure 6.9
SCI of nearby SPAs	Shoveler	11	5 – 36	0	Birds observed at Derragh Lough, Lough Iron, And Lough Sheelin.	Appendix 4, Figure 6.10
SCI of nearby SPA	Teal	41	3 – 240	7	Birds observed at wetland west of Lough Bane, Lough Iron, Lough Derravarragh, Lough Sheelin, Lough Kinale, Derragh Lough, and Robinstown.	Appendix 4, Figure 6.11
SCI of nearby SPAs	Tufted Duck	48	2 – 190	0	Birds observed at Lough Kinale, Bracklagh Lough, Lough Sheelin, Lough Derravaragh, Deragh Lough, Lough Iron and Robinstown.	Appendix 4, Figure 6.12
SCI of nearby SPA	Wigeon	37	2 – 263	8	Birds observed at Derragh Lough, Lough Derravaragh, Lough Sheelin, Lough Iron, Lough Kinale and Lough Bane.	Appendix 4, Figure 6.13
BoCCI Red Listed	Curlew	3	2 – 57	1	All observations were of birds commuting.	Appendix 4, Figure 6.14
BoCCI Red Listed	Goldeneye	9	5 – 24	0	Birds observed on Lough Derravaragh and Lough Sheelin.	Appendix 4, Figure 6.15
BoCCI Red Listed	Lapwing	28	1 – 245	6	All observations were of birds commuting, foraging or roosting.	Appendix 4, Figure 6.16

Conservation Status	Species	Total number of observations recorded during survey type	Flock Size Range	Number of observations on site/ within 500m	Activity of note	Figure
BoCCI Red Listed	Snipe	13	1 – 4	5	All observations were of birds being flushed by the observer.	Appendix 4, Figure 6.17

3.2.8 Incidentals

A number of incidental observations of target species were recorded during the survey period. The most significant of these observations are detailed in Table 3-7 below and discussed in further detail in Section 4 of this report.

Table 3-7 Incidental Observations

Conservation Status	Species	Survey Type	Observations recorded during surveys	Activity of note	Figure
Annex I	Kingfisher	Wildfowl distribution surveys	8	Birds observed along the River Inny.	Appendix 4, Figure 7.1
Annex I	Peregrine	Vantage point survey	1	One bird commuting at Doon.	Appendix 4, Figure 7.2
Annex I	White-tailed Eagle	Wildfowl distribution surveys	1	One observation of a birds soaring over Lough Derravaragh.	Appendix 4, Figure 7.3
BoCCI Red Listed	Kestrel	Wildfowl distribution surveys & winter walkover surveys	18	All observations were of birds commuting, hunting or perched.	Appendix 4, Figure 7.4
BoCCI Red Listed	Lapwing	Breeding raptor surveys	10	Two breeding territories identified to the north of the wind farm site.	Appendix 4, Figure 7.5
BoCCI Red Listed	Snipe	Breeding woodcock & vantage point surveys	10	Five observations of birds drumming and five observations of birds being flushed by the observer.	Appendix 4, Figure 7.6

Conservation Status	Species	Survey Type	Observations recorded during surveys	Activity of note	Figure
Schedule IV of the Wildlife Act	Buzzard	Vantage point surveys, wildfowl distribution surveys & winter walkover surveys	32	All observations were of birds commuting, soaring or perched.	Appendix 4, Figure 7.7
Schedule IV of the Wildlife Act	Sparrowhawk	Vantage point surveys, wildfowl distribution surveys & winter walkover surveys	6	All observations were of birds commuting.	Appendix 4, Figure 7.8

3.2.9 Target Species Status Summary

While breeding/roosting status is assigned according to the evidence obtained during individual breeding bird surveys as reported in Tables 3-1 to 3-7 above, Table 3-8 below provides the status of target species observed during surveys between March 2021 and March 2022 at Coole Wind Farm. In addition, the key observations from the 2022 breeding bird surveys are also summarised in the below table.

Table 3-8 Target Species Status Summary

Species	Overall breeding status	Overall roosting status
Greenland White-fronted Goose	**Does not breed in Ireland**	**Lough Iron hosts a roost (c. 12.8km from the proposed development).**
Golden Plover	**No breeding site identified.**	**No regularly used roosts identified.**
Hen Harrier	**No breeding site identified.**	**No regularly used roosts identified.**
Kingfisher	**No breeding site identified.**	**No regularly used roosts identified.**
Peregrine	**March 2021 to March 2022:** No breeding site identified. **Summer 2022:** Peregrine occupied the known breeding territory, approximately 1.3km from the wind farm site, during the 2022 breeding season. This site was last occupied in 2016. Please refer to Confidential Appendix 3 for location details.	**No regularly used roosts identified.**
White-tailed Eagle	**No breeding site identified.**	**No regularly used roosts identified.**
Whooper Swan	**Does not breed in Ireland**	**Lough Iron hosts a roost (c. 12.8km from the proposed development).**
Kestrel	**March 2021 to March 2022:** No breeding site identified. **Summer 2022:** One observation of a bird being agitated and one of a bird carrying prey, within the wind farm site. It is assumed both of these observations relate to one confirmed breeding territory, within the wind farm site.	**No regularly used roosts identified.**
Lapwing	**Confirmed breeding** **March 2021 to March 2022:** Three breeding territories, one presumed successful and two failed to fledge young. Two within 500m of the wind farm site, and one approximately 3.8km from the wind farm site. Please refer to Confidential Appendix 3 for location details. **Summer 2022:** There was an estimated 4 – 10 pairs of lapwing breeding in this area c. 441m from the nearest proposed infrastructure. This is discussed further in Section 4.4.7.	**No regularly used roosts identified.**

Species	Overall breeding status	Overall roosting status
Snipe	**Probable breeding –** Nine breeding territories identified, six within, or partially within, the wind farm site, to the north. Two within 500m of the wind farm site to the north. One approximately 3.8km south of the wind farm site. **Summer 2022** – Snipe were identified breeding within the wind farm site again in 2022.	**No regularly used roosts identified.**
Woodcock	**Probable breeding –** Seven breeding territories identified. Five within, or partially within, the wind farm site. **Summer 2022** – Woodcock were identified breeding within the wind farm site again in 2022.	**No regularly used roosts identified.**
Buzzard	**No breeding site identified.**	**No regularly used roosts identified.**
Sparrowhawk	**Confirmed breeding –** One territory, within the wind farm site. Sparrowhawk were also confirmed to have bred successfully within the wind farm site during the 2022 breeding season.	**No regularly used roosts identified.**

4. IMPACT ASSESSMENT

The ornithological evaluation criteria and impact assessment methods are outlined in Section 7.2.5 of the EIAR.

4.1 Identification of Key Ornithological Receptors

The identification of KOR species is outlined in Section 7.6 of the EIAR. Given the observations between March 2021 and March 2022 are in keeping with those outlined in the EIAR, the identified KOR species remains the same.

The following species were not discussed in the EIAR but were observed during surveys between March 2021 and March 2022:

- Common Tern
- Kingfisher
- Little Egret
- Ruff
- White-tailed Eagle
- Goldeneye

Of these, only kingfisher was observed at, or within 500m of, the wind farm site. This species was recorded infrequently and in low numbers. Therefore, kingfisher is not considered a KOR. The remaining species were only observed during the wildfowl distribution surveys, up to 8km from the wind farm site and are therefore not considered a KOR.

The following species have been moved from the BoCCI red list to the BoCCI amber list and were only recorded infrequently and in low numbers during surveys at, or near, the wind farm site between March 2021 and March 2022. Therefore, an updated impact assessment for these species is not required:

- Black-headed gull
- Teal
- Wigeon

Furthermore, osprey, barn owl and red kite were not recorded during these surveys, therefore, an updated impact assessment for these species is not required.

Please refer to the EIAR as lodged for the impact assessment.

4.2 KOR Sensitivity Determination

Criteria developed by Percival (2003) is presented in **Error! Reference source not found.** (Section **Error! Reference source not found.**) of the EIAR for assessing bird sensitivity within the study area. The sensitivity of KOR as per Percival are listed below and includes the rationale for their respective sensitivity classification included in brackets.

Very High Sensitivity KORs include:

- Greenland White-fronted Goose (Annex I; EU Birds Directive, SCI of nearby SPAs)

Medium Sensitivity KORs include:

- Golden Plover (Annex I; EU Birds Directive)

- Merlin (Annex I; EU Birds Directive)
- Peregrine Falcon (Annex I; EU Birds Directive)
- Whooper Swan (Annex I; EU Birds Directive)
- Kestrel (BoCCI Red-listed)
- Lapwing (BoCCI Red-listed)
- Snipe (BoCCI Red-listed)
- Woodcock (BoCCI Red-listed)

The remaining KORs identified in the study area were classified as **Low Sensitivity**:

- Buzzard
- Long-eared Owl
- Sparrowhawk

Please note since the lodging of the planning application for the proposed development the conservation status of several species has changed due to the recent update of the BoCCI red-list (Gilbert et al. 2021), this change is reflected in the classification of sensitivity for those species. The following updates have been made:

- Kestrel was added to the BoCCI Red-list moving it from low sensitivity to medium sensitivity.
- Snipe was added to the BoCCI Red-list moving it from low sensitivity to medium sensitivity.

4.3 Potential Effects Associated with the Proposed Development

As per SNH Guidance, wind farms present three potential risks to birds (Drewitt & Langston 2006, 2008; Band et al. 2007):

- **Direct habitat loss** through construction of wind farm infrastructure;
- **Displacement** (sometimes called indirect habitat loss) if birds avoid the wind farm and its surrounding area due to turbine construction and operation. Displacement may also include barrier effects in which birds are deterred from using normal routes to feeding or roosting grounds;
- Death through **Collision** or interaction with turbine blades and other infrastructure.

4.4 Effects on Key Ornithological Receptors during Construction and Operation

4.4.1 Greenland White-fronted Goose (*Wintering*)

As outlined in Section 7.8.2.2 of the EIAR, no significant effects were identified for this species. Please refer to Section 7.8.2.2 of the EIAR for further details on the impact assessment for Greenland white-fronted goose. The table below compares the data from the EIAR with the data collected between March 2021 and March 2022 and provides an updated impact assessment that considers all survey data. This impact assessment considers whether the results of surveys collected between March 2021 and March 2022 will inform any change to the impact assessment provided in Section 7.8.2.2 of the EIAR as lodged.

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2022)
Construction Phase			
Direct Habitat Loss	Similar to the data outlined in Section 7.8.2.2 of the EIAR, the vast majority of observations were of flocks recorded at Lough Iron, approximately 12.8km from the wind farm site. During surveys between March 2021 and March 2022, there was only one observation of a flock of fourteen birds commuting over the wind farm site. A similar rate of occurrence was reported in Section 7.8.2.2 of the EIAR (one observation every two years). There was no evidence of roosting or foraging within 1km of the wind farm site. Significant effects with regard to direct habitat loss are not predicted. This further corroborates the results of the impact assessment provided in Section 7.8.2.2 of the EIAR as lodged.	The magnitude of the effect is assessed as *Negligible*. The cross tablature of a *Very High* sensitivity species and *Negligible* Impact corresponds to a ***Low*** effect significance.	**Long-term Imperceptible Negative Effect**
Disturbance	Similar to the data outlined in Section 7.8.2.2 of the EIAR, this species was not recorded utilising habitats on, or within 500m of, the wind farm site. The species was observed flying over the site on only one occasion between March 2021 and March 2022.	The magnitude of the effect is assessed as *Negligible*. The cross tablature of a *Very High* sensitivity species and	**Short-term Imperceptible Negative Effect**

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2022)
	Given the low numbers recorded and the abundance of suitable habitats in the wider surroundings of the wind farm site, significant impacts are not predicted. Significant effects with regard to displacement are not predicted. This further corroborates the results of the impact assessment provided in Section 7.8.2.2 of the EIAR as lodged.	*Negligible* Impact corresponds to a ***Low*** effect significance.	
Operational Phase			
Direct Habitat Loss	Direct or indirect effects are not anticipated.	**No Effect**	**No Effect**
Displacement & Barrier Effect	Similar to the data outlined in Section 7.8.2.2 of the EIAR, there was only one observation of birds commuting over the wind farm site between March 2021 and March 2022. Given this low rate of occurrence, it is reasonable to conclude that there was no regularly used commuting corridor or migratory route that crossed the wind farm site. There was no foraging birds recorded on, or within 500m of, the wind farm site. Similarly, there was no evidence of roosting birds on, or within 1km of, the wind farm site. No significant displacement or barrier effects are predicted. This further corroborates the results of the impact assessment provided in Section 7.8.2.2 of the EIAR as lodged.	The magnitude of the effect is assessed as *Negligible*. The cross tablature of a *Very High* sensitivity species and *Negligible* Impact corresponds to a ***Low*** effect significance.	**Long-term Imperceptible Negative Effect**
Collision	The species was recorded flying within the potential collision risk zone during Vantage Point surveys. A "Random" collision risk analysis has been undertaken and full details are provided in Appendix 5. The collision risk has been calculated to be 0.04 collisions per year, or one bird every 25 years. The results of this analysis are not significantly different from the collision risk reported in the EIAR as lodged. No significant effects are predicted.	The magnitude of the effect is assessed as *Negligible*. The cross tablature of a *Very High* sensitivity species and *Negligible* Impact corresponds to a ***Low*** effect significance.	**Long-term Imperceptible Negative Effect**

4.4.2 Golden Plover (*Wintering*)

As outlined in Section 7.8.2.3 of the EIAR, no significant effects were identified for this species. Please refer to Section 7.8.2.3 of the EIAR for further details on the impact assessment for golden plover. The table below compares the data from the EIAR with the data collected between March 2021 and March 2022 and provides an updated impact assessment that considers all survey data. This impact assessment considers whether the results of surveys collected between March 2021 and March 2022 will inform any change to the impact assessment provided in Section 7.8.2.3 of the EIAR as lodged.

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
Construction Phase			
Direct Habitat Loss	In contrast to the data presented in Section 7.8.2.3 of the EIAR, there were no observations of golden plover utilizing habitats on, or within 500m of, the wind farm site between March 2021 and March 2022. Significant effects with regard to direct habitat loss are not predicted, given the development infrastructure is confined to a narrow corridor, therefore direct habitat loss will be minimal. Furthermore, the habitats within the Site are not of particularly high quality and there is an abundance of similar habitat in the surrounding area. This further corroborates the results of the impact assessment provided in Section 7.8.2.3 of the EIAR as lodged.	The magnitude of the effect is assessed as *Low*. The cross tablature of *Medium* sensitivity species and *Low* Impact corresponds to a ***Low*** effect significance.	**Long-term Slight Negative Effect**
Disturbance	As per McGuinness et al. (2015) the zone of sensitivity for the species is 800m during the breeding season only. The species is not identified as being particularly sensitive to wind farm developments during the wintering period. This species was recorded commuting or circling over the bog on, or within 500m of, the wind farm site during the winter season. Numbers of county importance were observed on six occasions on, or within 500m of, the wind farm site.	The magnitude of the effect is assessed as *Low*. The cross tablature of *Medium* sensitivity species and *Low* Impact corresponds to a ***Low*** effect significance.	**Short-term Slight Negative Effect**

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
	This is a marked reduction in the use of the Site compared to the regular use of the Site as reported in the EIAR. Given the abundance of similar suitable habitats in the wider surroundings of the wind farm site, significant impacts are not predicted. This further corroborates the results of the impact assessment provided in Section 7.8.2.3 of the EIAR as lodged.		
Operational Phase			
Direct Habitat Loss	Direct or indirect effects are not anticipated.	**No Effect**	**No Effect**
Displacement & Barrier Effect	A review of 29 studies suggests golden plover will approach wind turbines to an average distance of 175m in non-breeding season (Hötker et al., 2006). There were 10 observations of golden plover within 200m of the proposed turbine layout during surveys between March 2021 and March 2022. In the event of displacement, there are sufficient areas of suitable habitat in the wider area to render such an effect inconsequential. Furthermore, habitats within the wind farm site (e.g. cutover bog) are not of particularly high quality. There is no evidence to suggest that the wind farm site lies on a migratory/ regular commuting route for the species therefore barrier effect is not anticipated. Significant displacement or barrier effects are not predicted. This further corroborates the results of the impact assessment provided in Section 7.8.2.3 of the EIAR as lodged.	The magnitude of the effect is assessed as *Low*. The cross tablature of *Medium* sensitivity species and *Low* Impact corresponds to a ***Low*** effect significance.	**Long-term Slight Negative Effect**

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
Collision	The species was recorded flying within the potential collision risk zone during Vantage Point surveys. A "Random" collision risk analysis has been undertaken and full details are provided in Appendix 5. The collision risk has been calculated to be 10.6 collisions per year. It is noted that this is a reduction in the number of predicted collisions (34) reported in the EIAR as lodged (EIAR Appendix 7-5). This change is a result of incorporating new research into the analysis that shows golden plover to avoid colliding with turbines a high proportion of the time. Please see Appendix 5 for further discussion.	Impact corresponds to a ***Low*** effect significance. The cross tablature of *Medium* sensitivity species and *Low* Impact corresponds to a ***Low*** effect significance.	**Long-term Slight Negative Effect**

4.4.3 Merlin (All Seasons)

As outlined in Section 7.8.2.4 of the EIAR, no significant effects were identified for this species. Please refer to Section 7.8.2.4 of the EIAR for further details on the impact assessment for merlin. The table below compares the data from the EIAR with the data collected between March 2021 and March 2022 and provides an updated impact assessment that considers all survey data. This impact assessment considers whether the results of surveys collected between March 2021 and March 2022 will inform any change to the impact assessment provided in Section 7.8.2.4 of the EIAR as lodged.

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
Construction Phase			
Direct Habitat Loss	A similar abundance and rate of occurrence was recorded between March 2021 and March 2022 as reported in Section 7.8.2.4 of the EIAR. This species was not recorded utilising habitats within the wind farm site for roosting or breeding. Significant effects are not anticipated particularly given the low levels of activity recorded. The species was recorded hunting onsite on only four occasions between March 2021 and March 2022. This is not significantly different from the seven observations over four years as outlined in Section 7.8.2.4 of the EIAR. Extensive areas of suitable foraging habitat will remain post-construction and there is an abundance of suitable habitats in the surrounding area. Significant effects are not predicted. This further corroborates the results of the impact assessment provided in Section 7.8.2.4 of the EIAR as lodged.	The magnitude of the effect is assessed as *Negligible*. The cross tablature of *Medium* sensitivity species and *Negligible* Impact corresponds to a ***Very Low*** effect significance.	**Long-term Imperceptible Negative Effect**
Disturbance	Similar to the data outlined in Section 7.8.2.4 of the EIAR, there was no breeding activity recorded within the study area during the 2021 breeding season. Significant displacement effects are not anticipated, given how infrequently the wind farm site was visited by this species. In addition, the habitats that are present onsite are not considered to be of particularly high quality or unique to the wind farm site.	The magnitude of the effect is assessed as *Negligible*. The cross tablature of *Medium* sensitivity species and *Negligible* Impact corresponds to a ***Very Low*** effect significance.	**Short-term Imperceptible Negative Effect**

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
	Significant displacement effects are not predicted. This further corroborates the results of the impact assessment provided in Section 7.8.2.4 of the EIAR as lodged.		
Operational Phase			
Direct Habitat Loss	Direct or indirect effects are not anticipated.	**No Effect**	**No Effect**
Displacement & Barrier Effect	Significant effects are not anticipated particularly given the low levels of activity recorded throughout surveys. In addition, the habitats that are present onsite are not considered to be of particularly high quality or unique to the wind farm site. Significant displacement or barrier effects are not predicted. This further corroborates the results of the impact assessment provided in Section 7.8.2.4 of the EIAR as lodged.	The magnitude of the effect is assessed as *Negligible*. The cross tablature of *Medium* sensitivity species and *Negligible* Impact corresponds to a ***Very Low*** effect significance.	**Long-term Imperceptible Negative Effect**
Collision	The species was infrequently recorded flying with the potential collision risk zone during Vantage Point surveys. A "Random" collision risk analysis has been undertaken on a precautionary basis and full details are provided in Appendix 5. The collision risk has been calculated to be 0.011 collisions per year, or approximately one bird every 92 years. The results of this analysis are not significantly different from the collision risk report in the EIAR as lodged. The predicted collision risk is insignificant.	The magnitude of the effect is assessed as *Negligible*. The cross tablature of *Medium* sensitivity species and *Negligible* Impact corresponds to a ***Very Low*** effect significance.	**Long-term Imperceptible Negative Effect**

4.4.4 Peregrine (*All Seasons*)

As outlined in Section 7.8.2.5 of the EIAR, no significant effects were identified for this species. Please refer to Section 7.8.2.5 of the EIAR for further details on the impact assessment for peregrine. The table below compares the data from the EIAR with the data collected between March 2021 and March 2022 and provides an updated impact assessment that considers all survey data. This impact assessment considers whether the results of surveys collected between March 2021 and March 2022 will inform any change to the impact assessment provided in Section 7.8.2.5 of the EIAR as lodged.

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
Construction Phase			
Direct Habitat Loss	Similar to the data presented in Section 7.8.2.5 of the EIAR, this species was only occasionally recorded commuting/hunting at the wind farm site. There is no significant difference in the rate of occurrence of peregrine between these surveys and those discussed in Section 7.8.2.5 of the EIAR. There is no suitable breeding habitat for this species within the wind farm site. Extensive areas of suitable foraging habitat will remain post-construction and there is an abundance of suitable habitats in the surrounding area. Significant effects are not predicted. This further corroborates the results of the impact assessment provided in Section 7.8.2.5 of the EIAR as lodged.	The magnitude of the effect is assessed as *Low*. The cross tablature of *Medium* sensitivity species and *Low* Impact corresponds to a ***Low*** effect significance.	**Long-term Slight Negative Effect**
Disturbance	No breeding territories or roost sites were recorded within the wind farm site. Breeding activity was recorded at the historic nest site (please see Confidential Appendix 3 for further details), approximately 1.3km from the wind farm site, during the 2022 breeding season. Peregrine were recorded foraging on one occasion within the wind farm site between March 2021 and March 2022. However, the wind farm site does not contain habitats that are of particularly high quality or unique to the local area. Therefore, if displacement was to occur it would not result in the loss of a scarce resource for the local population.	The magnitude of the effect is assessed as *Low*. The cross tablature of *Medium* sensitivity species and *Low* Impact corresponds to a ***Low*** effect significance.	**Short-term Slight Negative Effect**

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
	Significant displacement or barrier effects are not predicted, particularly given the separation distance between the wind farm site and the nest site. This further corroborates the results of the impact assessment provided in Section 7.8.2.5 of the EIAR as lodged.		
Operational Phase			
Direct Habitat Loss	Direct or indirect effects are not anticipated.	**No Effect**	**No Effect**
Displacement & Barrier Effect	Disturbance impacts are not predicted for the nest, given the significant separation distance involved, i.e. 1.6km from the nearest proposed turbine. As previously discussed, this species was only recorded foraging within the wind farm site on one occasion between March 2021 and March 2022, which is less frequent that the data presented in the EIAR shows. Furthermore, the wind farm site does not contain habitats that are of particularly high quality for this species or unique to the local area. Therefore, if displacement were to occur it would not result in the loss of a scarce resource for the local population. Significant displacement effects are not predicted. This further corroborates the results of the impact assessment provided in Section 7.8.2.5 of the EIAR as lodged.	The magnitude of the effect is assessed as *Low*. The cross tablature of *Medium* sensitivity species and *Low* Impact corresponds to a ***Low*** effect significance.	**Long-term Slight Negative Effect**
Collision	The species was recorded flying within the potential collision risk zone during VP surveys. A "Random" collision risk analysis has been undertaken and full details are provided in Appendix 5. The collision risk has been calculated at 0.196 collisions per year or one bird every 5 years. The results of this analysis are not significantly different from the collision risk reported in the EIAR as lodged. Significant effects are not predicted for a rate of one potential collision every eight years.	The magnitude of the effect is assessed as *Low*. The cross tablature of a *Medium* sensitivity species and *Low* Impact corresponds to a ***Low*** effect significance.	**Long-term Slight Negative Effect**

4.4.5 Whooper Swan (*Wintering*)

As outlined in Section 7.8.2.1 of the EIAR, no significant effects were identified for this species. Please refer to Section 7.8.2.1 of the EIAR for further details on the impact assessment for whooper swan. The table below compares the data from the EIAR with the data collected between March 2021 and March 2022 and provides an updated impact assessment that considers all survey data. This impact assessment considers whether the results of surveys collected between March 2021 and March 2022 will inform any change to the impact assessment provided in Section 7.8.2.1 of the EIAR as lodged.

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
Construction Phase			
Direct Habitat Loss	The wind farm site is dominated by cutover bog, this is not considered suitable for wintering whooper swan. There were no whooper swans observed utilising the habitats within the wind farm site. The unfavourable nature of this habitat limits the potential for construction activities to result in ecologically significant habitat loss for whooper swan. Significant effects with regard to direct habitat loss are not predicted. This further corroborates the results of the impact assessment provided in Section 7.8.2.1 of the EIAR as lodged.	The magnitude of the effect is assessed as *Negligible*. The cross tablature of a *Medium* sensitivity species and *Negligible* Impact corresponds to a ***Very Low*** effect significance.	**Long-term Slight Negative Effect**
Disturbance	Similar to the data presented in Section 7.8.2.1 of the EIAR, most observations were of flocks recorded during the wildfowl distribution surveys, with the majority of these being at Lough Iron, approximately 12.8km from the wind farm site. In contrast to the data presented in Section 7.8.2.1 of the EIAR, the frequency of whooper swan commuting flights over the wind farm site increased during surveys between March 2021 and March 2022. There were 25 observations of whooper swan commuting during this period, compared to an average of three flights per winter presented in Section 7.4.1 of the EIAR (twelve flights total over a four-year period). The number of birds per flock remained similar to	The magnitude of the effect is assessed as *Negligible*. The cross tablature of a *Medium* sensitivity species and *Negligible* Impact corresponds to a ***Very Low*** effect significance.	**Short-term Slight Negative Effect**

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
	those presented in Section 7.4.1 of the EIAR, with between two and sixteen birds being observed. However, the number of flights over the wind farm site remains low and given that the habitats on site are unlikely to attract whooper swan significant disturbance impacts are not predicted. This further corroborates the results of the impact assessment provided in Section 7.8.2.1 of the EIAR as lodged.		
Operational Phase			
Direct Habitat Loss	Direct or indirect effects are not anticipated.	**No Effect**	**No Effect**
Displacement & Barrier Effect	No foraging areas were recorded on, or within 500m of, the wind farm site and there was no evidence of roosting on, or within 1km of, the wind farm site. Whooper swan were rarely recorded flying over the wind farm site during surveys presented in the EIAR. The frequency of flights increased slightly between March 2021 and March 2022 compared to data presented in Section 7.4.2 of the EIAR, but whooper swans were still infrequently observed. Survey results indicate that the wind farm site does not lie on a migratory corridor for this species. Therefore, no barrier effect is predicted. Based on the complete dataset there is no potential for significant displacement effects given that whooper swans were not dependent on the habitats of the whooper swan for roosting or feeding. Furthermore, it is unlikely that any significant displacement impact will result during the operational phase, given the low level of flight activity and particularly the low numbers recorded per flight.	The magnitude of the effect is assessed as *Negligible*. The cross tablature of a *Medium* sensitivity species and *Negligible* Impact corresponds to a ***Very Low*** effect significance.	**Long-term Slight Negative Effect**

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
	No significant displacement or barrier effects are predicted. This further corroborates the results of the impact assessment provided in Section 7.8.2.1 of the EIAR as lodged.		
Collision	The species was recorded flying within the potential collision risk zone during Vantage Point surveys. A "Random" collision risk analysis has been undertaken and full details are provided in Appendix 5. The collision risk has been calculated at a ratio of 0.79 collisions per year. The results of this analysis are not significantly different from the collision risk reported in the EIAR as lodged. No significant effects are predicted.	The magnitude of the effect is assessed as *Negligible*. The cross tablature of a *Medium* sensitivity species and *Negligible* Impact corresponds to a ***Very Low*** effect significance.	**Long-term Imperceptible Negative Effect**

4.4.6 Kestrel (All Seasons)

As outlined in Section 7.8.2.17 of the EIAR, no significant effects were identified for this species. Please refer to Section 7.8.2.17 of the EIAR for further details on the impact assessment for Greenland white-fronted goose. The table below compares the data from the EIAR with the data collected between March 2021 and March 2022 and provides an updated impact assessment that considers all survey data. This impact assessment considers whether the results of surveys collected between March 2021 and March 2022 will inform any change to the impact assessment provided in Section 7.8.2.17 of the EIAR as lodged.

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
Construction Phase			
Direct Habitat Loss	Similar to the data presented Section 7.8.2.17 in the EIAR, this species was frequently recorded hunting, potentially breeding and commuting on, or within 500m of, the wind farm site. Direct loss of foraging habitat relative to its availability onsite and within the surrounding area, will be minimal. Substantial areas of undisturbed suitable breeding and foraging habitat will remain post construction. Significant effects are not predicted. This further corroborates the results of the impact assessment provided in Section 7.8.2.17 of the EIAR as lodged.	The magnitude of the effect is assessed as *Low.* The cross tablature of a *Medium*[2] sensitivity species and a *Low* Impact corresponds to a ***Low*** effect significance.	**Long-term Slight Negative Effect**
Disturbance	This species was frequently recorded on, or within 500m of, the wind farm site. The majority of observations involve hunting or commuting birds. The proposed development area does not contain habitats that are of particularly high quality for this species (e.g. cutover bog) or unique to the local area. Therefore, were displacement to occur it would not result in the loss of a scarce resource for the local kestrel population.	The magnitude of the effect is assessed as *Low.* The cross tablature of *Medium* sensitivity species and *Low* Impact corresponds to a ***Low*** effect significance.	**Short-term Slight Negative Effect**

[2] *Note that kestrel is a medium sensitivity species now (compared to a low sensitivity species as outlined in Section 7.8.2.17 of the EIAR) due to being added to the BoCCI Red List (Gilbert et al., 2021).*

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
	Significant displacement effects are not predicted. This further corroborates the results of the impact assessment provided in Section 7.8.2.17 of the EIAR as lodged.		
Operational Phase			
Direct Habitat Loss	Direct or indirect effects are not anticipated.	**No Effect**	**No Effect**
Displacement & Barrier Effect	Studies on raptors have generally found only low levels of turbine avoidance (Hötker et al., 2006; Madders & Whitfield, 2006), with some species, such as kestrels, known to continue foraging activity close to turbines (Pearce Higgins et al., 2009). Significant effects are not anticipated, given that extensive areas of suitable foraging habitat exist and will remain in the wider area. In addition, onsite habitats are not considered of particularly high quality to this species (e.g. cutover bog) or unique to the wind farm site. Significant effects are not predicted. This further corroborates the results of the impact assessment provided in Section 7.8.2.17 of the EIAR as lodged.	The magnitude of the effect is assessed as *Low*. The cross tablature of *Medium* sensitivity species and *Low* Impact corresponds to a ***Low*** effect significance.	**Long-term Slight Negative Effect**
Collision	The species was recorded flying within the potential collision risk zone during VP surveys. A "Random" collision risk analysis has been undertaken and full details are provided in Appendix 5. The collision risk has been calculated to be 2.5 collisions per year. The results of this analysis are not significantly different from the collision risk reported in the EIAR as lodged. The predicted collision risk is therefore negligible in the context of the county population.	The magnitude of the effect is assessed as *Negligible*. The cross tablature of *Medium* sensitivity species and *Negligible* Impact corresponds to a ***Very Low*** effect significance.	**Long-term Slight Negative Effect**

4.4.7 Lapwing (All Seasons)

As outlined in Section 7.8.2.11 of the EIAR, no significant effects were identified for this species. Please refer to Section 7.8.2.11 of the EIAR for further details on the impact assessment for lapwing. The table below compares the data from the EIAR with the data collected between March 2021 and March 2022 and provides an updated impact assessment that considers all survey data. This impact assessment considers whether the results of surveys collected between March 2021 and March 2022 will inform any change to the impact assessment provided in Section 7.8.2.11 of the EIAR as lodged.

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
Construction Phase			
Direct Habitat Loss	Similar to the data outlined in Section 7.8.2.11 of the EIAR, lapwing nested within 500m of the wind farm site (Please see Confidential Appendix 3 for details). In 2021, there were two breeding pairs in this area, with one nest fledging young and the second nest was presumed to have failed (furthermore, these breeding territories remained active in 2022 breeding season). Additionally, there was one breeding territory located approximately 3.8km from the wind farm site and adjacent to the grid connection. This pair was presumed to have hatched chicks but was predated before fledging. Lapwing were observed utilising habitats on, or within 500m of, the wind farm site on seven occasions during the winter season (October 2021 to March 2022). The majority of observations were near Lough Bane. No development infrastructure is proposed in the areas of bog where breeding was recorded and lapwing were recorded infrequently and in low numbers within the wind farm site. Significant effects with regard to direct habitat loss are not predicted. This further corroborates the results of the impact assessment provided in Section 7.8.2.11 of the EIAR as lodged.	The magnitude of the effect is assessed as *Low.* The cross tablature of *Medium* sensitivity species and *Low* Impact corresponds to a ***Low*** effect significance.	**Long-term Slight Negative Effect**

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
Disturbance	Construction works can result in disturbance impacts within 350m of lapwing breeding habitat (Hotker et al. 2006). The species was rarely encountered within the wind farm site. This species was recorded breeding adjacent to the wind farm site. As reported in Section 7.8.2.11 of the EIAR birds were previously recorded breeding 380m from the nearest infrastructure. More recently, in 2021 and 2022, the closest breeding territories within this same approx. area were c. 441m from the nearest proposed infrastructure. Taking a highly precautionary approach, if it is assumed that construction works could occur anywhere within the EIAR Site boundary. In which case, construction works adjacent (within 350m) to this nesting area have the potential to cause disturbance of breeding lapwing. Additionally, breeding activity was recorded c. 3.8km from the wind farm site, adjacent to the grid connection route. There is little similar suitable habitat available locally (i.e. a mosaic of revegetating bog, with exposed shale and pools). Construction works adjacent to this nesting area associated with the grid connection route has the potential to cause disturbance of breeding lapwing. The majority of winter season (October 2021 to March 2022) observations were recorded at Lough Bane. Wintering birds are unlikely to be significantly impacted.	The magnitude of the effect is assessed as *Medium.* The cross tablature of *Medium* sensitivity species and *Medium* Impact corresponds to a ***Low*** effect significance.	**Short-term Moderate Negative Effect** **Please see Section 4.6 below for proposed mitigation.**
Operational Phase			
Direct Habitat Loss	Direct or indirect effects are not anticipated.	**No Effect**	**No Effect**
Displacement & Barrier Effect	Hotker et al. (2006) undertook a meta-analysis of existing literature on disturbance distances from turbines. This review reported from the 13 studies examined the disturbance distance could occur up to 350m for breeding	The magnitude of the effect is assessed as *Low.*	**Long-term Slight Negative Effect**

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
	lapwing. This species was recorded breeding: the nearest proposed infrastructure is between 380-441m from the closest territory to the wind farm site. Based on the separation distance, significant disturbance displacement of these breeding birds is not predicted. The majority of winter season (October 2021 to March 2022) observations were at Lough Bane. No significant operational phase displacement impacts are predicted for the identified nesting habitat along the grid connection route. As previously discussed, this species was infrequently recorded within the wind farm site. Significant effects are not predicted particularly given the low levels of activity recorded within the wind farm site. Significant displacement or barrier effects are not anticipated. This further corroborates the results of the impact assessment provided in Section 7.8.2.11 of the EIAR as lodged.	The cross tablature of *Medium* sensitivity species and *Low* Impact corresponds to a ***Low*** effect significance.	
Collision	The species was recorded flying within the potential collision risk zone during VP surveys. A "Random" collision risk analysis has been undertaken and full details are provided in Appendix 5. The collision risk has been calculated to be 0.38 collisions per winter season and there were no collisions predicted for the breeding season[3]. The results of this analysis are not significantly different from the collision risk reported in the EIAR as lodged. The predicted collision risk is therefore insignificant.	The magnitude of the effect is assessed as *Low.* The cross tablature of *Medium* sensitivity species and *Low* Impact corresponds to a ***Low*** effect significance.	**Long-term Slight Negative Effect**

[3] *There were no breeding season flights recorded at possible collision height.*

4.4.8 Snipe (*All Seasons*)

As outlined in Section 7.8.2.18 of the EIAR, no significant effects were identified for this species. Please refer to Section 7.8.2.18 of the EIAR for further details on the impact assessment for snipe. The table below compares the data from the EIAR with the data collected between March 2021 and March 2022 and provides an updated impact assessment that considers all survey data. This impact assessment considers whether the results of surveys collected between March 2021 and March 2022 will inform any change to the impact assessment provided in Section 7.8.2.18 of the EIAR as lodged.

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
Construction Phase			
Direct Habitat Loss	Similar to the data outlined in Section 7.8.2.18 of the EIAR, snipe were recorded regularly during surveys, during both the summer and winter months. Snipe favour open habitats for foraging and breeding. There will likely be the loss of some suitable habitat within the wind farm site as a result of construction works. However, the (direct) loss of breeding and foraging habitat will be minimal as the infrastructure is confined to a narrow corridor. Significant effects are not anticipated at the county, national or international scale. This further corroborates the results of the impact assessment provided in Section 7.8.2.18 of the EIAR as lodged.	The magnitude of the effect is assessed as *Low.* The cross tablature of a *Medium*[4] sensitivity species and a *Low* Impact corresponds to a ***Low*** effect significance.	**Long-term Slight Negative Effect**
Disturbance	Snipe were regularly recorded during surveys between March 2021 and March 2022. Disturbance from construction activities could result in the loss of snipe breeding and wintering habitat locally. Pearce Higgins et. al (2009), found a c. 50% reduction in breeding density of snipe within 500m of turbines. The majority of the open habitat onsite is located within 500m of turbines. There is therefore potential for a measurable reduction in breeding density of snipe due	The magnitude of the effect is assessed as *Low.* The cross tablature of *Medium* sensitivity species and *Low*	**Short-term Slight Negative Effect**

[4] *Note that snipe is a medium sensitivity species now (compared to a low sensitivity species as outlined in Section 7.8.2.17 of the EIAR) due to being added to the BoCCI Red List (Gilbert et al., 2021).*

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
	to disturbance associated with construction works. However, the wind farm site does not contain habitats that are of particularly high quality to this species or unique to the local area. Therefore, were disturbance to occur it would not result in the loss of a scarce resource for the local snipe population. Significant displacement effects are not predicted to occur at the county, national and international scale. This further corroborates the results of the impact assessment provided in Section 7.8.2.18 of the EIAR as lodged.	Impact corresponds to a ***Low*** effect significance.	
Operational Phase			
Direct Habitat Loss	Direct or indirect effects are not anticipated.	**No Effect**	**No Effect**
Displacement & Barrier Effect	Snipe were regularly recorded during surveys between March 2021 and March 2022. As previously discussed, Pearce Higgins et. al (2009), found a 50% reduction in breeding density of snipe within 500m of turbines. A 500m buffer around the turbines would cover the majority of the open habitat onsite, therefore it is likely that there will be a measurable reduction in breeding density of snipe within the development and its immediate surroundings. However, the Proposed Development Site does not contain habitats that are unique to the local area nor are cutover bogs of particularly high-quality breeding habitat for this species. If displacement were to occur, it would not result in the loss of a scarce resource for the local snipe population Significant displacement or barrier effects are not predicted to occur at the county, national and international scale. This further corroborates the results of the impact assessment provided in Section 7.8.2.18 of the EIAR as lodged.	The magnitude of the effect is assessed as *Low*. The cross tablature of *Medium* sensitivity species and *Low* Impact corresponds to a ***Low*** effect significance.	**Long-term Slight Negative Effect**
Collision	It is acknowledged that the predicted number of transits, and hence the predicted rate of collision for common snipe may be underestimated, as flight	The magnitude of the effect is assessed as *Low*.	**Long-term Slight Negative Effect**

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
	activity for this species is predominantly crepuscular in nature while the Vantage Point surveys are largely diurnal (Table 1.4, SNH (2017)). The species was recorded flying with the potential collision risk zone during VP surveys. A "Random" collision risk analysis has been undertaken and full details are provided in Appendix 5. The collision risk has been calculated at a ratio of 0.18 collisions per year, or one bird every 5.6 years. The results of this analysis are not significantly different from the collision risk reported in the EIAR as lodged. The predicted collision risk is low in the context of the county, national and international population.	The cross tablature of *Medium* sensitivity species and *Low* Impact corresponds to a ***Low*** effect significance.	

4.4.9 Woodcock (*Breeding*)

As outlined in Section 7.8.2.12 of the EIAR, no significant effects were identified for this species. Please refer to Section 7.8.2.12 of the EIAR for further details on the impact assessment for woodcock. The table below compares the data from the EIAR with the data collected between March 2021 and March 2022 and provides an updated impact assessment that considers all survey data. This impact assessment considers whether the results of surveys collected between March 2021 and March 2022 will inform any change to the impact assessment provided in Section 7.8.2.12 of the EIAR as lodged.

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
Construction Phase			
Direct Habitat Loss	Direct loss of habitat will be minimal. The majority of the wind farm site is bare peat which does not provide optimal habitat for the species. The felling of forestry may temporarily reduce the distribution and availability of suitable habitat. However significant areas of forestry will remain within the wind farm site and surrounding area. Significant effects are not anticipated. This further corroborates the results of the impact assessment provided in Section 7.8.2.12 of the EIAR as lodged.	The magnitude of the effect is assessed as *Low.* The cross tablature of *Medium* sensitivity species and *Low* Impact corresponds to a ***Low*** effect significance.	**Long-term Slight Negative Effect**
Disturbance	Similar to the data outlined in Section 7.8.2.12 of the EIAR, this species was frequently recorded during breeding woodcock surveys. Disturbance from construction activities could result in the disturbance of woodcock from suitable breeding habitat locally. However, habitat loss will be restricted to the small areas of forestry onsite. It is noted that the majority of proposed development infrastructure will be sited in cutover bog, a habitat of very limited ecological value to this species. Should any potential displacement effect occur, there are extensive areas of suitable habitat in the wider area, to render this potential impact inconsequential. Significant impacts are not predicted. This further corroborates the results of the impact assessment provided in Section 7.8.2.12 of the EIAR as lodged.	The magnitude of the effect is assessed as *Low.* The cross tablature of *Medium* sensitivity species and *Low* Impact corresponds to a ***Low*** effect significance.	**Short-term Slight Negative Effect**

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
Operational Phase			
Direct Habitat Loss	Direct or indirect effects are not anticipated.	**No Effect**	**No Effect**
Displacement & Barrier Effect	There is potential for displacement of breeding woodcock in areas of forestry adjacent to proposed turbines. The wind farm site does not contain habitats that are unique to the local area nor are commercial forestry plantations of particularly high-quality breeding habitat for this species. Significant effects are not predicted. This further corroborates the results of the impact assessment provided in Section 7.8.2.12 of the EIAR as lodged.	The magnitude of the effect is assessed as *Low.* The cross tablature of *Medium* sensitivity species and *Low* Impact corresponds to a ***Low*** effect significance.	**Long-term Slight Negative Effect**
Collision	The species was recorded flying within the potential collision risk zone during VP surveys. A "Random" collision risk analysis has been undertaken and full details are provided in Appendix 5. The collision risk has been calculated to be 0.009 collisions per year or one bird every 106 years. The results of this analysis are not significantly different from the collision risk reported in the EIAR as lodged. The predicted collision risk is insignificant in the context of the county, national and international population.	The magnitude of the effect is assessed as *Negligible.* The cross tablature of *Medium* sensitivity species and *Negligible* Impact corresponds to a ***Very Low*** effect significance.	**Long-term Imperceptible Negative Effect**

4.4.10 Buzzard (All Seasons)

As outlined in Section 7.8.2.15 of the EIAR, no significant effects were identified for this species. Please refer to Section 7.8.2.15 of the EIAR for further details on the impact assessment for buzzard. The table below compares the data from the EIAR with the data collected between March 2021 and March 2022 and provides an updated impact assessment that considers all survey data. This impact assessment considers whether the results of surveys collected between March 2021 and March 2022 will inform any change to the impact assessment provided in Section 7.8.2.15 of the EIAR as lodged.

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
Construction Phase			
Direct Habitat Loss	Similar to the data outlined in Section 7.8.2.15 of the EIAR, this species was frequently recorded foraging and commuting within the wind farm site during the breeding and winter seasons. Direct loss of foraging habitat relative to its availability onsite, will be minimal. Substantial areas of undisturbed suitable breeding and foraging habitat will remain post construction. Significant effects are not predicted. This further corroborates the results of the impact assessment provided in Section 7.8.2.15 of the EIAR as lodged.	The magnitude of the effect is assessed as *Low.* The cross tablature of a *Low* sensitivity species and a *Low* Impact corresponds to a ***Very Low*** effect significance.	**Long-term Slight Negative Effect**
Disturbance	Similar to the data outlined in Section 7.8.2.15 of the EIAR, this species was frequently recorded within the wind farm site during the breeding and winter seasons. The majority of observations involve foraging or commuting birds. The wind farm site does not contain habitats that are of particularly high quality for this species (e.g. cutover bog) or unique to the local area. Therefore, were displacement to occur it would not result in the loss of a scarce resource for the local buzzard population. Significant displacement effects are not predicted. This further corroborates the results of the impact assessment provided in Section 7.8.2.15 of the EIAR as lodged.	The magnitude of the effect is assessed as *Low.* The cross tablature of *Low* sensitivity species and *low* Impact corresponds to a ***Very Low*** effect significance.	**Short-term Slight Negative Effect**

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
Operational Phase			
Direct Habitat Loss	Direct or indirect effects are not anticipated	**No Effect**	**No Effect**
Displacement & Barrier Effect	Significant effects are not anticipated, given that extensive areas of suitable foraging habitat exist and will remain in the wider area. In addition, onsite habitats are not considered of particularly high quality to this species (e.g. cutover bog) or unique to the wind farm site. Significant effects are not anticipated at any geographical scale. This further corroborates the results of the impact assessment provided in Section 7.8.2.15 of the EIAR as lodged.	The magnitude of the effect is assessed as *Low*. The cross tablature of *Low* sensitivity species and *Low* Impact corresponds to a ***Very Low*** effect significance.	**Long-term Slight Negative Effect**
Collision	The species was recorded flying with the potential collision risk zone during VP surveys. A "Random" collision risk analysis has been undertaken and full details are provided in Appendix 5. The collision risk has been calculated at a ratio of 3.7 collisions per year. A separate collision risk was run relating to breeding buzzard specifically. The collision risk for breeding buzzard was calculated as 2.4 birds per breeding season. The results of this analysis are not significantly different from the collision risk reported in the EIAR as lodged. The favourable conservation status of this species (Green-listed BoCCI) limits the potential for ecologically significant effects to result. The predicted collision risk is insignificant in the context of the county, national and international population.	The magnitude of the effect is assessed as *Low*. The cross tablature of *Low* sensitivity species and *Low* Impact corresponds to a ***Very Low*** effect significance.	**Long-term Slight Negative Effect**

4.4.11 Long-eared Owl (All Seasons)

As outlined in Section 7.8.2.14 of the EIAR, no significant effects were identified for this species. Please refer to Section 7.8.2.14 of the EIAR for further details on the impact assessment for long-eared owl. The table below compares the data from the EIAR with the data collected between March 2021 and March 2022 and provides an updated impact assessment that considers all survey data. This impact assessment considers whether the results of surveys collected between March 2021 and March 2022 will inform any change to the impact assessment provided in Section 7.8.2.14 of the EIAR as lodged.

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
Construction Phase			
Direct Habitat Loss	This species was observed perched in a tree on one occasion, within the wind farm site (along the internal road route) and 1.2km from the closest turbine. This is the same location where birds were observed during surveys outlined in the EIAR. The habitats of the wind farm site (i.e. predominantly cutover bog) are considered sub-optimal foraging habitat for long-eared owl. Long-eared owl favour open grassland for foraging. One turbine is proposed in agricultural grassland. However, habitat loss in this area is likely to be insignificant given the availability of similar habitat in the wider surroundings. Significant effects with regard to direct habitat loss are not predicted. This further corroborates the results of the impact assessment provided in Section 7.8.2.14 of the EIAR as lodged.	The magnitude of the effect is assessed as *Low.* The cross tablature of *Low* sensitivity species and *Low* Impact corresponds to a ***Very Low*** effect significance.	**Long-term Slight Negative Effect**
Disturbance	As previously discussed, the habitats of the wind farm site (i.e. predominantly cutover bog) are considered sub-optimal foraging habitat for long-eared owl. Long-eared owl favour open grassland for foraging. One turbine is proposed in agricultural grassland. Therefore, disturbance from construction works is unlikely to be significant as birds would not be foraging in habitats where the majority of these works will be taking place.	The magnitude of the effect is assessed as *Low.* The cross tablature of *Low* sensitivity species and *Low* Impact corresponds to a ***Very Low*** effect significance.	**Short-term Slight Negative Effect**

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
	Significant disturbance effects are not predicted. This further corroborates the results of the impact assessment provided in Section 7.8.2.14 of the EIAR as lodged.		
Operational Phase			
Direct Habitat Loss	Direct or indirect effects are not anticipated	**No Effect**	**No Effect**
Displacement & Barrier Effect	Significant displacement is not predicted given the area of grassland (i.e. long-eared owl foraging habitat) within the wind farm site is confined to a small marginal area and there is an abundance of similar suitable habitat in the wider surroundings. Significant displacement or barrier effects are not predicted. This further corroborates the results of the impact assessment provided in Section 7.8.2.14 of the EIAR as lodged.	The magnitude of the effect is assessed as *Low.* The cross tablature of *Low* sensitivity species and *Low* Impact corresponds to a ***Very Low*** effect significance.	**Long-term Slight Negative Effect**
Collision	The species was not recorded flying at Potential Collision Height during Vantage Point Surveys. Collision related mortality is not likely to significantly impact this species.	**No Effect**	**No Effect**

4.4.12 Sparrowhawk (*All Seasons*)

As outlined in Section 7.8.2.16 of the EIAR, no significant effects were identified for this species. Please refer to Section 7.8.2.16 of the EIAR for further details on the impact assessment for sparrowhawk. The table below compares the data from the EIAR with the data collected between March 2021 and March 2022 and provides an updated impact assessment that considers all survey data. This impact assessment considers whether the results of surveys collected between March 2021 and March 2022 will inform any change to the impact assessment provided in Section 7.8.2.16 of the EIAR as lodged.

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
Construction Phase			
Direct Habitat Loss	Similar to the data discussed in Section 7.8.2.16 the EIAR, this species was frequently recorded foraging and commuting within the wind farm site during the breeding and winter seasons. There was one confirmed breeding territory within the wind farm site. Direct loss of foraging and breeding habitat relative to its availability onsite will be minimal. Substantial areas of undisturbed suitable breeding and foraging habitat will remain post construction. Significant effects are not predicted at the county or national level. This further corroborates the results of the impact assessment provided in Section 7.8.2.16 of the EIAR as lodged.	The magnitude of the effect is assessed as *Low.* The cross tablature of a *Low* sensitivity species and a *Low* Impact corresponds to a ***Very Low*** effect significance.	**Long-term Slight Negative Effect**
Disturbance	This species was frequently recorded within the wind farm site during the breeding and winter seasons. The majority of observations involved foraging and commuting birds, with one confirmed breeding territory within the wind farm site during the 2021 breeding season. Construction adjacent to these nest sites could potentially cause displacement of breeding and foraging sparrowhawk. The disturbance associated with construction works will result in a measurable reduction in the breeding density of sparrowhawk and a reduction in the amount of foraging habitat within the wind farm site. However, these	The magnitude of the effect is assessed as *Low.* The cross tablature of *Low* sensitivity species and *low* Impact corresponds to a ***Very Low*** effect significance.	**Short-term Slight Negative Effect**

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
	lands (e.g. cutover bog and scrub) are not considered unique to the wind farm site or rare in the wider surroundings. Significant displacement effects are not predicted at the county, national or international scale. This further corroborates the results of the impact assessment provided in Section 7.8.2.16 of the EIAR as lodged.		
Operational Phase			
Direct Habitat Loss	Direct or indirect effects are not anticipated.	**No Effect**	**No Effect**
Displacement & Barrier Effect	As previously discussed, the wind farm site hosts breeding and foraging sparrowhawk. Displacement from turbines is not reported for sparrowhawk, however, it is assumed for the purposes of the assessment that sparrowhawk show avoidance to a distance of 500m from turbines as with other raptors (Pearce-Higgins et al., 2009). There was one breeding territory within 500m of the proposed turbine layout in 2021. The disturbance associated with operational turbines will result in a measurable reduction in the breeding density of sparrowhawk and a reduction in the amount of foraging habitat within the wind farm site. Notwithstanding this, extensive areas of suitable foraging habitat exist and will remain in the wider area (i.e. outside 500m from the proposed turbine layout). Moreover, onsite habitats are not considered unique to the wind farm site. Significant displacement or barrier effects are not predicted at the county, national or international scale. This further corroborates the results of the impact assessment provided in Section 7.8.2.16 of the EIAR as lodged.	The magnitude of the effect is assessed as *Low*. The cross tablature of *Low* sensitivity species and *Low* Impact corresponds to a ***Very Low*** effect significance.	**Long-term Slight Negative Effect**
Collision	The species was recorded flying with the potential collision risk zone during VP surveys. A "Random" collision risk analysis has been undertaken and full details are provided in Appendix 5.	The magnitude of the effect is assessed as *Negligible*.	**Long-term Slight Negative Effect**

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
	The collision risk has been calculated to be 0.09 collisions per year, equating to one bird every 10.9 years. The results of this analysis are not significantly different from the collision risk reported in the EIAR as lodged. The predicted collision risk is insignificant in the context of the county, national and international population.	The cross tablature of *Low* sensitivity species and *Negligible* Impact corresponds to a ***Very Low*** effect significance.	

4.5 Effects on Key Ornithological Receptors during Decommissioning

4.5.1 All Species

Potential effects during the construction and operational phases of the Proposed Development		Significance (Percival 2003)	Significance (EPA 2017)
Construction Phase			
Direct Habitat Loss	Direct or indirect effects are not anticipated	**No Effect**	**No Effect**
Displacement & Barrier Effect	As above for construction phase for each species listed as a KOR.	As above for construction phase for each KOR	As above for construction phase for each KOR

4.6 Mitigation

Lapwing continues to breed locally the potential for the construction works to impact breeding lapwing persists and requires mitigation (as per Section 4.4.7 above). This further corroborates the results of the impact assessment as reported the EIAR as lodged. Please refer to Section 7.9.2.1 of the EIAR for the prescriptive mitigation measures that have been designed to ensure significant impacts are avoided.

4.7 Cumulative Effects

There has been no significant changes to the bird communities observed at the wind farm site during surveys between March 2021 and March 2022 when compared to those outlined in the EIAR. Furthermore, there have been no significant changes to the effects of the wind farm site on key ornithological receptors to those outlined in the EIAR. Therefore, the cumulative effects as described in the EIAR remain unchanged, and no additional information is required.

5. CONCLUSION

Following consideration of the residual effects (post-mitigation), it is concluded that the proposed development will not result in any significant effects on any of the identified KORs. No significant effects on receptors of International, National or County Importance were identified.

Provided that the proposed development is constructed, operated and decommissioned in accordance with the design, best practice and mitigation that is described within the EIAR, significant individual or cumulative effects on ornithology are not anticipated at the international, national or county scales or on any of the identified KORs.

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APPENDIX 1

SURVEY EFFORT

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1. APPENDIX 1 (SURVEY EFFORT)

Table 1-1 Vantage Point Survey Effort

Date	Survey		Duration (h)	Weather Conditions	Comments	Surveyor
06/04/2021	Vantage Point Survey	VP6	3:00 starting at 14:30	Visibility: good; Wind speed and direction: gentle breeze W; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		PM
06/04/2021	Vantage Point Survey	VP6	1:00 starting at 18:00	Visibility: good; Wind speed and direction: gentle breeze W; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		PM
06/04/2021	Vantage Point Survey	VP6	2:00 starting at 19:00	Visibility: good; Wind speed and direction: gentle breeze W; Cloud cover and height: 66-100% >500m; Rain: light showers; Frost: none; Snow: none		PM
28/04/2021	Vantage Point Survey	VP4	3:00 starting at 15:30	Visibility: good; Wind speed and direction: gentle breeze NE; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		PM
28/04/2021	Vantage Point Survey	VP4	3:00 starting at 19:00	Visibility: good; Wind speed and direction: gentle breeze NE; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		PM
21/05/2021	Vantage Point Survey	VP4	3:00 starting at 04:20	Visibility: good; Wind speed and direction: moderate breeze W; Cloud cover and height: 66-100% >500m; Rain: light showers; Frost: none; Snow: none		PM
21/05/2021	Vantage Point Survey	VP4	3:00 starting at 07:50	Visibility: good; Wind speed and direction: moderate breeze W; Cloud cover and height: 66-100% >500m; Rain: light showers; Frost: none; Snow: none		PM
26/05/2021	Vantage Point Survey	VP6	3:00 starting at 04:15	Visibility: good; Wind speed and direction: light breeze N; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		PM
26/05/2021	Vantage Point Survey	VP6	3:00 starting at 07:45	Visibility: good; Wind speed and direction: light breeze N; Cloud cover and height: 33-66% >500m; Rain: none; Frost: none; Snow: none		PM
17/06/2021	Vantage Point Survey	VP4	3:00 starting at 11:00	Visibility: good; Wind speed and direction: light breeze W; Cloud cover and height: 0-33% <150m; Rain: none; Frost: none; Snow: none		PM
17/06/2021	Vantage Point Survey	VP4	3:00 starting at 14:30	Visibility: good; Wind speed and direction: light breeze W; Cloud cover and height: 0-33% <150m; Rain: none; Frost: none; Snow: none		PM
30/06/2021	Vantage Point Survey	VP6	3:00 starting at 09:30	Visibility: good; Wind speed and direction: light air W; Cloud cover and height: 66-100% <150m; Rain: none; Frost: none; Snow: none	No target species	PM

Date	Survey		Duration (h)	Weather Conditions	Comments	Surveyor
30/06/2021	Vantage Point Survey	VP6	3:00 starting at 13:00	Visibility: good; Wind speed and direction: light air W; Cloud cover and height: 0-33% <150m; Rain: none; Frost: none; Snow: none		PM
27/07/2021	Vantage Point Survey	VP4	3:00 starting at 08:00	Visibility: good; Wind speed and direction: light breeze W; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		PM
27/07/2021	Vantage Point Survey	VP4	3:00 starting at 11:30	Visibility: good; Wind speed and direction: light breeze W; Cloud cover and height: 66-100% >500m; Rain: light showers; Frost: none; Snow: none		PM
30/07/2021	Vantage Point Survey	VP6	3:00 starting at 09:00	Visibility: good; Wind speed and direction: gentle breeze W; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		PM
30/07/2021	Vantage Point Survey	VP6	3:00 starting at 12:30	Visibility: good; Wind speed and direction: gentle breeze W; Cloud cover and height: 66-100% >500m; Rain: light showers; Frost: none; Snow: none		PM
19/08/2021	Vantage Point Survey	VP6	1:00 starting at 09:30	Visibility: moderate; Wind speed and direction: light breeze E; Cloud cover and height: 66-100% 150-500m; Rain: none; Frost: none; Snow: none		TRea
19/08/2021	Vantage Point Survey	VP6	1:00 starting at 10:30	Visibility: moderate; Wind speed and direction: light breeze E; Cloud cover and height: 66-100% 150-500m; Rain: none; Frost: none; Snow: none		TRea
19/08/2021	Vantage Point Survey	VP6	1:00 starting at 11:30	Visibility: good; Wind speed and direction: light air E; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		TRea
19/08/2021	Vantage Point Survey	VP6	1:00 starting at 13:00	Visibility: good; Wind speed and direction: light air E; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		TRea
19/08/2021	Vantage Point Survey	VP6	1:00 starting at 14:00	Visibility: good; Wind speed and direction: light breeze E; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		TRea
19/08/2021	Vantage Point Survey	VP6	1:00 starting at 15:00	Visibility: good; Wind speed and direction: light breeze E; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		TRea
26/08/2021	Vantage Point Survey	VP4	1:00 starting at 09:30	Visibility: limited; Wind speed and direction: light breeze E; Cloud cover and height: 66-100% 150-500m; Rain: none; Frost: none; Snow: none	Fog for at beginning limited visibility	TRea
26/08/2021	Vantage Point Survey	VP4	1:00 starting at 10:30	Visibility: good; Wind speed and direction: light breeze E; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		TRea
26/08/2021	Vantage Point Survey	VP4	1:00 starting at 11:30	Visibility: good; Wind speed and direction: light breeze E; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		TRea

Date	Survey		Duration (h)	Weather Conditions	Comments	Surveyor
26/08/2021	Vantage Point Survey	VP4	1:00 starting at 13:00	Visibility: good; Wind speed and direction: light breeze E; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		TRea
26/08/2021	Vantage Point Survey	VP4	1:00 starting at 14:00	Visibility: good; Wind speed and direction: light breeze E; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		TRea
26/08/2021	Vantage Point Survey	VP4	1:00 starting at 15:00	Visibility: good; Wind speed and direction: light breeze E; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		TRea
06/09/2021	Vantage Point Survey	VP6	1:00 starting at 14:35	Visibility: good; Wind speed and direction: gentle breeze SW; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		TRea
06/09/2021	Vantage Point Survey	VP6	1:00 starting at 15:35	Visibility: good; Wind speed and direction: gentle breeze SW; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		TRea
06/09/2021	Vantage Point Survey	VP6	1:00 starting at 16:35	Visibility: good; Wind speed and direction: gentle breeze SW; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		TRea
06/09/2021	Vantage Point Survey	VP6	1:00 starting at 18:05	Visibility: good; Wind speed and direction: light breeze SW; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		TRea
06/09/2021	Vantage Point Survey	VP6	1:00 starting at 19:05	Visibility: good; Wind speed and direction: light air SW; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		TRea
06/09/2021	Vantage Point Survey	VP6	1:00 starting at 20:05	Visibility: good; Wind speed and direction: light air SW; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		TRea
07/09/2021	Vantage Point Survey	VP4	1:00 starting at 14:35	Visibility: good; Wind speed and direction: gentle breeze E; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		TRea
07/09/2021	Vantage Point Survey	VP4	1:00 starting at 15:35	Visibility: good; Wind speed and direction: gentle breeze E; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		TRea
07/09/2021	Vantage Point Survey	VP4	1:00 starting at 16:35	Visibility: good; Wind speed and direction: gentle breeze E; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		TRea
07/09/2021	Vantage Point Survey	VP4	1:00 starting at 18:05	Visibility: good; Wind speed and direction: gentle breeze E; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		TRea
07/09/2021	Vantage Point Survey	VP4	1:00 starting at 19:05	Visibility: good; Wind speed and direction: gentle breeze E; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		TRea
07/09/2021	Vantage Point Survey	VP4	1:00 starting at 20:05	Visibility: good; Wind speed and direction: gentle breeze E; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		TRea

Date	Survey		Duration (h)	Weather Conditions	Comments	Surveyor
08/10/2021	Vantage Point Survey	VP5	3:00 starting at 06:50	Visibility: moderate; Wind speed and direction: fresh breeze S; Cloud cover and height: 66-100% 150-500m; Rain: persistent; Frost: none; Snow: none	Sunrise - 07:45. Persistent lights and drizzly showers throughout which reduced visibility a great deal (especially at a distance). Occasional clear and brighter spells but drizzle was always threatening. Very mild with fresh S breeze (14 - 17˚C).	NM
08/10/2021	Vantage Point Survey	VP5	3:00 starting at 10:15	Visibility: moderate; Wind speed and direction: fresh breeze S; Cloud cover and height: 66-100% <150m; Rain: light showers; Frost: none; Snow: none		NM
19/10/2021	Vantage Point Survey	VP4	6:30 starting at 07:00	Visibility: good; Wind speed and direction: moderate breeze W; Cloud cover and height: 66-100% >500m; Rain: drizzle; Frost: none; Snow: none	Sunrise - 08:05	

Date	Survey		Duration (h)	Weather Conditions	Comments	Surveyor
22/10/2021	Vantage Point Survey	VP6	3:00 starting at 07:15	Visibility: moderate; Wind speed and direction: moderate breeze W; Cloud cover and height: 66-100% 150-500m; Rain: light showers; Frost: none; Snow: none	Sunrise - 08:06. Cool with moderate W breeze (which was especially apparent in open areas). Largely overcast early on with thin sheets of cloud being blown across. 90% cover. Frequent drizzly and misty showers moving across early in the survey which produced sporadic decreases in visibility. (6 - 12°C)	NM

Date	Survey		Duration (h)	Weather Conditions	Comments	Surveyor
22/10/2021	Vantage Point Survey	VP6	3:00 starting at 10:30	Visibility: good; Wind speed and direction: fresh breeze W; Cloud cover and height: 33-66% >500m; Rain: drizzle; Frost: none; Snow: none	Became a lot brighter by mid-morning with prolonged periods of sunny and clearer conditions stretching into lunchtime. Cloud cover reduced but the threat of showers remained. Wind increased to fresh W which made it feel cold despite the sun. Very occasional drizzly shower	NM
23/10/2021	Vantage Point Survey	VP3	6:10 starting at 07:20	Visibility: good; Wind speed and direction: moderate breeze S; Cloud cover and height: 33-66% >500m; Rain: none; Frost: none; Snow: none	Sunrise - 08:06. Cool and moderate S breeze (5 - 13°C). Patchy cloud and partly overcast with some clearer spots. Continued to be largely cloudy with moderate breeze (+ fresher gusts).	
15/11/2021	Vantage Point Survey	VP3	3:00 starting at 11:17	Visibility: good; Wind speed and direction: light breeze S; Cloud cover and height: 33-66% >500m; Rain: none; Frost: none; Snow: none		CR
15/11/2021	Vantage Point Survey	VP3	3:00 starting at 14:47	Visibility: good; Wind speed and direction: light breeze S; Cloud cover and height: 33-66% >500m; Rain: none; Frost: none; Snow: none		CR
16/11/2021	Vantage Point Survey	VP4	3:00 starting at 11:05	Visibility: good; Wind speed and direction: moderate breeze N; Cloud cover and height: 66-100% 150-500m; Rain: none; Frost: none; Snow: none		CR

Date	Survey		Duration (h)	Weather Conditions	Comments	Surveyor
16/11/2021	Vantage Point Survey	VP4	3:00 starting at 14:35	Visibility: moderate; Wind speed and direction: moderate breeze N; Cloud cover and height: 66-100% 150-500m; Rain: drizzle; Frost: none; Snow: none	Drizzle and reduced visibility until 15:26 pm.	CR
19/11/2021	Vantage Point Survey	VP5	3:00 starting at 11:04	Visibility: good; Wind speed and direction: gentle breeze W; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		CR
19/11/2021	Vantage Point Survey	VP5	3:00 starting at 14:34	Visibility: moderate; Wind speed and direction: gentle breeze W; Cloud cover and height: 66-100% 150-500m; Rain: drizzle; Frost: none; Snow: none	Drizzle and reduced visibility from 16:23 pm.	CR
22/11/2021	Vantage Point Survey	VP6	3:00 starting at 11:02	Visibility: good; Wind speed and direction: light breeze W; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		CR
22/11/2021	Vantage Point Survey	VP6	3:00 starting at 14:32	Visibility: good; Wind speed and direction: light breeze W; Cloud cover and height: 0-33% >500m; Rain: none; Frost: ; Snow:		CR
09/12/2021	Vantage Point Survey	VP4	3:00 starting at 07:33	Visibility: good; Wind speed and direction: gentle breeze S; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		KB
09/12/2021	Vantage Point Survey	VP4	3:00 starting at 11:03	Visibility: good; Wind speed and direction: gentle breeze S; Cloud cover and height: 66-100% <150m; Rain: drizzle; Frost: none; Snow: none		KB
15/12/2021	Vantage Point Survey	VP6	3:00 starting at 07:39	Visibility: good; Wind speed and direction: gentle breeze SW; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		KB
15/12/2021	Vantage Point Survey	VP6	3:00 starting at 11:10	Visibility: good; Wind speed and direction: gentle breeze SW; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		KB
23/12/2021	Vantage Point Survey	VP3	3:00 starting at 07:44	Visibility: good; Wind speed and direction: moderate breeze SW; Cloud cover and height: 66-100% <150m; Rain: drizzle; Frost: none; Snow: none		KB
23/12/2021	Vantage Point Survey	VP3	3:00 starting at 11:14	Visibility: good; Wind speed and direction: moderate breeze SW; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		KB
03/01/2022	Vantage Point Survey	VP5	3:00 starting at 07:45	Visibility: good; Wind speed and direction: gentle breeze NW; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		KB
03/01/2022	Vantage Point Survey	VP5	3:00 starting at 11:15	Visibility: good; Wind speed and direction: gentle breeze NW; Cloud cover and height: 33-66% >500m; Rain: drizzle; Frost: none; Snow: none		KB
25/01/2022	Vantage Point Survey	VP5	3:00 starting at 11:00	Visibility: good; Wind speed and direction: light air S; Cloud cover and height: 66-100% 150-500m; Rain: none; Frost: none; Snow: none		ZE
25/01/2022	Vantage Point Survey	VP5	3:00 starting at 14:30	Visibility: good; Wind speed and direction: light air S; Cloud cover and height: 33-66% 150-500m; Rain: none; Frost: none; Snow: none		ZE

Date	Survey		Duration (h)	Weather Conditions	Comments	Surveyor
26/01/2022	Vantage Point Survey	VP3	3:00 starting at 11:30	Visibility: good; Wind speed and direction: moderate breeze NE; Cloud cover and height: 66-100% 150-500m; Rain: none; Frost: none; Snow: none		ZE
26/01/2022	Vantage Point Survey	VP3	1:00 starting at 15:00	Visibility: good; Wind speed and direction: moderate breeze NE; Cloud cover and height: 66-100% 150-500m; Rain: none; Frost: none; Snow: none		ZE
26/01/2022	Vantage Point Survey	VP3	1:00 starting at 16:00	Visibility: moderate; Wind speed and direction: fresh breeze NE; Cloud cover and height: 66-100% 150-500m; Rain: drizzle; Frost: none; Snow: none		ZE
26/01/2022	Vantage Point Survey	VP3	1:00 starting at 17:00	Visibility: good; Wind speed and direction: moderate breeze NE; Cloud cover and height: 66-100% 150-500m; Rain: none; Frost: none; Snow: none		ZE
27/01/2022	Vantage Point Survey	VP4	3:00 starting at 11:30	Visibility: good; Wind speed and direction: light air NE; Cloud cover and height: 66-100% 150-500m; Rain: none; Frost: none; Snow: none	Occasional light drizzle for few minutes	ZE
27/01/2022	Vantage Point Survey	VP4	3:00 starting at 15:00	Visibility: good; Wind speed and direction: light breeze NE; Cloud cover and height: 66-100% 150-500m; Rain: none; Frost: none; Snow: none		ZE
31/01/2022	Vantage Point Survey	VP6	3:00 starting at 11:40	Visibility: good; Wind speed and direction: moderate breeze S; Cloud cover and height: 66-100% 150-500m; Rain: none; Frost: none; Snow: none		ZE
31/01/2022	Vantage Point Survey	VP6	3:00 starting at 15:10	Visibility: good; Wind speed and direction: moderate breeze S; Cloud cover and height: 66-100% 150-500m; Rain: none; Frost: none; Snow: none		ZE
08/02/2022	Vantage Point Survey	VP5	0:30 starting at 07:00	Visibility: none; Wind speed and direction: light air SW; Cloud cover and height: 66-100% <150m; Rain: light showers; Frost: none; Snow: none		NS
08/02/2022	Vantage Point Survey	VP5	0:30 starting at 07:30	Visibility: poor; Wind speed and direction: light air SW; Cloud cover and height: 66-100% <150m; Rain: light showers; Frost: none; Snow: none		NS
08/02/2022	Vantage Point Survey	VP5	1:00 starting at 08:00	Visibility: poor; Wind speed and direction: light breeze SW; Cloud cover and height: 66-100% <150m; Rain: light showers; Frost: none; Snow: none	Very misty, visibility reduced greatly	NS
08/02/2022	Vantage Point Survey	VP5	1:00 starting at 09:00	Visibility: ; Wind speed and direction: SW; Cloud cover and height: ; Rain: ; Frost: ; Snow:		NS

Date	Survey		Duration (h)	Weather Conditions	Comments	Surveyor
08/02/2022	Vantage Point Survey	VP5	1:00 starting at 10:30	Visibility: good; Wind speed and direction: calm SW; Cloud cover and height: 66-100% <150m; Rain: none; Frost: none; Snow: none		NS
08/02/2022	Vantage Point Survey	VP5	0:30 starting at 11:30	Visibility: moderate; Wind speed and direction: calm SW; Cloud cover and height: 66-100% <150m; Rain: drizzle; Frost: none; Snow: none		NS
08/02/2022	Vantage Point Survey	VP5	1:30 starting at 12:00	Visibility: poor; Wind speed and direction: light air SW; Cloud cover and height: 66-100% <150m; Rain: drizzle; Frost: none; Snow: none		NS
15/02/2022	Vantage Point Survey	VP3	0:30 starting at 06:45	Visibility: none; Wind speed and direction: light air WSW; Cloud cover and height: 66-100% <150m; Rain: none; Frost: none; Snow: none		NS
15/02/2022	Vantage Point Survey	VP3	2:30 starting at 07:15	Visibility: good; Wind speed and direction: light air WSW; Cloud cover and height: 66-100% <150m; Rain: none; Frost: none; Snow: none		NS
15/02/2022	Vantage Point Survey	VP3	3:00 starting at 10:15	Visibility: moderate; Wind speed and direction: light breeze WSW; Cloud cover and height: 66-100% <150m; Rain: none; Frost: none; Snow: none		NS
16/02/2022	Vantage Point Survey	VP4	1:45 starting at 06:45	Visibility: poor; Wind speed and direction: gentle breeze SW; Cloud cover and height: 66-100% <150m; Rain: drizzle; Frost: none; Snow: none		NS
16/02/2022	Vantage Point Survey	VP4	1:15 starting at 08:30	Visibility: moderate; Wind speed and direction: fresh breeze SW; Cloud cover and height: 66-100% <150m; Rain: heavy showers; Frost: none; Snow: none	visibility low, very misty	NS
16/02/2022	Vantage Point Survey	VP4	0:45 starting at 10:15	Visibility: poor; Wind speed and direction: strong breeze SW; Cloud cover and height: 66-100% <150m; Rain: drizzle; Frost: none; Snow: none		NS
16/02/2022	Vantage Point Survey	VP4	0:30 starting at 11:00	Visibility: poor; Wind speed and direction: strong breeze SW; Cloud cover and height: 66-100% <150m; Rain: drizzle; Frost: none; Snow: none		NS
16/02/2022	Vantage Point Survey	VP4	1:45 starting at 11:30	Visibility: limited; Wind speed and direction: strong breeze SW; Cloud cover and height: 66-100% <150m; Rain: persistent; Frost: none; Snow: none		NS
17/02/2022	Vantage Point Survey	VP6	0:50 starting at 06:40	Visibility: poor; Wind speed and direction: light air SW; Cloud cover and height: 66-100% <150m; Rain: none; Frost: none; Snow: none		NS
17/02/2022	Vantage Point Survey	VP6	1:30 starting at 07:30	Visibility: good; Wind speed and direction: light breeze SW; Cloud cover and height: 66-100% <150m; Rain: none; Frost: none; Snow: none		NS
17/02/2022	Vantage Point Survey	VP6	0:40 starting at 09:00	Visibility: poor; Wind speed and direction: SW; Cloud cover and height: ; Rain: heavy showers; Frost: none; Snow: none		NS

Date	Survey		Duration (h)	Weather Conditions	Comments	Surveyor
17/02/2022	Vantage Point Survey	VP6	2:00 starting at 10:10	Visibility: poor; Wind speed and direction: moderate breeze SW; Cloud cover and height: 66-100% <150m; Rain: heavy showers; Frost: none; Snow: none		NS
17/02/2022	Vantage Point Survey	VP6	1:00 starting at 12:10	Visibility: moderate; Wind speed and direction: gentle breeze SW; Cloud cover and height: 66-100% <150m; Rain: drizzle; Frost: none; Snow: none		NS
09/03/2022	Vantage Point Survey	VP6	3:00 starting at 13:20	Visibility: moderate; Wind speed and direction: near gale SW; Cloud cover and height: 66-100% <150m; Rain: persistent; Frost: none; Snow: none		NS
09/03/2022	Vantage Point Survey	VP6	3:00 starting at 16:50	Visibility: good; Wind speed and direction: strong breeze SW; Cloud cover and height: 66-100% <150m; Rain: none; Frost: none; Snow: none		NS
10/03/2022	Vantage Point Survey	VP4	3:00 starting at 13:25	Visibility: good; Wind speed and direction: strong breeze WSW; Cloud cover and height: 66-100% <150m; Rain: none; Frost: none; Snow: none		NS
10/03/2022	Vantage Point Survey	VP4	3:00 starting at 16:55	Visibility: good; Wind speed and direction: strong breeze WSW; Cloud cover and height: 66-100% <150m; Rain: none; Frost: none; Snow: none		NS
22/03/2022	Vantage Point Survey	VP5	3:00 starting at 13:10	Visibility: good; Wind speed and direction: light breeze N; Cloud cover and height: 66-100% 150-500m; Rain: none; Frost: none; Snow: none		ZOC
22/03/2022	Vantage Point Survey	VP5	3:00 starting at 16:40	Visibility: good; Wind speed and direction: light air N; Cloud cover and height: 33-66% 150-500m; Rain: none; Frost: none; Snow: none		ZOC
23/03/2022	Vantage Point Survey	VP3	3:00 starting at 13:15	Visibility: good; Wind speed and direction: moderate breeze NE; Cloud cover and height: 0-33% 150-500m; Rain: none; Frost: none; Snow: none		ZOC
23/03/2022	Vantage Point Survey	VP3	3:00 starting at 16:45	Visibility: good; Wind speed and direction: light breeze N; Cloud cover and height: 33-66% 150-500m; Rain: none; Frost: none; Snow: none		ZOC

Table 1-2 Breeding Bird Survey Effort

Date	Survey		Duration (h)	Weather Conditions	Comments	Surveyor
07/04/2021	Breeding Walkover Survey	500m Survey Radius	6:00 starting at 07:00	Visibility: good; Wind speed and direction: gentle breeze W; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		PM
14/05/2021	Breeding Walkover Survey	500m Survey Radius	3:00 starting at 05:30	Visibility: poor; Wind speed and direction: light air S; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none	Foggy	PM
14/05/2021	Breeding Walkover Survey	500m Survey Radius	3:00 starting at 08:30	Visibility: good; Wind speed and direction: light air S; Cloud cover and height: 33-66% >500m; Rain: none; Frost: none; Snow: none		PM
18/06/2021	Breeding Walkover Survey	500M Survey Radius	6:00 starting at 05:00	Visibility: good; Wind speed and direction: light breeze W; Cloud cover and height: 0-33% <150m; Rain: none; Frost: none; Snow: none		PM
21/06/2021	Breeding Walkover Survey	500M Survey Radius	9:00 starting at 08:20	Visibility: good; Wind speed and direction: gentle breeze W; Cloud cover and height: 0-33% >500m; Rain: none; Frost: light; Snow: none	Cool, bright and clear with almost no clouds early on and some light frost in places (2 - 11˚C). No apparent breeze to start with but gentle - moderate W wind emerged (in open areas). Remaining clear and bright for the majority of the survey (cool in wind but warm in shade). Cloud cover gradually increasing towards evening with very light passing showers - but continued to be clear and cloud cover never went above 30%.	NM

Date	Survey		Duration (h)	Weather Conditions	Comments	Surveyor
23/07/2021	Breeding Walkover Survey	500M Survey Radius	5:00 starting at 05:30	Visibility: good; Wind speed and direction: light air E; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		PM
06/05/2022	Breeding Walkover Survey	VP3	3:00 starting at 10:00	Visibility: poor; Wind speed and direction: gentle breeze NE; Cloud cover and height: 66-100% <150m; Rain: persistent; Frost: none; Snow: none	Persistant rain through entire walkover.	NS
09/05/2022	Breeding Walkover Survey	VP6	3:30 starting at 09:00	Visibility: good; Wind speed and direction: moderate breeze NE; Cloud cover and height: 66-100% <150m; Rain: light showers; Frost: none; Snow: none		NS
09/05/2022	Breeding Walkover Survey	VP4	3:30 starting at 13:30	Visibility: moderate; Wind speed and direction: strong breeze NE; Cloud cover and height: 66-100% <150m; Rain: ; Frost: none; Snow: none		NS
10/05/2022	Breeding Walkover Survey	VP5	3:00 starting at 08:15	Visibility: good; Wind speed and direction: moderate breeze NE; Cloud cover and height: 66-100% <150m; Rain: persistent; Frost: none; Snow: none	Persistant rain through entire walkover.	NS
24/05/2022	Breeding Walkover Survey	500M Survey Radius	11:00 starting at 06:00	Visibility: good; Wind speed and direction: moderate breeze W; Cloud cover and height: 33-66% >500m; Rain: drizzle; Frost: none; Snow: none	Primarily clear throughout with widespread sunny spells. Occasional showers with some heavier ones emerging later in the day. 9 - 14°C	NM
25/05/2022	Breeding Walkover Survey	500M Survey Radius	12:00 starting at 06:00	Visibility: good; Wind speed and direction: fresh breeze WSW; Cloud cover and height: 33-66% >500m; Rain: none; Frost: none; Snow: none	Largely clear throughout with bright spells. Occasional light showers but they were seldom and short-lived. 9 - 13°C. Fresh WSW breeze with some stronger gusts.	NM

Table 1-3 Breeding Raptor Survey Effort

Date	Survey		Duration (h)	Weather Conditions	Comments	Surveyor
29/04/2021	Breeding Raptor Survey	BRVP5	3:00 starting at 08:30	Visibility: good; Wind speed and direction: light breeze NE; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		PM
29/04/2021	Breeding Raptor Survey	BRVP6	3:00 starting at 12:00	Visibility: good; Wind speed and direction: light breeze NE; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		PM
30/04/2021	Breeding Raptor Survey	BRVP2	3:00 starting at 07:30	Visibility: good; Wind speed and direction: light breeze NE; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		PM
30/04/2021	Breeding Raptor Survey	BRVP1	3:00 starting at 11:00	Visibility: good; Wind speed and direction: light breeze NE; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		PM
06/05/2021	Breeding Raptor Survey	BRVP1	3:00 starting at 16:30	Visibility: good; Wind speed and direction: light breeze NW; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		PM
18/05/2021	Breeding Raptor Survey	BRVP6	3:00 starting at 17:00	Visibility: good; Wind speed and direction: light breeze W; Cloud cover and height: 33-66% >500m; Rain: none; Frost: none; Snow: none		PM
20/05/2021	Breeding Raptor Survey	BRVP5	3:00 starting at 16:30	Visibility: good; Wind speed and direction: moderate breeze W; Cloud cover and height: 66-100% >500m; Rain: light showers; Frost: none; Snow: none	No Raptors Observed	PM
24/05/2021	Breeding Raptor Survey	BRVP2a	3:00 starting at 17:15	Visibility: good; Wind speed and direction: gentle breeze NW; Cloud cover and height: 33-66% >500m; Rain: light showers; Frost: none; Snow: none		PM
03/06/2021	Breeding Raptor Survey	BRVP1	3:00 starting at 17:45	Visibility: good; Wind speed and direction: gentle breeze S; Cloud cover and height: 66-100% <150m; Rain: light showers; Frost: none; Snow: none		PM
04/06/2021	Breeding Raptor Survey	BRVP6	3:00 starting at 17:20	Visibility: good; Wind speed and direction: gentle breeze S; Cloud cover and height: 66-100% <150m; Rain: none; Frost: none; Snow: none		PM
28/06/2021	Breeding Raptor Survey	BRVP2	3:00 starting at 17:30	Visibility: good; Wind speed and direction: gentle breeze N; Cloud cover and height: 0-33% <150m; Rain: none; Frost: none; Snow: none		PM
29/06/2021	Breeding Raptor Survey	BRVP6	3:00 starting at 17:30	Visibility: good; Wind speed and direction: gentle breeze N; Cloud cover and height: 0-33% <150m; Rain: none; Frost: none; Snow: none		PM
13/07/2021	Breeding Raptor Survey	BRVP6	1:00 starting at 09:00	Visibility: good; Wind speed and direction: gentle breeze NW; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		Trea
13/07/2021	Breeding Raptor Survey	BRVP6	1:00 starting at 10:00	Visibility: good; Wind speed and direction: gentle breeze NW; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		Trea

Date	Survey		Duration (h)	Weather Conditions	Comments	Surveyor
13/07/2021	Breeding Raptor Survey	BRVP6	1:00 starting at 11:00	Visibility: good; Wind speed and direction: gentle breeze NW; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none	No target species observed	Trea
13/07/2021	Breeding Raptor Survey	BRVP5	1:00 starting at 12:30	Visibility: good; Wind speed and direction: gentle breeze NW; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		Trea
13/07/2021	Breeding Raptor Survey	BRVP5	1:00 starting at 13:30	Visibility: good; Wind speed and direction: gentle breeze NW; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		Trea
13/07/2021	Breeding Raptor Survey	BRVP5	1:00 starting at 14:30	Visibility: good; Wind speed and direction: gentle breeze NW; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		Trea
19/07/2021	Breeding Raptor Survey	BRVP1	1:00 starting at 10:00	Visibility: good; Wind speed and direction: light breeze E; Cloud cover and height: 33-66% >500m; Rain: none; Frost: none; Snow: none		Trea
19/07/2021	Breeding Raptor Survey	BRVP1	1:00 starting at 11:00	Visibility: good; Wind speed and direction: light breeze E; Cloud cover and height: 33-66% >500m; Rain: none; Frost: none; Snow: none		Trea
19/07/2021	Breeding Raptor Survey	BRVP1	1:00 starting at 12:00	Visibility: good; Wind speed and direction: light breeze E; Cloud cover and height: 33-66% >500m; Rain: none; Frost: none; Snow: none		Trea
19/07/2021	Breeding Raptor Survey	BRVP2	1:00 starting at 12:30	Visibility: good; Wind speed and direction: calm E; Cloud cover and height: 33-66% >500m; Rain: none; Frost: none; Snow: none		Trea
19/07/2021	Breeding Raptor Survey	BRVP2	1:00 starting at 13:30	Visibility: good; Wind speed and direction: calm E; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		Trea
19/07/2021	Breeding Raptor Survey	BRVP2	1:00 starting at 14:30	Visibility: good; Wind speed and direction: calm E; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		Trea

Table 1-4 Winter Transect Survey Effort

Date	Survey		Duration (h)	Weather Conditions	Comments	Surveyor
20/10/2021	Winter Walkover Survey	500M Survey Radius	7:25 starting at 08:35	Visibility: good; Wind speed and direction: moderate breeze SW; Cloud cover and height: 33-66% >500m; Rain: light showers; Frost: none; Snow: none	Grey and dark with persistent heavy showers to start with but cleared considerably by mid-morning - leading to relatively bright conditions and occasional sunny spells. Occasional heavy showers and drizzly outbursts. (10 - 17˚C).	NM
27/01/2022	Winter Walkover Survey	T1	6:00 starting at 11:30	Visibility: moderate; Wind speed and direction: moderate breeze SW; Cloud cover and height: 66-100% 150-500m; Rain: light showers; Frost: none; Snow: none		AOD
28/01/2022	Winter Walkover Survey	T1,T2	6:00 starting at 11:20	Visibility: good; Wind speed and direction: moderate breeze S; Cloud cover and height: 66-100% <150m; Rain: drizzle; Frost: none; Snow: none		AOD
22/02/2022	Winter Walkover Survey	T1	6:00 starting at 11:50	Visibility: good; Wind speed and direction: fresh breeze S; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		AOD
23/02/2022	Winter Walkover Survey	T1,T2	6:00 starting at 12:00	Visibility: good; Wind speed and direction: fresh breeze SE; Cloud cover and height: 66-100% 150-500m; Rain: heavy showers; Frost: none; Snow: none		AOD
15/03/2022	Winter Walkover Survey	VP3&4 area	7:00 starting at 09:30	Visibility: good; Wind speed and direction: moderate breeze NE; Cloud cover and height: 66-100% <150m; Rain: none; Frost: none; Snow: none		NS
16/03/2022	Winter Walkover Survey	VP6&4 area	7:00 starting at 09:30	Visibility: good; Wind speed and direction: gentle breeze NE; Cloud cover and height: 66-100% <150m; Rain: drizzle; Frost: none; Snow: none		NS

Table 1-5 Wildfowl Survey Effort

Date	Survey		Duration (h)	Weather Conditions	Comments	Surveyor
16/09/2021	Waterfowl Distribution Survey	8km buffer	9:10 starting at 08:00	Visibility: good; Wind speed and direction: light breeze SE; Cloud cover and height: 33-66% >500m; Rain: none; Frost: none; Snow: none	Overcast with some patchy clearences peeking through at times. Quite calm with light SE breeze, mild (10 - 18˚C). Some lights showers emerging by mid-morning - mixture of random showers and hazy sunshine for the remainder of survey	NM
17/09/2021	Waterfowl Distribution Survey	8km buffer	5:30 starting at 12:00	Visibility: good; Wind speed and direction: moderate breeze SW; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none	Warm and humid throughout (16 - 18˚C) with largely cloudy sky but with clearer spells on occasion. Occasional sporadic lights showers. Moderate SW breeze.	NM
17/09/2021	Waterfowl Distribution Survey	L. Iron Roost	11:30 starting at 18:00	Visibility: good; Wind speed and direction: light air SW; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none	Mild conditions continued along with a reduction in cloud cover leading to a bright a largely clear evening. Wind dropped considerably - light air from SW. 14 - 17˚C. Sunset - 19:40	NM

29/09/2021	Waterfowl Distribution Survey	8km buffer	8:15 starting at 07:45	Visibility: moderate; Wind speed and direction: moderate breeze SW; Cloud cover and height: 66-100% 150-500m; Rain: drizzle; Frost: none; Snow: none	Relatively mild (6 - 14˚C) and entirely overcast. Moderate SW breeze. Grey and drear throughout. Blustery showers at dawn followed by sporadic drizzly showers throughout the morning - some heavier and more persistent showers towards evening.	NM
30/09/2021	Waterfowl Distribution Survey	L. Iron Roost	2:45 starting at 17:30	Visibility: good; Wind speed and direction: fresh breeze SW; Cloud cover and height: 33-66% >500m; Rain: light showers; Frost: none; Snow: none	Breezy with fresh SW breeze. Sunny spells and scattered showers blowing across. Relatively mild (10 - 14˚C) but wind made it feel colder	NM
11/10/2021	Waterfowl Distribution Survey	L. Iron Roost	3:15 starting at 16:30	Visibility: good; Wind speed and direction: light breeze NW; Cloud cover and height: 33-66% >500m; Rain: none; Frost: none; Snow: none	Sunset - 18:56. Cool and bright evening with bright sunny patches. Almost no breeze whatsoever with light movement of air on occasion. Cool with the temperature dropping towards dusk (4 - 10˚C). Mist gathering low of fields and wetlands at dusk also.	NM

12/10/2021	Waterfowl Distribution Survey	8km buffer (point survey on water bodies)	9:15 starting at 08:00	Visibility: good; Wind speed and direction: light breeze NW; Cloud cover and height: 33-66% 150-500m; Rain: none; Frost: none; Snow: none	Grey and overcast but with thinner and brighter patches at times (remaining largely overcast throughout). Patches of sunny spells emerging towards mid afternoon but continued to remain rather cloudy. (8 - 13˚C).	NM
25/10/2021	Waterfowl Distribution Survey	L. Iron roost	2:30 starting at 16:45	Visibility: moderate; Wind speed and direction: light breeze W; Cloud cover and height: 33-66% >500m; Rain: drizzle; Frost: none; Snow: none	Sunset - 18:10	NM
26/10/2021	Waterfowl Distribution Survey	8km buffer	8:45 starting at 08:15	Visibility: good; Wind speed and direction: light breeze SW; Cloud cover and height: 66-100% 150-500m; Rain: drizzle; Frost: none; Snow: none	Very mild and humid (12 - 15˚C) with overcast sky and sporadic light SW breeze. Occasional drizzly showers. Brightening up as morniong progressed with some patchy brighter spots but remaining largely overcast. Prolonged clear spells in afternoon.	NM

08/11/2021	Waterfowl Distribution Survey	8km buffer	5:30 starting at 11:00	Visibility: good; Wind speed and direction: moderate breeze SW; Cloud cover and height: 33-66% >500m; Rain: drizzle; Frost: none; Snow: none	Mild with moderate SW breeze (10 - 13˚C). Damp with rain in the morning - but when survey started it had cleared significantly. Extensive clearer spells throughout the day with drifting lines of stratus clouds. Becoming cloudier and darker in afternoon.	NM
09/11/2021	Waterfowl Distribution Survey	8km buffer (+ L. Iron roost)	9:10 starting at 08:20	Visibility: good; Wind speed and direction: gentle breeze SE; Cloud cover and height: 33-66% >500m; Rain: none; Frost: none; Snow: none	Sunset - 16:40. L. Iron roost: 15:15 - 17:30	NM
22/11/2021	Waterfowl Distribution Survey	L. Iron Roost	2:30 starting at 15:00	Visibility: good; Wind speed and direction: light breeze S; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none	Cool (3 - 8˚C) with light S breeze. Bright and clear with no cloud. Sunset - 16:21	NM

23/11/2021	Waterfowl Distribution Survey	8km buffer	8:15 starting at 08:15	Visibility: good; Wind speed and direction: light breeze SW; Cloud cover and height: 66-100% 150-500m; Rain: none; Frost: none; Snow: none	Cool (4 - 6˚C) with light SW breeze. Almost entirely overcast with occasional thinner and brighter areas but these were fleeting. Still and quiet for the most part with breeze apparent in open areas. L. Bane - almost inaccesible, perimter of tangled and boggy birch woodland and scrub + very wet and boggy shores (with Sphagnum) - fully saturated (quaking bog??).	NM
09/12/2021	Waterfowl Distribution Survey	8km buffer (+ L. Iron roost)	4:20 starting at 13:00	Visibility: limited; Wind speed and direction: moderate breeze W; Cloud cover and height: 66-100% <150m; Rain: light showers; Frost: none; Snow: none	Constant drizzle and rain throughout made survey unpleasent. Very poor visibility throughout. Cold with moderate W breeze (4 - 6˚C). The weather during this survey was very bad and the visibility very poor. The lake was seen to be full of wildfowl but ID was nearly impossible.	NM

10/12/2021	Waterfowl Distribution Survey	8km buffer	8:05 starting at 08:15	Visibility: good; Wind speed and direction: gentle breeze NW; Cloud cover and height: 0-33% >500m; Rain: drizzle; Frost: light; Snow: none	Cold and crisp throughout the day with light NW breeze (3 - 7°C). Cold and sleety showers to start with but by mid-morning it had tunred into a clear and bright day.	NM
22/12/2021	Waterfowl Distribution Survey	8km buffer	7:50 starting at 08:30	Visibility: good; Wind speed and direction: gentle breeze SE; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none	Cool with gentle SE breeze throuough (2 - 7°C). Grey and entirely overcast	NM
23/12/2021	Waterfowl Distribution Survey	L. Iron roost	2:15 starting at 14:45	Visibility: good; Wind speed and direction: light air S; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none	Mild and calm with clear bright skies (9 - 12°C). No wind. Good visibility.	NM

04/01/2022	Waterfowl Distribution Survey	8km buffer (+ L. Iron roost	8:20 starting at 09:00	Visibility: good; Wind speed and direction: moderate breeze SE; Cloud cover and height: 33-66% 150-500m; Rain: drizzle; Frost: heavy; Snow: falling	Cold all day (-1 - 3˚C). Light snow on ground along with heavy frost which stayed put all day. Predominantly overcast througout with snow showers up until 13:00 - visibility greatly reduced during snow. Turning clear and bright very abruptly in the afternoon with clear and sunny conditions - but remained very cold. Clouding over once again in evening but remaining high and bright. L. Iron roost: 15:00 - 17:20. Numbers of WF recorded were likely to be understimates due to high numbers and distance away from lake by surveyor. Sunset: 16:22	NM

05/01/2022	Waterfowl Distribution Survey	8km buffer	7:45 starting at 08:45	Visibility: good; Wind speed and direction: gentle breeze W; Cloud cover and height: 33-66% >500m; Rain: none; Frost: light; Snow: none	Predominantly bright and clear with prolonged sunny spells which persisted for the survey duration. Cold and crisp (-2 - 4˚C) and remained so throughout.	NM

17/01/2022	Waterfowl Distribution Survey	8km buffer	8:30 starting at 08:30	Visibility: good; Wind speed and direction: calm W; Cloud cover and height: 0-33% >500m; Rain: none; Frost: heavy; Snow: none	Cold and crisp early in the morning (-3 - 7°C) with heavy frost on ground. No wind, very calm all day. Patchy mist and haze early on which hampered visibility but it was quickly burned off. Clear and bright all day, never a cloud to be seen. Warming up gradually with frost disappearing mostly by mid-morning (except in shaded areas). Remaining clear and calm throughout. Large numbers of wildfowl on L. Sheelin, with CO & TU being notable numerous - underestimation of numbers likely. Large RE & SG flocks flying over site at dusk.	NM

18/01/2022	Waterfowl Distribution Survey	8km buffer	5:00 starting at 10:00	Visibility: good; Wind speed and direction: light breeze S; Cloud cover and height: 33-66% >500m; Rain: drizzle; Frost: none; Snow: none	Largely clear and bright early on with with prolonged sunny spells (5 - 8°C). Relatively calm with light S breeze. Becoming gradually cloudier and greyer towards lunchtime with rain showers blowing in - turning entirely overcast and wet by mid-afternoon.	NM
18/01/2022	Waterfowl Distribution Survey	L. Iron roost	2:00 starting at 15:30	Visibility: poor; Wind speed and direction: gentle breeze S; Cloud cover and height: 66-100% 150-500m; Rain: heavy showers; Frost: none; Snow: none	Entirely overcast with mid-height cloud (5 - 9°C). Consistent heavy rain and very wet conditions - some occasional but short-lived clearences. Rain hampered visibility greatly. Sunset - 16:43	NM
14/02/2022	Waterfowl Distribution Survey	5km buffer	4:40 starting at 10:30	Visibility: good; Wind speed and direction: fresh breeze NW; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		KB
15/02/2022	Waterfowl Distribution Survey	5km buffer	6:00 starting at 09:30	Visibility: good; Wind speed and direction: gentle breeze W; Cloud cover and height: 66-100% 150-500m; Rain: none; Frost: none; Snow: none		KB
26/02/2022	Waterfowl Distribution Survey	5km buffer	5:00 starting at 09:00	Visibility: good; Wind speed and direction: moderate breeze S; Cloud cover and height: 66-100% 150-500m; Rain: light showers; Frost: none; Snow: none		KB
28/02/2022	Waterfowl Distribution Survey	5km buffer	3:50 starting at 11:40	Visibility: good; Wind speed and direction: gentle breeze S; Cloud cover and height: 33-66% >500m; Rain: light showers; Frost: none; Snow: none		KB
07/03/2022	Waterfowl Distribution Survey	5km buffer	4:00 starting at 09:00	Visibility: good; Wind speed and direction: gentle breeze S; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		KB

08/03/2022	Waterfowl Distribution Survey	5km buffer	4:30 starting at 11:30	Visibility: good; Wind speed and direction: fresh breeze S; Cloud cover and height: 66-100% >500m; Rain: light showers; Frost: none; Snow: none		KB
31/03/2022	Waterfowl Distribution Survey	5km buffer	4:00 starting at 08:00	Visibility: good; Wind speed and direction: gentle breeze N; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		KB
31/03/2022	Waterfowl Distribution Survey	5km buffer	3:30 starting at 13:00	Visibility: good; Wind speed and direction: gentle breeze N; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		KB
17/04/2022	Waterfowl Distribution Survey	5km buffer	5:30 starting at 11:00	Visibility: good; Wind speed and direction: moderate breeze S; Cloud cover and height: 66-100% 150-500m; Rain: persistent; Frost: none; Snow: none		KB
04/05/2022	Waterfowl Distribution Survey	5km buffer	6:00 starting at 11:00	Visibility: good; Wind speed and direction: moderate breeze NW; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		KB
20/05/2022	Waterfowl Distribution Survey	8km buffer	11:00 starting at 07:00	Visibility: good; Wind speed and direction: moderate breeze WSW; Cloud cover and height: 66-100% 150-500m; Rain: light showers; Frost: none; Snow: none	Consistent rain for the first half of the day - light showers. Clearing gradually towards the evening with the onset of clearer and sunny spells. Moderate WSW breeze, 11 - 15˚C	NM
27/05/2022	Waterfowl Distribution Survey	5km buffer	10:15 starting at 08:15	Visibility: good; Wind speed and direction: moderate breeze SW; Cloud cover and height: 33-66% >500m; Rain: none; Frost: none; Snow: none	Moderate SW breeze , 10 - 16˚C. Largely clear and bright and remained so throughout - some darker and cloudier spells came and went. Brightening significantly (and warming) from 1pm onwards with a decrease in cloud cover	NM

Table 1-6 Woodcock Survey Effort

Date	Survey		Duration (h)	Weather Conditions	Comments	Surveyor
06/05/2021	Breeding Woodcock Survey	T1	2:30 starting at 20:00	Visibility: good; Wind speed and direction: light breeze NW; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		PM
18/05/2021	Breeding Woodcock Survey	T3	2:00 starting at 20:30	Visibility: good; Wind speed and direction: light breeze W; Cloud cover and height: 33-66% >500m; Rain: none; Frost: none; Snow: none		PM
20/05/2021	Breeding Woodcock Survey	T4	2:00 starting at 20:30	Visibility: good; Wind speed and direction: moderate breeze W; Cloud cover and height: 66-100% >500m; Rain: drizzle; Frost: none; Snow: none	No WK Observed	PM
24/05/2021	Breeding Woodcock Survey	T2	2:00 starting at 20:30	Visibility: good; Wind speed and direction: gentle breeze NW; Cloud cover and height: 33-66% >500m; Rain: light showers; Frost: none; Snow: none		PM
03/06/2021	Breeding Woodcock Survey	T2	2:00 starting at 20:50	Visibility: good; Wind speed and direction: gentle breeze S; Cloud cover and height: 66-100% <150m; Rain: light showers; Frost: none; Snow: none		PM
03/06/2021	Breeding Woodcock Survey	T1	2:00 starting at 20:50	Visibility: good; Wind speed and direction: gentle breeze S; Cloud cover and height: 66-100% >500m; Rain: light showers; Frost: none; Snow: none		Trea
04/06/2021	Breeding Woodcock Survey	T4	3:00 starting at 20:50	Visibility: good; Wind speed and direction: gentle breeze S; Cloud cover and height: 66-100% <150m; Rain: none; Frost: none; Snow: none	No WK observed	PM
04/06/2021	Breeding Woodcock Survey	T3	2:00 starting at 20:50	Visibility: good; Wind speed and direction: gentle breeze S; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		Trea
28/06/2021	Breeding Woodcock Survey	T2	2:00 starting at 21:00	Visibility: good; Wind speed and direction: gentle breeze N; Cloud cover and height: 0-33% <150m; Rain: none; Frost: none; Snow: none	No WK observed	PM
28/06/2021	Breeding Woodcock Survey	T1	2:00 starting at 21:00	Visibility: good; Wind speed and direction: gentle breeze N; Cloud cover and height: 0-33% <150m; Rain: none; Frost: none; Snow: none		Trea

Date	Survey		Duration (h)	Weather Conditions	Comments	Surveyor
29/06/2021	Breeding Woodcock Survey	T4	2:00 starting at 21:00	Visibility: good; Wind speed and direction: gentle breeze N; Cloud cover and height: 0-33% <150m; Rain: none; Frost: none; Snow: none	No WK observed	PM
29/06/2021	Breeding Woodcock Survey	T3	2:00 starting at 21:00	Visibility: good; Wind speed and direction: gentle breeze N; Cloud cover and height: 0-33% <150m; Rain: none; Frost: none; Snow: none	No WK Observed	Trea
16/05/2022	Breeding Woodcock Survey	T4	2:10 starting at 20:30	Visibility: moderate; Wind speed and direction: gentle breeze NE; Cloud cover and height: 66-100% <150m; Rain: none; Frost: none; Snow: none		NS
20/05/2022	Breeding Woodcock Survey	T2	2:20 starting at 20:30	Visibility: moderate; Wind speed and direction: light breeze NE; Cloud cover and height: 66-100% <150m; Rain: none; Frost: none; Snow: none		NS
24/05/2022	Breeding Woodcock Survey	T1	2:10 starting at 20:40	Visibility: moderate; Wind speed and direction: light air NE; Cloud cover and height: 33-66% <150m; Rain: none; Frost: none; Snow: none		NS

APPENDIX 2

SURVEY DATA

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1. APPENDIX 2 (SURVEY DATA)

Table 1-1 Common Tern Wildfowl Distribution Survey Data

Vantage Point Surveys							
Map Ref.	**Location**	**Date**	**Time**	**Species**	**Number**	**Habitat and activity**	**Surveyor**
CN001	L. D'varagh	17/09/2021	13:48	Common Tern	2	mesotrophic lakes; appeared to be doing laps around lake shore	NM

Table 1-2 Golden Plover Vantage Point Survey Data

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
GP001	VP5	08/10/2021	12:43	Golden Plover	175	330	0	0	0	330	improved agricultural grassland, semi-natural grassland and scrub; flying high over and back far to the s of vp	NM
GP002	VP4	19/10/2021	09:13	Golden Plover	65	170	0	0	170	0	cutover bog; flying w across site	NM
GP003	VP6	22/10/2021	13:05	Golden Plover	54	245	0	40	205	0	cutover bog and scrub; flying and swirling over bog in flock	NM
GP004	VP3	23/10/2021	10:10	Golden Plover	6	65	0	65	0	0	cutover bog; flying s	NM
GP005	VP3	23/10/2021	10:18	Golden Plover	6	60	25	35	0	0	cutover bog; flying across bog + rapidly low across ground	NM
GP006	VP3	23/10/2021	10:21	Golden Plover	148	650	0	60	590	0	cutover bog, improved agricultural grassland and hedgerows; flying and swirling in group over bog and farmland	NM
GP007	VP3	23/10/2021	10:27	Golden Plover	46	125	0	0	125	0	cutover bog, improved agricultural grassland and scrub; flying across s of site	NM
GP008	VP3	23/12/2021	08:47	Golden Plover	11	5	5	0	0	0	cutover bog; travelling	KB
GP009	VP3	23/12/2021	09:14	Golden Plover	10	8	8	0	0	0	cutover bog; travelling	KB

Table 1-3 Golden Plover Breeding Walkover Survey Data

Breeding Walkover Surveys						
Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
GP001	07/04/2021	08:47	Golden Plover	3	cutover bog; travelling (flyover; non-breeding)	PM

Table 1-4 Golden Plover Winter Walkover Survey Data

Winter Walkover Surveys						
Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
GP002	20/10/2021	10:56	Golden Plover	6	cutover bog; flying and swirling across bog (wintering)	NM
GP003	20/10/2021	16:13	Golden Plover	6	improved agricultural grassland and scattered tress and parkland; flying and calling (wintering)	NM
GP004	20/10/2021	10:56	Golden Plover	16	cutover bog; on bog and calling (wintering)	NM
GP005	27/01/2022	16:27	Golden Plover	14	cutover bog; roosting, roosting on bog (wintering)	AOD

Table 1-5 Golden Plover Wildfowl Distribution Survey Data

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
GP001	L. D'varagh	12/10/2021	16:16	Golden Plover	6	lakes and ponds; flying low and rapidly across lake - heading w	NM

Wildfowl Distribution Surveys							
Map Ref.	**Location**	**Date**	**Time**	**Species**	**Number**	**Habitat and activity**	**Surveyor**
GP002		26/10/2021	12:47	Golden Plover	5	cutover bog; flying low across bog wetland	NM
GP003		23/11/2021	15:40	Golden Plover	160	lakes and ponds; flying over farmland to n of lake	NM
GP004	L. D'varagh	04/01/2022	09:14	Golden Plover	19	improved agricultural grassland and hedgerows; swirling low over fields	NM

Table 1-6 Greenland White-fronted Goose Vantage Point Survey Data

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
WG001	VP6	06/04/2021	19:54	Greenland White-fronted Goose	14	100	0	0	100	0	cutover bog and wet grassland; travelling	PM

Table 1-7 Greenland White-fronted Goose Winter Walkover Survey Data

Winter Walkover Surveys						
Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
WG001	21/10/2021	10:14	Greenland White-fronted Goose	5	cutover bog and scrub; flying sw across site (wintering)	NM

Table 1-8 Greenland White-fronted Goose Waterfowl Survey Data

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
WG001	Piercefield	15/02/2022	10:10	Greenland White-fronted Goose	24	wet grassland; foraging, rest of the flock was unseen through vegetation/trees but more birds heard calling	KB
WG002	Piercefield	15/02/2022	10:10	Greenland White-fronted Goose	4	wet grassland; foraging, more birds likely present but unseen through hedgerow	KB

Wildfowl Distribution Surveys							
Map Ref.	**Location**	**Date**	**Time**	**Species**	**Number**	**Habitat and activity**	**Surveyor**
WG003	Lough Iron - piercefield fields	28/02/2022	15:30	Greenland White-fronted Goose	9	wet grassland; foraging, more birds present but not visible through the vegetation/trees - calling heard indicating larger flock	KB
WG004	Lough Iron - piercefield	08/03/2022	11:42	Greenland White-fronted Goose	12	wet grassland; foraging, whole flock not visible through the vegetation/trees - more birds likely present	KB

Table 1-9 Hen Harrier Vantage Point Survey Data

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
HH001	VP6	06/04/2021	19:53	Hen Harrier	1	110	110	0	0	0	wet grassland, cutover bog and conifer plantation; travelling, 2cy male	PM
HH002	VP6	06/09/2021	17:30	Hen Harrier	1	6	6	0	0	0	cutover bog; flying, ringtail, glided in and landed out of site in scrub near river	TRea
HH003	VP6	06/09/2021	18:13	Hen Harrier	1	27	27	0	0	0	cutover bog; travelling, ringtail, flew low over bog and landed by stream	TRea
HH004	VP6	22/10/2021	12:14	Hen Harrier	1	95	95	0	0	0	semi-natural grassland, scrub and cutover bog; flying low with acrobatics across grassland and scrub along river, diving at passerines	NM
HH005	VP6	17/02/2022	09:48	Hen Harrier	1	20	20	0	0	0	lowland blanket bog; flying, male	NS
HH006	VP6	17/02/2022	12:35	Hen Harrier	1	150	150	0	0	0	lowland blanket bog; flying, male	NS
HH008	VP6	17/02/2022	10:17	Hen Harrier	1	15	15	0	0	0	improved agricultural grassland; flying, male	NS
HH008	VP6	17/02/2022	12:13	Hen Harrier	1	25	25	0	0	0	improved agricultural grassland; flying, same male in the area seen 4 times	NS

Table 1-10 Kingfisher Vantage Point Survey Data

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
KF001	VP4	27/07/2021	12:38	Kingfisher	1	40	40	0	0	0	cutover bog; flew from drain	PM
KF002	VP6	22/11/2021	16:03	Kingfisher	1	21	21	0	0	0	eroding/upland rivers; flying	CR

Table 1-11 Kingfisher Vantage Point Survey Non-flight Survey Data

Vantage Point Surveys							
Map Ref.	VP	Date	Time	Species	Number	Habitat and activity	Surveyor
KF003	VP6	22/11/2021	16:07	Kingfisher	1	depositing/lowland rivers; calling/flying, kingfisher heard calling whilst travelling downstream.	CR

Table 1-12 Kingfisher Winter Walkover Survey Data

Winter Walkover Surveys						
Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
KF001	28/01/2022	13:04	Kingfisher	1	depositing/lowland rivers; fly, along inny (wintering)	AOD

Table 1-13 Kingfisher Wildfowl Distribution Survey Data

Wildfowl Distribution Surveys							
Map Ref.	**Location**	**Date**	**Time**	**Species**	**Number**	**Habitat and activity**	**Surveyor**
KF001	River Inny and lake off Loughh Derravaragh	31/03/2022	14:12	Kingfisher	1	watercourses; foraging	KB

Table 1-14 Kingfisher Incidental Observations Data

Incidental Records							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
KF001	Wildfowl Distribution Survey, r. inny	16/09/2021	16:24	Kingfisher	1	depositing/lowland rivers; flying over river, perching on riverbank willow before flying low and rapidly upstream, appeared to be hunting	NM
KF002	Wildfowl Distribution Survey,	12/10/2021	09:45	Kingfisher	1	depositing/lowland rivers; flying rapidly along wooded river	NM
KF003	Wildfowl Distribution Survey, r. inny	12/10/2021	15:10	Kingfisher	1	depositing/lowland rivers; flying low and rapidly over river	NM
KF004	Wildfowl Distribution Survey,	26/10/2021	10:37	Kingfisher	1	depositing/lowland rivers; flying rapidly along river, perched	NM
KF005	Wildfowl Distribution Survey, r. inny	23/11/2021	13:10	Kingfisher	1	depositing/lowland rivers; flying low downstream along river edge	NM
KF006	Wildfowl Distribution Survey, r. inny	10/12/2021	13:08	Kingfisher	1	depositing/lowland rivers; flushed from perch at bridge, flying low and rapidly along river	NM
KF007	Wildfowl Distribution Survey,	22/12/2021	11:32	Kingfisher	1	lakes and ponds; flying rapidly along vegetated river channel	NM
KF008	Wildfowl Distribution Survey, r. inny	05/01/2022	11:18	Kingfisher	1	depositing/lowland rivers; flying low and rapidly along river, perching in willow	NM

Table 1-15 Little Egret Wildfowl Distribution Survey Data

Wildfowl Distribution Surveys							
Map Ref.	**Location**	**Date**	**Time**	**Species**	**Number**	**Habitat and activity**	**Surveyor**
ET001		12/10/2021	10:18	Little Egret	1	lakes and ponds and scrub; flying over scrubby lake shore	NM
ET002		12/10/2021	15:41	Little Egret	1	lakes and ponds and semi-natural grassland; flying over lake fringes	NM
ET003	L. Iron	22/11/2021	16:06	Little Egret	1	lakes and ponds; flying across lake	NM
ET004		10/12/2021	08:35	Little Egret	2	scrub; flying over bog and scrubland near to lake	NM
ET005	L. Iron	23/12/2021	15:43	Little Egret	2	lakes and ponds; flying low along lake edge	NM
ET006	L. Sheelin	17/01/2022	08:34	Little Egret	2	scrub, semi-natural grassland and lakes and ponds; perched on scrubby lake shore	NM
ET007		17/01/2022	11:28	Little Egret	1	depositing/lowland rivers and semi-natural grassland; perched on grassy bank of river	NM
ET008		17/01/2022	12:30	Little Egret	1	improved agricultural grassland; grazing on farmland	NM
ET009	BN2	17/01/2022	16:08	Little Egret	2	cutover bog; flying low across bog wetland + landing and foraging sporadically at different locations on wetland, consistently in area for over an hour	NM
ET010	BN2	17/01/2022	16:16	Little Egret	1	cutover bog; flying across bog wetland + landing within	NM
ET011	Derragh Lough	14/02/2022	13:26	Little Egret	1	lakes and ponds; foraging	KB
ET012	Bracklagh Lough	26/02/2022	09:00	Little Egret	2	lakes and ponds; roosting	KB

ET013	Lough Derravaragh north	28/02/2022	13:31	Little Egret	1	lakes and ponds; foraging	KB
ET014	Brackagh Lough	07/03/2022	09:00	Little Egret	2	lakes and ponds; roosting	KB
ET015	Derragh Lough	07/03/2022	10:51	Little Egret	1	lakes and ponds; foraging	KB
ET016	Derragh Lough	31/03/2022	09:32	Little Egret	1	lakes and ponds; foraging	KB

Table 1-16 Merlin Vantage Point Survey Data

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
ML001	VP4	09/12/2021	10:21	Merlin	1	5	5	0	0	0	cutover bog; foraging, adult male	KB
ML002	VP6	15/12/2021	09:31	Merlin	1	6	6	0	0	0	cutover bog; foraging - landed on ground, female	KB
ML003	VP6	15/12/2021	09:42	Merlin	1	8	8	0	0	0	cutover bog and semi-natural grassland; foraging, female	KB
ML004	VP6	15/12/2021	14:01	Merlin	1	6	6	0	0	0	scrub and semi-natural grassland; foraging, male	KB
ML005	VP4	10/03/2022	15:12	Merlin	1	18	18	0	0	0	cutover bog; flying	NS

Table 1-17 Peregrine Falcon Vantage Point Survey Data

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
PE001	VP5	03/01/2022	09:17	Peregrine Falcon	1	12	0	12	0	0	improved agricultural grassland and hedgerows; foraging	KB
PE002	VP3	26/01/2022	15:05	Peregrine Falcon	1	25	25	0	0	0	cutover bog; flying	ZE

Table 1-18 Peregrine Falcon Breeding Raptor Survey Data

Breeding Raptor Surveys								
Map Ref.	BRVP	Date	Time	Species	Number	Habitat and activity	Breeding status	Surveyor
PE001	BRVP6	29/06/2021	17:46	Peregrine Falcon	1	improved agricultural grassland and mixed broadleaved/conifer woodland, soaring/travelling	flyover; non-breeding	PM
PE002	BRVP6	13/07/2021	15:13	Peregrine Falcon	1	highly modified/non-native woodland and bogs, travelling	suitable nesting habitat; possible breeder	TRea

Table 1-19 Peregrine Falcon Incidental Observations Data

Incidental Records							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
PE001	Vantage Point Survey, doon	31/01/2022	14:55	Peregrine Falcon	1	lowland blanket bog and improved agricultural grassland; flying	ZE

Table 1-20 Ruff Wildfowl Distribution Survey Data

Wildfowl Distribution Surveys							
Map Ref.	**Location**	**Date**	**Time**	**Species**	**Number**	**Habitat and activity**	**Surveyor**
RU001	BN2	16/09/2021	14:13	Ruff	2	cutover bog; perched on bare peat at edge of shallow bog pool	NM

Table 1-21 White-tailed Eagle Breeding Raptor Survey Data

Breeding Raptor Surveys								
Map Ref.	BRVP	Date	Time	Species	Number	Habitat and activity	Breeding status	Surveyor
WE001	BRVP2	19/07/2021	14:20	White-tailed Eagle	1	highly modified/non-native woodland and improved grassland, fighting buzzards, buzzards soaring above and diving down, eagle flipped to repel with talons.	flyover; non-breeding	TRea

Table 1-22 White-tailed Eagle Incidental Observation Data

Incidental Records							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
WE001	Wildfowl Distribution Survey,	12/10/2021	16:33	White-Tailed Eagle	1	lakes and ponds, highly modified/non-native woodland and improved agricultural grassland; soaring over lake and adjacent sloping ground - appeared to descend and land within scrub	NM

Table 1-23 Whooper Swan Vantage Point Survey Data

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
WS001	VP4	19/10/2021	08:12	Whooper Swan	7	100	0	100	0	0	cutover bog; flying across bog and calling, descending towards bn2	NM
WS002	VP4	19/10/2021	12:34	Whooper Swan	4	210	0	0	210	0	cutover bog; flying w across bog	NM
WS003	VP6	22/10/2021	09:05	Whooper Swan	7	120	105	15	0	0	cutover bog, scrub and improved agricultural grassland; flying sw across site	NM
WS004	VP6	22/10/2021	08:53	Whooper Swan	2	85	40	45	0	0	cutover bog and depositing/lowland rivers; flying along river and adjacent bog	NM
WS005	VP6	22/10/2021	09:02	Whooper Swan	9	150	0	130	20	0	improved agricultural grassland, hedgerows and semi-natural grassland; flying ne across farmland	NM
WS006	VP6	22/10/2021	10:27	Whooper Swan	8	130	0	0	130	0	cutover bog and improved agricultural grassland; flying and calling to w of site	NM
WS007	VP6	22/10/2021	10:56	Whooper Swan	16	140	0	125	15	0	improved agricultural grassland and bogs; flying ne and calling	NM
WS008	VP6	22/10/2021	10:58	Whooper Swan	3	65	0	65	0	0	cutover bog, improved agricultural grassland and semi-natural grassland; flying n	NM
WS009	VP6	22/10/2021	11:24	Whooper Swan	3	65	0	40	25	0	watercourses and cutover bog; flying ne along river and bog fringes	NM
WS010	VP6	22/10/2021	11:32	Whooper Swan	12	170	0	0	170	0	cutover bog, scrub and improved agricultural grassland; flying w across bog to nw of site	NM
WS011	VP3	23/10/2021	08:22	Whooper Swan	5	180	25	155	0	0	cutover bog, scrub and hedgerows; flying along s boundary of site	NM

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
WS012	VP3	23/10/2021	08:16	Whooper Swan	7	90	0	90	0	0	treelines, improved agricultural grassland and cutover bog; flying n	NM
WS013	VP3	23/10/2021	09:23	Whooper Swan	8	125	0	125	0	0	cutover bog, scrub and improved agricultural grassland; flying s across bog	NM
WS014	VP3	23/10/2021	09:28	Whooper Swan	15	95	25	70	0	0	cutover bog and scrub; flying n across bog	NM
WS015	VP3	23/10/2021	10:25	Whooper Swan	12	95	95	0	0	0	depositing/lowland rivers and cutover bog; flying and calling along river	NM
WS016	VP3	23/10/2021	11:00	Whooper Swan	7	240	210	30	0	0	cutover bog and scrub; flying low across bog	NM
WS017	VP5	03/01/2022	08:24	Whooper Swan	5	8	0	0	8	0	improved agricultural grassland; travelling	KB
WS018	VP5	03/01/2022	08:31	Whooper Swan	5	30	0	0	30	0	improved agricultural grassland; travelling	KB
WS019	VP5	03/01/2022	08:32	Whooper Swan	9	10	0	0	10	0	improved agricultural grassland; travelling	KB
WS020	VP5	03/01/2022	08:46	Whooper Swan	10	50	0	0	50	0	improved agricultural grassland; travelling	KB
WS021	VP5	03/01/2022	09:05	Whooper Swan	3	70	0	20	50	0	improved agricultural grassland; travelling	KB
WS022	VP5	03/01/2022	09:09	Whooper Swan	2	25	0	0	25	0	improved agricultural grassland; travelling	KB
WS023	VP5	03/01/2022	09:12	Whooper Swan	2	20	0	0	20	0	improved agricultural grassland; travelling	KB
WS024	VP4	27/01/2022	17:54	Whooper Swan	8	13	0	13	0	0	cutover bog and conifer plantation; flying	ZE
WS025	VP5	08/02/2022	09:08	Whooper Swan	2	30	0	30	0	0	improved agricultural grassland; flying	NS

Table 1-24 Whooper Swan Wildfowl Distribution Survey Data

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
WS001	L. Iron	30/09/2021	18:30	Whooper Swan	3	lakes and ponds; swimming on lake	NM
WS002	L. Iron	11/10/2021	18:00	Whooper Swan	3	improved agricultural grassland and scrub; flying in from s and descending onto lake, roost	NM
WS003	L. Iron	25/10/2021	17:20	Whooper Swan	26	lakes and ponds; swimming on lake	NM
WS004	L. Iron	25/10/2021	17:47	Whooper Swan	5	lakes and ponds, highly modified/non-native woodland and improved agricultural grassland; flying onto lake from w/sw, roost	NM
WS005	L. Iron	25/10/2021	18:29	Whooper Swan	9	semi-natural grassland and reed and large sedge swamps; flying in and landing on lake - coming from n, roost	NM
WS008		26/10/2021	10:21	Whooper Swan	18	lakes and ponds; swimming on lake, some individuals grazing on banks	NM
WS007		26/10/2021	09:40	Whooper Swan	49	improved agricultural grassland; foraging on grassy edge of lake	NM
WS009		26/10/2021	14:58	Whooper Swan	11	lakes and ponds and highly modified/non-native woodland; flying sw along lake shore	NM
WS006		26/10/2021	09:46	Whooper Swan	16	lakes and ponds; flying e across lake	NM
WS010	Derragh Lough	09/11/2021	11:34	Whooper Swan	25	lakes and ponds; swimming on lake	NM
WS012	L. Iron	09/11/2021	16:24	Whooper Swan	21	lakes and ponds; swimming on lake, roost	NM
WS011	Lough Iron	09/11/2021	16:53	Whooper Swan	7	improved agricultural grassland, highly modified/non-native woodland and lakes and ponds; commuting towards and landing on lake - arriving in group from farmland to w	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
WS015	L. Iron	22/11/2021	16:00	Whooper Swan	24	lakes and ponds; swimming on lake, roost	NM
WS013	Lough Iron	22/11/2021	16:30	Whooper Swan	5	semi-natural grassland, scrub and lakes and ponds; flying in from s and landing on lake	NM
WS014	Lough Iron	22/11/2021	16:46	Whooper Swan	7	improved agricultural grassland and lakes and ponds; flying from farmland to sw of lake, roost	NM
WS016		23/11/2021	10:47	Whooper Swan	7	improved agricultural grassland and highly modified/non-native woodland; flying sw across farmland	NM
WS017		10/12/2021	14:10	Whooper Swan	4	lakes and ponds and semi-natural grassland; feeding on reedy grassland adjacent to lake	NM
WS019	R. Inny	22/12/2021	10:16	Whooper Swan	2	depositing/lowland rivers; swimming on river	NM
WS021	L. Bane	22/12/2021	15:45	Whooper Swan	39	lakes and ponds; swimming and foraging on lake, calling	NM
WS018		22/12/2021	10:10	Whooper Swan	8	lakes and ponds; swimming and feeding within reedy lake margins	NM
WS020		22/12/2021	10:34	Whooper Swan	16	cutover bog and scrub; flying sw across bog	NM
WS024	L. Iron	23/12/2021	15:32	Whooper Swan	16	lakes and ponds; swimming on lake, roost	NM
WS022	Lough Iron	23/12/2021	16:16	Whooper Swan	5	semi-natural grassland and scrub; flying in from fields to n	NM
WS023	Lough Iron	23/12/2021	16:35	Whooper Swan	16	semi-natural grassland, reed and large sedge swamps and scrub; flying in from fields and wetland to the n, calling profusely, roost	NM
WS025	L. Iron	04/01/2022	15:40	Whooper Swan	12	lakes and ponds; swimming on lake	NM
WS026	L. Bane	05/01/2022	09:02	Whooper Swan	16	lakes and ponds; swimming on lake	NM
WS029	L. Sheelin	17/01/2022	08:47	Whooper Swan	6	lakes and ponds; swimming on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
WS028	R. Inny	17/01/2022	14:00	Whooper Swan	7	improved agricultural grassland; grazing on grassland adjacent to river	NM
WS027	L. Sheelin	17/01/2022	09:55	Whooper Swan	6	lakes and ponds; flying low across lake	NM
WS030	L. Iron	18/01/2022	15:43	Whooper Swan	45	lakes and ponds, reed and large sedge swamps and scrub; swimming on lake and within swollen edges	NM
WS031	Lough Iron	18/01/2022	16:56	Whooper Swan	7	improved agricultural grassland, highly modified/non-native woodland and lakes and ponds; flying in from lands to sw and landing on lake - calling. numbers unclear due to poor visibility, roost	NM
WS032	Piercefield	15/02/2022	09:40	Whooper Swan	77	improved agricultural grassland; foraging	KB
WS033	Piercefield	15/02/2022	10:10	Whooper Swan	1	wet grassland; foraging	KB
WS034	Lough Iron - piercefield fields	28/02/2022	15:20	Whooper Swan	31	improved agricultural grassland; foraging	KB
WS035	Lough Iron - piercefield fields	28/02/2022	15:30	Whooper Swan	2	wet grassland; foraging	KB
WS036	Flooded bog on site	08/03/2022	15:24	Whooper Swan	4	cutover bog; foraging	KB

Table 1-25 Coot Vantage Point Survey Data

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
CO001	VP6	31/01/2022	15:37	Coot	1	111	0	0	111	0	improved agricultural grassland and conifer plantation; flying	ZE
CO002	VP6	31/01/2022	16:19	Coot	1	121	0	0	121	0	cutover bog and conifer plantation; flying	ZE
CO003	VP6	17/02/2022	07:30	Coot	2	30	0	30	0	0	lowland blanket bog; flying west	NS
CO004	VP6	17/02/2022	11:56	Coot	1	25	0	25	0	0	lowland blanket bog and improved agricultural grassland; flying	NS

Table 1-26 Coot Waterfowl Distribution Survey Data

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
CO001	Derragh Lough	16/09/2021	12:16	Coot	96	mesotrophic lakes; swimming on lake - in groups and frequently within reed boundaries + diving, throughout lake	NM
CO002		16/09/2021	17:00	Coot	5	mesotrophic lakes; swimming on lake	NM
CO003	L. Kinale	16/09/2021	10:56	Coot	9	mesotrophic lakes; swimming on lake	NM
CO004	L. Kinale	16/09/2021	11:05	Coot	13	mesotrophic lakes; swimming on lake	NM
CO005	L. Sheelin	16/09/2021	10:03	Coot	16	mesotrophic lakes; swimming and diving on lake near reed beds - forming group with lg	NM
CO006	L. D'varagh	17/09/2021	14:40	Coot	25	mesotrophic lakes; swimming on lake - n section	NM
CO007	Bracklagh Lough	17/09/2021	12:30	Coot	10	mesotrophic lakes; swimming on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
CO008	L. D'varagh	17/09/2021	12:59	Coot	9	mesotrophic lakes; swimming on lake	NM
CO009	L. D'varagh	17/09/2021	13:06	Coot	3	mesotrophic lakes; swimming on lake	NM
CO010	L. D'varagh	17/09/2021	13:10	Coot	13	mesotrophic lakes; swimming on lake	NM
CO011	L. D'varagh	17/09/2021	14:01	Coot	3	mesotrophic lakes; swimming on lake	NM
CO012	L. D'varagh	17/09/2021	13:08	Coot	6	mesotrophic lakes; swimming in reedy fringes	NM
CO013	L. Iron	17/09/2021	19:00	Coot	78	mesotrophic lakes; swimming and foraging on lake	NM
CO014	L. D'varagh	17/09/2021	13:05	Coot	7	mesotrophic lakes; swimming and diving on lake	NM
CO015	L. D'varagh	17/09/2021	13:49	Coot	8	mesotrophic lakes; swimming and diving on lake	NM
CO016	L. D'varagh	17/09/2021	16:16	Coot	9	mesotrophic lakes; swimming and diving along lake fringes	NM
CO017	L. D'varagh	17/09/2021	16:07	Coot	18	mesotrophic lakes; swimming and calling on lake and within reeds	NM
CO018	L. D'varagh	17/09/2021	15:45	Coot	37	mesotrophic lakes; swimming and calling on lake (+ foraging within reeds)	NM
CO019	L. D'varagh	17/09/2021	13:06	Coot	8	mesotrophic lakes; swimming along edge of lake	NM
CO020	Bracklagh Lough	29/09/2021	09:25	Coot	16	mesotrophic lakes; swimming on lake	NM
CO021	L. D'varagh	29/09/2021	16:15	Coot	31	mesotrophic lakes; swimming on lake	NM
CO022	L. Sheelin	29/09/2021	08:07	Coot	6	lakes and ponds; swimming on lake	NM
CO023	L. Sheelin	29/09/2021	08:45	Coot	6	lakes and ponds; swimming on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
CO024	Derragh Lough	29/09/2021	10:53	Coot	180	mesotrophic lakes; swimming and foraging on lake, approx. count	NM
CO025	L. D'varagh	29/09/2021	16:00	Coot	47	mesotrophic lakes; swimming and foraging in and around reed islets	NM
CO026	L. Kinale	29/09/2021	12:15	Coot	16	mesotrophic lakes; swimming along lake edge	NM
CO027	L. D'varagh	29/09/2021	16:15	Coot	58	mesotrophic lakes; swimming along lake edge	NM
CO028	L. D'varagh	12/10/2021	16:07	Coot	12	lakes and ponds; swimming within reedy islets	NM
CO029	L. Kinale	12/10/2021	12:05	Coot	19	lakes and ponds; swimming on lake	NM
CO030	L. D'varagh	12/10/2021	16:02	Coot	53	lakes and ponds; swimming on lake	NM
CO031	L. Sheelin	12/10/2021	08:18	Coot	287	lakes and ponds; swimming in large group in open water	NM
CO032	Derragh Lough	12/10/2021	11:10	Coot	91	lakes and ponds; swimming and diving on lake	NM
CO033	L. D'varagh	12/10/2021	15:37	Coot	13	lakes and ponds; swimming and diving on lake	NM
CO034	L. D'varagh	12/10/2021	16:31	Coot	14	lakes and ponds; swimming and diving on lake	NM
CO035	L. D'varagh	12/10/2021	16:14	Coot	10	lakes and ponds; swimming and calling within complex of reedy islets	NM
CO036	L. Sheelin	26/10/2021	15:04	Coot	265	lakes and ponds; swimming on lake in large dense flock	NM
CO037	L. Sheelin	26/10/2021	15:00	Coot	129	lakes and ponds; swimming on lake in dense flock	NM
CO038	Derragh Lough	26/10/2021	11:24	Coot	58	lakes and ponds; swimming on lake and foraging around fringes	NM
CO039		26/10/2021	09:12	Coot	6	lakes and ponds; swimming on lake	NM
CO040		26/10/2021	09:12	Coot	15	lakes and ponds; swimming on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
CO041		26/10/2021	09:34	Coot	156	lakes and ponds; swimming on lake	NM
CO042		26/10/2021	09:38	Coot	24	lakes and ponds; swimming on lake	NM
CO043		26/10/2021	10:22	Coot	9	lakes and ponds; swimming on lake	NM
CO044	L. Sheelin	26/10/2021	14:06	Coot	6	lakes and ponds; swimming on lake	NM
CO045	L. Sheelin	26/10/2021	15:00	Coot	34	lakes and ponds; swimming on lake	NM
CO046		26/10/2021	09:06	Coot	39	lakes and ponds; swimming and calling on lake	NM
CO047		26/10/2021	09:21	Coot	2	lakes and ponds; flying w across lake	NM
CO048	L. D'varagh	26/10/2021	08:36	Coot	5	lakes and ponds; calling within reedy fringes of lake	NM
CO049		26/10/2021	10:18	Coot	6	reed and large sedge swamps and dystrophic lakes; calling within reeds	NM
CO050	L. D'varagh	08/11/2021	12:26	Coot	6	lakes and ponds; swimming on lake	NM
CO051	L. Sheelin	09/11/2021	09:28	Coot	87	lakes and ponds; swimming on lake - large group in open water	NM
CO052	L. Sheelin	09/11/2021	10:02	Coot	8	lakes and ponds; swimming on lake	NM
CO053	Derragh Lough	09/11/2021	11:34	Coot	46	lakes and ponds; swimming and diving on lake	NM
CO054	L. Iron	22/11/2021	16:02	Coot	56	lakes and ponds; swimming on lake	NM
CO055	Derragh Lough	23/11/2021	11:10	Coot	56	lakes and ponds; swimming on lake + calling within reedy margins	NM
CO056	L. Sheelin	23/11/2021	09:13	Coot	70	lakes and ponds; swimming on lake - large 'raft' in open water	NM
CO057	L. D'varagh	23/11/2021	15:40	Coot	11	lakes and ponds; swimming on lake	NM
CO058	L. D'varagh	23/11/2021	15:41	Coot	26	lakes and ponds; swimming on lake	NM
CO059	L. D'varagh	23/11/2021	15:45	Coot	149	lakes and ponds; swimming on lake	NM
CO060		23/11/2021	15:45	Coot	7	lakes and ponds; swimming on lake	NM
CO061	L. D'varagh	23/11/2021	15:46	Coot	61	lakes and ponds; swimming on lake	NM
CO062	L. D'varagh	23/11/2021	15:49	Coot	23	lakes and ponds; swimming on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
CO063	L. Sheelin	23/11/2021	08:46	Coot	6	lakes and ponds; swimming on lake	NM
CO064	L. Sheelin	23/11/2021	08:53	Coot	4	lakes and ponds; swimming and diving on lake	NM
CO065	Derragh Lough	10/12/2021	10:48	Coot	37	lakes and ponds; swimming on lake and around reedy margins	NM
CO066	L. Sheelin	10/12/2021	09:05	Coot	13	lakes and ponds; swimming on lake	NM
CO067	L. Sheelin	10/12/2021	08:40	Coot	54	lakes and ponds; swimming in large raft on lake	NM
CO068	L. Sheelin	22/12/2021	13:40	Coot	890	lakes and ponds; swimming on lake - 3 large rafts of birds floating in open water	NM
CO069	L. D'varagh	22/12/2021	08:34	Coot	13	lakes and ponds; swimming on lake	NM
CO070	L. D'varagh	22/12/2021	08:40	Coot	64	lakes and ponds; swimming on lake	NM
CO071	L. D'varagh	22/12/2021	08:50	Coot	14	lakes and ponds; swimming on lake	NM
CO072	L. D'varagh	22/12/2021	08:43	Coot	5	lakes and ponds; swimming on lake	NM
CO073	L. Kinale	22/12/2021	11:27	Coot	6	lakes and ponds; swimming on lake	NM
CO074	L. Sheelin	22/12/2021	13:53	Coot	170	lakes and ponds; swimming on lake	NM
CO075	L. Kinale	22/12/2021	12:24	Coot	43	lakes and ponds; swimming and diving on lake	NM
CO076	Deragh Lough	22/12/2021	11:01	Coot	68	lakes and ponds; swimming and calling on lake	NM
CO077	L. Kinale	22/12/2021	12:22	Coot	5	lakes and ponds; swimming and calling on lake	NM
CO078	L. Kinale	22/12/2021	11:23	Coot	4	lakes and ponds; calling within reedy margins	NM
CO079		22/12/2021	09:30	Coot	46	lakes and ponds; calling and swimming on lake	NM
CO080	L. Iron	23/12/2021	15:30	Coot	36	lakes and ponds; swimming on lake	NM
CO081	L. D'varagh	04/01/2022	09:10	Coot	5	lakes and ponds; swimming on lake	NM
CO082	L. D'varagh	04/01/2022	10:00	Coot	6	lakes and ponds; swimming on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
CO083	L. D'varagh	04/01/2022	13:30	Coot	5	lakes and ponds; swimming on lake	NM
CO084	L. D'varagh	04/01/2022	14:45	Coot	11	lakes and ponds; swimming and calling on lake	NM
CO085	L. D'varagh	04/01/2022	14:16	Coot	6	lakes and ponds; calling from lake edge	NM
CO086	L. D'varagh	05/01/2022	13:20	Coot	77	lakes and ponds; swimming on lake	NM
CO087	Derragh Lough	05/01/2022	10:34	Coot	80	lakes and ponds; swimming and calling on lake	NM
CO088	R. Inny	17/01/2022	11:28	Coot	7	depositing/lowland rivers; swimming on river	NM
CO089	L. Kinale N	17/01/2022	10:40	Coot	146	lakes and ponds; swimming on lake	NM
CO090	Derragh Lough	17/01/2022	11:20	Coot	81	lakes and ponds; swimming on lake	NM
CO091	L. Kinale S	17/01/2022	11:46	Coot	9	lakes and ponds; swimming on lake	NM
CO092	L. D'varagh	17/01/2022	13:05	Coot	16	lakes and ponds; swimming on lake	NM
CO093	L. D'varagh	17/01/2022	13:08	Coot	16	lakes and ponds; swimming on lake	NM
CO094	L. Sheelin	17/01/2022	08:32	Coot	4	lakes and ponds; swimming on lake	NM
CO095	L. Sheelin	17/01/2022	08:35	Coot	13	lakes and ponds; swimming on lake	NM
CO096	L. Sheelin	17/01/2022	08:38	Coot	6	lakes and ponds; swimming on lake	NM
CO097	L. Sheelin	17/01/2022	09:30	Coot	37	lakes and ponds; swimming on lake	NM
CO098	L. Sheelin	17/01/2022	08:49	Coot	340	lakes and ponds; swimming on lake	NM
CO099	L. Sheelin	17/01/2022	08:46	Coot	130	lakes and ponds; swimming on lake	NM
CO100	L. D'varagh	17/01/2022	13:10	Coot	196	lakes and ponds; swimming in large group within sw corner of lake	NM
CO101	L. D'varagh	17/01/2022	13:04	Coot	8	lakes and ponds; swimming and diving on lake	NM
CO102	L. D'varagh	17/01/2022	13:12	Coot	5	lakes and ponds; swimming and calling on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
CO103	L. Sheelin	17/01/2022	08:55	Coot	15	lakes and ponds; swimming and calling on lake	NM
CO104	L. D'varagh	17/01/2022	13:05	Coot	7	lakes and ponds; swimming and calling close to lake fringes	NM
CO105	L. D'varagh	17/01/2022	13:52	Coot	32	lakes and ponds; swimming all over lake	NM
CO106	L. Sheelin	17/01/2022	08:52	Coot	3	lakes and ponds; calling within reedy margins of lake	NM
CO107	L. D'varagh	18/01/2022	13:03	Coot	9	lakes and ponds; swimming on lake	NM
CO108	Lough Sheelin west	14/02/2022	11:45	Coot	8	lakes and ponds; foraging	KB
CO109	Lough Kinale	14/02/2022	12:50	Coot	153	lakes and ponds; foraging	KB
CO110	Derragh Lough	14/02/2022	13:26	Coot	27	lakes and ponds; foraging	KB
CO111	Lough Kinale south	14/02/2022	13:40	Coot	7	lakes and ponds; foraging	KB
CO112	Lough Iron	15/02/2022	09:40	Coot	70	lakes and ponds; foraging, estimate - birds difficult to id, vp very far away from lake - no access to get closer to the lake	KB
CO113	lake off Lough Derravaragh	15/02/2022	11:47	Coot	9	lakes and ponds; foraging	KB
CO114	Lough Derravaragh south	15/02/2022	12:20	Coot	347	lakes and ponds; foraging	KB
CO115	Lough Derravaragh north	15/02/2022	13:13	Coot	13	lakes and ponds; foraging	KB
CO116	Bracklagh Lough	26/02/2022	09:00	Coot	3	lakes and ponds; foraging	KB
CO117	Lough Sheelin west	26/02/2022	09:20	Coot	151	lakes and ponds; foraging	KB

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
CO118	Lough Sheelin centre	26/02/2022	09:53	Coot	1	lakes and ponds; foraging	KB
CO119	Lough Kinale	26/02/2022	10:26	Coot	266	lakes and ponds; foraging	KB
CO120	Derragh Lough	26/02/2022	11:04	Coot	29	lakes and ponds; foraging	KB
CO121	Lough Kinale south	26/02/2022	11:28	Coot	1	lakes and ponds; foraging	KB
CO122	Robinstown flooded fields	26/02/2022	13:46	Coot	4	wet grassland; foraging	KB
CO123	Lough Derravaragh south	28/02/2022	11:45	Coot	272	lakes and ponds; foraging	KB
CO124	lake off Lough Derravaragh	28/02/2022	12:28	Coot	16	lakes and ponds; foraging	KB
CO125	River Inny and lake off Lough Derravaragh	28/02/2022	13:05	Coot	10	lakes and ponds and watercourses; foraging	KB
CO126	Lough Derravaragh north	28/02/2022	13:31	Coot	10	lakes and ponds; foraging	KB
CO127	Lough Sheelin west	07/03/2022	09:16	Coot	1	lakes and ponds; foraging	KB
CO128	Lough Kinale	07/03/2022	10:20	Coot	53	lakes and ponds; foraging	KB
CO129	Derragh Lough	07/03/2022	10:51	Coot	22	lakes and ponds; foraging	KB
CO130	Lough Kinale south	07/03/2022	11:08	Coot	13	lakes and ponds; foraging	KB
CO131	Lough Derravaragh south	08/03/2022	12:01	Coot	137	lakes and ponds; foraging	KB
CO132	Lake off Lough Derravaragh	08/03/2022	12:37	Coot	17	lakes and ponds; foraging	KB

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
CO133	River Inny and lake off Loughh Derravaragh	08/03/2022	13:10	Coot	14	lakes and ponds and watercourses; foraging	KB
CO134	Lough Derravaragh north	08/03/2022	13:32	Coot	7	lakes and ponds; foraging	KB
CO135	Lough Kinale	31/03/2022	09:07	Coot	7	lakes and ponds; foraging	KB
CO136	Derragh Lough	31/03/2022	09:32	Coot	22	lakes and ponds; foraging	KB
CO137	Lough Kinale south	31/03/2022	09:50	Coot	3	lakes and ponds; foraging	KB
CO138	Robinstown flooded fields	31/03/2022	13:16	Coot	5	lakes and ponds; foraging	KB
CO139	Lough Derravaragh north	31/03/2022	13:41	Coot	16	lakes and ponds; foraging	KB
CO140	River Inny and lake off Loughh Derravaragh	31/03/2022	14:12	Coot	1	lakes and ponds; foraging	KB
CO141	Lake off Lough Derravaragh	31/03/2022	15:00	Coot	5	lakes and ponds; foraging	KB
CO142	Lough Derravaragh south	31/03/2022	15:27	Coot	34	lakes and ponds; foraging	KB

Table 1-27 Shoveler Wildfowl Distribution Survey Data

Wildfowl Distribution Surveys							
Map Ref.	**Location**	**Date**	**Time**	**Species**	**Number**	**Habitat and activity**	**Surveyor**
SV001	Derragh Lough	16/09/2021	12:18	Shoveler	12	mesotrophic lakes; foraging on lake + a few resting	NM
SV002	L. Iron	17/09/2021	18:56	Shoveler	13	mesotrophic lakes; swimming and foraging on lake	NM
SV003	Derragh Lough	29/09/2021	11:04	Shoveler	6	mesotrophic lakes; swimming and foraging on lake	NM
SV004	L. Iron	25/10/2021	17:40	Shoveler	36	lakes and ponds; swimming and dabbling on lake	NM
SV005		26/10/2021	10:21	Shoveler	5	lakes and ponds; swimming on lake	NM
SV006	L. Iron	09/11/2021	16:32	Shoveler	14	lakes and ponds; swimming on lake	NM
SV007	L. Iron	22/11/2021	16:05	Shoveler	27	lakes and ponds; swimming on lake	NM
SV008	L. Sheelin	23/11/2021	08:46	Shoveler	5	lakes and ponds; flying low across lake	NM
SV009	Derragh lough	10/12/2021	10:52	Shoveler	6	lakes and ponds; swimming and feeding on lake	NM
SV010	L. Iron	23/12/2021	15:35	Shoveler	19	lakes and ponds; swimming on lake	NM
SV011	L. Sheelin	17/01/2022	08:54	Shoveler	7	lakes and ponds; flying low across lake	NM

Table 1-28 Teal Winter Walkover Survey Data

Winter Walkover Surveys						
Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
T001	27/01/2022	16:07	Teal	2	cutover bog; fly, m and f pair (wintering)	AOD
T002	28/01/2022	16:55	Teal	22	lakes and ponds; foraging (wintering)	AOD
T003	22/02/2022	17:11	Teal	2	cutover bog; roosting (wintering)	AOD

Table 1-29 Teal Wildfowl Distribution Survey Data

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
T001	BN2	16/09/2021	14:10	Teal	31	cutover bog; roosting in shallow water and on bare peat with flooded area of bog	NM
T004	L. Iron	17/09/2021	19:28	Teal	14	reed and large sedge swamps and mesotrophic lakes; wading within reedy pool at se end of lake	NM
T002	L. D'varagh	17/09/2021	13:37	Teal	3	mesotrophic lakes and reed and large sedge swamps; wading within reedbeds at edge of lake	NM
T003	L. Iron	17/09/2021	19:04	Teal	94	mesotrophic lakes; swimming and foraging on lake	NM
T005		29/09/2021	12:36	Teal	145	raised bog, immature woodland and mesotrophic lakes; swimming in large frantic flock over s of l. kinale	NM
T006		29/09/2021	12:40	Teal	23	mesotrophic lakes and mixed conifer woodland; flying s across woodland and lake fringes	NM
T008	L. Sheelin	29/09/2021	08:29	Teal	16	lakes and ponds; flying ne across lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
T007		29/09/2021	12:49	Teal	33	mixed broadleaved woodland, raised bog and mesotrophic lakes; flying in wide random circles	NM
T009	L. Iron	30/09/2021	18:30	Teal	57	lakes and ponds; swimming on lake	NM
T010	L. Sheelin	12/10/2021	08:12	Teal	6	lakes and ponds; flying low across lake	NM
T011	L. Iron	25/10/2021	17:48	Teal	134	lakes and ponds; swimming on lake and around wetland fringes	NM
T012		26/10/2021	14:54	Teal	16	lakes and ponds; calling within reedy fringes	NM
T013	L. Sheelin	09/11/2021	10:01	Teal	16	lakes and ponds; swimming on lake	NM
T014		09/11/2021	11:54	Teal	6	improved agricultural grassland; swimming and feeding on pond within field	NM
T015	L. Iron	22/11/2021	16:04	Teal	95	lakes and ponds; swimming on lake	NM
T016	L Kinale	23/11/2021	10:56	Teal	26	lakes and ponds; calling within reedy & flooded margins	NM
T017	L. Bane	10/12/2021	15:57	Teal	34	lakes and ponds and semi-natural grassland; swimming on lake and foraging on wet boggy margins	NM
T020		22/12/2021	14:24	Teal	4	lakes and ponds; swimming on pool within field hollow	NM
T018	Deragh Lough	22/12/2021	11:04	Teal	13	lakes and ponds; swimming on lake	NM
T019	L. Sheelin	22/12/2021	13:45	Teal	7	lakes and ponds; swimming on lake	NM
T021	L. Bane	22/12/2021	15:45	Teal	26	lakes and ponds; swimming and calling on lake	NM
T022		22/12/2021	15:57	Teal	23	bogs and scrub; flying in wide circles over lake area	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
T023	L. Iron	23/12/2021	15:37	Teal	52	lakes and ponds; swimming and calling on lake	NM
T024	L. Iron	04/01/2022	15:40	Teal	240	lakes and ponds; swimming and calling on lake and within reedy fringes	NM
T025	L. D'varagh	04/01/2022	09:10	Teal	12	lakes and ponds; calling within flooded reedy margins of lake	NM
T026	L. D'varagh	04/01/2022	12:40	Teal	15	semi-natural grassland, highly modified/non-native woodland and lakes and ponds; calling within flooded birch / willow woodland along lake perimeter	NM
T027	L. Bane	05/01/2022	09:06	Teal	6	lakes and ponds; swimming on lake	NM
T030	L. Bane	17/01/2022	15:50	Teal	28	lakes and ponds, semi-natural grassland and transition mire and quaking bog; swimming on lake and within saturated margins	NM
T028	L. Kinale N	17/01/2022	10:40	Teal	67	lakes and ponds; swimming on lake	NM
T033	L. Sheelin	17/01/2022	08:58	Teal	13	lakes and ponds; swimming and calling within reedy margins	NM
T029		17/01/2022	13:54	Teal	16	improved agricultural grassland and reed and large sedge swamps; swimming and calling on flooding adjacent to lake	NM
T032	L. Sheelin	17/01/2022	08:50	Teal	16	lakes and ponds; flying across lake	NM
T031		17/01/2022	13:13	Teal	7	reed and large sedge swamps, scrub and lakes and ponds; bursting from wetland surrounding lake, flying	NM
T034	L. Iron	18/01/2022	16:00	Teal	45	lakes and ponds; swimming on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
T035		18/01/2022	10:33	Teal	4	turloughs, lakes and ponds and improved agricultural grassland; calling within flooded reeds	NM
T036	Robinstown flooded fields	14/02/2022	14:50	Teal	12	wet grassland; foraging	KB
T038	Lough Bane	26/02/2022	12:50	Teal	4	lakes and ponds; roosting	KB
T037	Derragh Lough	26/02/2022	11:04	Teal	4	lakes and ponds; foraging	KB
T039	Robinstown flooded fields	07/03/2022	12:50	Teal	5	wet grassland; foraging	KB
T040	Robinstown pond	31/03/2022	13:10	Teal	12	lakes and ponds; foraging	KB
T041	Lough Derravaragh north	31/03/2022	13:41	Teal	6	lakes and ponds; foraging	KB

Table 1-30 Tufted Duck Wildfowl Distribution Survey Data

Wildfowl Distribution Surveys							
Map Ref.	**Location**	**Date**	**Time**	**Species**	**Number**	**Habitat and activity**	**Surveyor**
TU001	L. Kinale	16/09/2021	10:52	Tufted Duck	2	mesotrophic lakes; swimming on lake	NM
TU002	Bracklagh Lough	29/09/2021	09:26	Tufted Duck	57	mesotrophic lakes; swimming and diving on lake	NM
TU003	L. Kinale	29/09/2021	10:12	Tufted Duck	6	mesotrophic lakes; swimming and diving on lake	NM
TU004	L. Sheelin	29/09/2021	08:43	Tufted Duck	6	lakes and ponds; swimming and diving on lake	NM
TU005	Bracklagh Lough	12/10/2021	08:55	Tufted Duck	6	lakes and ponds; swimming on lake	NM
TU006	L. Sheelin	12/10/2021	08:07	Tufted Duck	4	lakes and ponds; swimming on lake	NM
TU007		26/10/2021	15:12	Tufted Duck	5	lakes and ponds; swimming on lake	NM
TU008	Bracklagh Lough	28/10/2021	16:18	Tufted Duck	14	lakes and ponds; swimming and diving on lake	NM
TU010	L. Sheelin	23/11/2021	09:00	Tufted Duck	7	lakes and ponds; swimming and diving on lake	NM
TU009	L. Kinale	23/11/2021	09:55	Tufted Duck	3	lakes and ponds; diving on lake	NM
TU011	Bracklagh Lough	10/12/2021	09:26	Tufted Duck	7	lakes and ponds; swimming on lake	NM
TU013	Deragh Lough	22/12/2021	11:02	Tufted Duck	6	lakes and ponds; swimming on lake	NM
TU016	L. Sheelin	22/12/2021	13:47	Tufted Duck	12	lakes and ponds; swimming on lake	NM
TU012	L. D'varagh	22/12/2021	08:32	Tufted Duck	10	lakes and ponds; swimming and diving on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
TU014	Bracklagh Lough	22/12/2021	12:03	Tufted Duck	9	lakes and ponds; swimming and diving on lake	NM
TU015	L. Sheelin	22/12/2021	13:40	Tufted Duck	5	lakes and ponds; swimming and diving on lake	NM
TU017	L. D'varagh	04/01/2022	13:34	Tufted Duck	2	lakes and ponds; swimming and diving on lake	NM
TU018	L. Sheelin	17/01/2022	09:46	Tufted Duck	38	lakes and ponds; swimming on lake	NM
TU020	L. Sheelin	17/01/2022	09:49	Tufted Duck	7	lakes and ponds; swimming on lake	NM
TU022	L. Sheelin	17/01/2022	08:37	Tufted Duck	13	lakes and ponds; swimming on lake	NM
TU023	L. Sheelin	17/01/2022	08:48	Tufted Duck	7	lakes and ponds; swimming on lake	NM
TU024	L. Sheelin	17/01/2022	08:46	Tufted Duck	19	lakes and ponds; swimming on lake	NM
TU025	L. Sheelin	17/01/2022	08:47	Tufted Duck	78	lakes and ponds; swimming on lake	NM
TU026	L. Sheelin	17/01/2022	08:47	Tufted Duck	190	lakes and ponds; swimming on lake	NM
TU027	L. Sheelin	17/01/2022	09:25	Tufted Duck	49	lakes and ponds; swimming on lake	NM
TU021	L. Kinale N	17/01/2022	10:40	Tufted Duck	36	lakes and ponds; swimming and diving on lake	NM
TU019	L. Sheelin	17/01/2022	09:57	Tufted Duck	16	lakes and ponds; flying across sw of lake	NM
TU028	Bracklagh Lough	18/01/2022	10:00	Tufted Duck	16	lakes and ponds; swimming on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
TU029	Lough Sheelin west	14/02/2022	11:45	Tufted Duck	183	lakes and ponds; foraging	KB
TU030	Bracklagh Lough	14/02/2022	12:20	Tufted Duck	10	lakes and ponds; foraging	KB
TU031	Lough Kinale	14/02/2022	12:50	Tufted Duck	81	lakes and ponds; foraging	KB
TU032	Robinstown pond	14/02/2022	14:32	Tufted Duck	2	lakes and ponds; foraging	KB
TU033	Lough Iron	15/02/2022	09:40	Tufted Duck	20	lakes and ponds; foraging, estimate - birds difficult to id, vp very far away from lake - no access to get closer to the lake	
TU034	Lough Derravaragh south	15/02/2022	12:20	Tufted Duck	174	lakes and ponds; foraging	KB
TU035	Bracklagh Lough	26/02/2022	09:00	Tufted Duck	11	lakes and ponds; foraging	KB
TU036	Lough Sheelin west	26/02/2022	09:20	Tufted Duck	74	lakes and ponds; foraging	KB
TU037	Lough Sheelin centre	26/02/2022	09:53	Tufted Duck	76	lakes and ponds; foraging	KB
TU038	Lough Kinale	26/02/2022	10:26	Tufted Duck	98	lakes and ponds; foraging	KB
TU039	Derragh Lough	26/02/2022	11:04	Tufted Duck	7	lakes and ponds; foraging	KB

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
TU040	Lough Derravaragh south	28/02/2022	11:45	Tufted Duck	96	lakes and ponds; foraging	KB
TU041	Lough Derravaragh north	28/02/2022	13:31	Tufted Duck	7	lakes and ponds; foraging	KB
TU042	Brackagh Lough	07/03/2022	09:00	Tufted Duck	43	lakes and ponds; foraging	KB
TU043	Lough Sheelin west	07/03/2022	09:16	Tufted Duck	8	lakes and ponds; foraging	KB
TU044	Lough Kinale	07/03/2022	10:20	Tufted Duck	33	lakes and ponds; foraging	KB
TU045	Lough Derravaragh south	08/03/2022	12:01	Tufted Duck	49	lakes and ponds; foraging	KB
TU046	Brackagh Lough	31/03/2022	08:00	Tufted Duck	23	lakes and ponds; foraging	KB
TU047	Lough Sheelin west	31/03/2022	08:20	Tufted Duck	6	lakes and ponds; foraging	KB
TU048	Lough Kinale	31/03/2022	09:07	Tufted Duck	62	lakes and ponds; foraging	KB

Table 1-31 Wigeon Winter Walkover Survey Data

Winter Walkover Surveys						
Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
WN001	28/01/2022	16:55	Wigeon	8	lakes and ponds; foraging (wintering)	AOD

Table 1-32 Wigeon Wildfowl Distribution Survey Data

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
WN001	Derragh Lough	16/09/2021	12:18	Wigeon	7	mesotrophic lakes; swimming on lake	NM
WN004		29/09/2021	12:36	Wigeon	243	mesotrophic lakes and immature woodland; swirling in large frantic flock over s of l. kinale	NM
WN005	L. Sheelin	29/09/2021	08:50	Wigeon	10	lakes and ponds; swimming on lake	NM
WN003	Derragh Lough	29/09/2021	11:00	Wigeon	15	mesotrophic lakes; swimming and foraging on lake	NM
WN002	L. D'varagh	29/09/2021	16:18	Wigeon	14	mesotrophic lakes; swimming and dabbling on lake	NM
WN006	L. Iron	30/09/2021	18:30	Wigeon	25	lakes and ponds; swimming on lake	NM
WN007	L. Iron	11/10/2021	17:30	Wigeon	76	lakes and ponds; swimming on lake	NM
WN008	L. Kinale	12/10/2021	10:11	Wigeon	16	lakes and ponds; swimming on lake	NM
WN009	Derragh Lough	12/10/2021	11:12	Wigeon	7	lakes and ponds; swimming and dabbling on lake	NM
WN010	L. Sheelin	12/10/2021	08:14	Wigeon	5	lakes and ponds; flying high across lake	NM
WN011		26/10/2021	09:49	Wigeon	7	lakes and ponds; swimming on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
WN015		09/11/2021	12:13	Wigeon	4	improved agricultural grassland; swimming on pond (flooding) within field	NM
WN014	Derragh Lough	09/11/2021	11:36	Wigeon	263	lakes and ponds; swimming on lake, flying around in vicinity, approximate numbers, numbers regulary cycling as individuals arrived and departed	NM
WN013	L. Sheelin	09/11/2021	09:27	Wigeon	5	lakes and ponds; swimming on lake	NM
WN016	L. Iron	09/11/2021	16:26	Wigeon	71	lakes and ponds; swimming on lake	NM
WN012	L. Sheelin	09/11/2021	09:29	Wigeon	13	lakes and ponds; flying low across lake, heading e	NM
WN017	L. Iron	22/11/2021	16:03	Wigeon	120	lakes and ponds; swimming on lake	NM
WN018	L. Bane	23/11/2021	14:20	Wigeon	39	lakes and ponds; swimming and dabbling on lake	NM
WN019	L. Sheelin	10/12/2021	09:03	Wigeon	5	lakes and ponds; swimming on lake	NM
WN021	L. Bane	10/12/2021	15:54	Wigeon	16	lakes and ponds; swimming on lake	NM
WN020	L. Kinale	10/12/2021	10:02	Wigeon	12	lakes and ponds; flying low across lake	NM
WN023		22/12/2021	14:24	Wigeon	3	lakes and ponds; swimming on pool within field hollow	NM
WN022	Deragh Lough	22/12/2021	11:00	Wigeon	22	lakes and ponds; swimming and calling on lake	NM
WN024	L. Bane	22/12/2021	15:44	Wigeon	34	lakes and ponds; swimming and calling on lake	NM
WN025		22/12/2021	15:46	Wigeon	9	lakes and ponds and bogs; flying in wide circles over lake area	NM
WN026	L. Iron	23/12/2021	15:30	Wigeon	76	lakes and ponds; swimming on lake	NM
WN027	L. Iron	04/01/2022	15:40	Wigeon	70	lakes and ponds; swimming on lake	NM
WN028	L. Bane	05/01/2022	09:05	Wigeon	16	lakes and ponds; swimming on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
WN030	L. Bane	17/01/2022	15:50	Wigeon	34	lakes and ponds, transition mire and quaking bog and semi-natural grassland; swimming on lake and within saturated edges	NM
WN029	L. Kinale N	17/01/2022	10:39	Wigeon	23	lakes and ponds; swimming on lake	NM
WN033	L. Sheelin	17/01/2022	08:42	Wigeon	11	lakes and ponds; swimming on lake	NM
WN032	L. D'varagh	17/01/2022	13:09	Wigeon	26	lakes and ponds; swimming and foraging on lake	NM
WN031	L. D'varagh	17/01/2022	13:13	Wigeon	6	reed and large sedge swamps and lakes and ponds; spooked and bursting from wetland, flying	NM
WN034	L. Iron	18/01/2022	16:00	Wigeon	46	lakes and ponds; swimming on lake	NM
WN035	Lough Sheelin west	26/02/2022	09:20	Wigeon	2	lakes and ponds; foraging	KB
WN036	Lough Bane	26/02/2022	12:50	Wigeon	2	lakes and ponds; foraging	KB
WN037	Lough Bane	31/03/2022	11:25	Wigeon	2	lakes and ponds; foraging	KB

Table 1-33 Curlew Vantage Point Survey Data

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
CU001	VP5	08/10/2021	09:53	Curlew	3	80	0	80	0	0	improved agricultural grassland, semi-natural grassland and scrub; flying n along e 500m boundary + calling	NM
CU002	VP6	22/10/2021	09:32	Curlew	1	350	0	140	210	0	depositing/lowland rivers, cutover bog and semi-natural grassland; flying and soaring along river and adjacent areas, calling	NM

Table 1-34 Curlew Wildfowl Distribution Survey Data

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
CU001		16/09/2021	08:54	Curlew	2	mesotrophic lakes, immature woodland and raised bog; flying se across lake, bog and scrubby woodland	NM
CU002	BN2	22/12/2021	15:35	Curlew	6	cutover bog, scrub and mixed conifer woodland; flying high and calling, heading s	NM
CU003		23/12/2021	15:50	Curlew	57	improved agricultural grassland and hedgerows; flying low across farmland, heading sw	NM

Table 1-35 Goldeneye Wildfowl Distribution Survey Date

Wildfowl Distribution Surveys							
Map Ref.	**Location**	**Date**	**Time**	**Species**	**Number**	**Habitat and activity**	**Surveyor**
GN001	L. D'varagh	12/10/2021	16:23	Goldeneye	12	lakes and ponds; swimming on lake	NM
GN002	L. D'varagh	12/10/2021	16:31	Goldeneye	13	lakes and ponds; flying at mid height (~15m) across lake - heading se	NM
GN003	L. Sheelin	10/12/2021	08:42	Goldeneye	7	lakes and ponds; swimming and diving on lake	NM
GN004	L. D'varagh	05/01/2022	13:30	Goldeneye	6	lakes and ponds; swimming on lake	NM
GN005	L. D'varagh	17/01/2022	13:05	Goldeneye	24	lakes and ponds; swimming on lake	NM
GN006	L. Sheelin	17/01/2022	08:43	Goldeneye	17	lakes and ponds; swimming on lake	NM
GN007	Lough Derravaragh south	15/02/2022	12:20	Goldeneye	11	lakes and ponds; foraging	KB
GN008	Lough Derravaragh north	15/02/2022	13:13	Goldeneye	6	lakes and ponds; foraging	KB
GN009	Lough Derravaragh north	31/03/2022	13:41	Goldeneye	5	lakes and ponds; foraging	KB

Table 1-36 Kestrel Vantage Point Survey Data

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
K002	VP4	28/04/2021	17:09	Kestrel	1	212	0	100	112	0	mixed broadleaved/conifer woodland and improved agricultural grassland; hunting	PM
K003	VP4	21/05/2021	06:34	Kestrel	1	58	58	0	0	0	cutover bog; travelling low	PM
K004	VP4	21/05/2021	10:12	Kestrel	1	192	0	92	100	0	mixed broadleaved/conifer woodland; hunting	PM
K005	VP6	30/07/2021	13:23	Kestrel	1	175	0	0	175	0	cutover bog and mixed broadleaved/conifer woodland; hunting	PM
K006	VP4	26/08/2021	13:48	Kestrel	1	186	0	0	186	0	cutover bog; hunting	TRea
K007	VP4	26/08/2021	15:54	Kestrel	1	182	20	43	129	0	cutover bog and treelines; chased by bzto open bog, flew low to edged, soared, flew off	TRea
K008	VP5	08/10/2021	08:17	Kestrel	1	130	80	50	0	0	improved agricultural grassland and hedgerows; hunting and hovering along hedgerows within farmland	NM
K009	VP6	22/10/2021	08:15	Kestrel	1	75	35	40	0	0	scrub and cutover bog; flying over bog and fringes	NM
K010	VP6	22/10/2021	09:26	Kestrel	1	70	0	70	0	0	cutover bog; commuting s across bog	NM

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
K011	VP3	15/11/2021	13:00	Kestrel	1	53	13	40	0	0	cutover bog and conifer plantation; flying, male observed descending into conifer plantation.	CR
K012	VP3	15/11/2021	13:06	Kestrel	1	292	9	37	246	0	conifer plantation and cutover bog; hunting, male observed hunting before descending into conifer plantation.	CR
K013	VP4	16/11/2021	13:02	Kestrel	1	444	6	98	340	0	highly modified/non-native woodland and cutover bog; hunting, observed hunting before descending into woodland.	CR
K014	VP5	19/11/2021	13:22	Kestrel	1	40	40	0	0	0	improved grassland; flying, male observed heading south east.	CR
K015	VP5	19/11/2021	13:47	Kestrel	1	250	5	25	220	0	improved grassland and conifer plantation; hunting, observed hunting for four minutes before descending into conifer woodland to the west of the 500 buffer.	CR
K016	VP6	22/11/2021	13:16	Kestrel	1	133	133	0	0	0	improved grassland, cutover bog and highly modified/non-native woodland; flying, male observed heading east before descending into woodland.	CR
K017	VP6	15/12/2021	13:36	Kestrel	1	660	60	570	30	0	cutover bog, wet grassland and scrub; foraging	KB
K018	VP5	03/01/2022	08:20	Kestrel	1	480	30	200	250	0	immature woodland and wet grassland; foraging	KB
K019	VP4	27/01/2022	15:24	Kestrel	1	510	0	0	510	0	conifer plantation and cutover bog; flying, hovering	ZE
K020	VP6	31/01/2022	14:22	Kestrel	1	648	0	26	622	0	cutover bog and conifer plantation; flying, hovering	ZE

Vantage Point Surveys											
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
K021	VP6	31/01/2022	14:32	Kestrel	1	370	0	0	370	0	improved agricultural grassland and conifer plantation; flying	ZE
K022	VP6	31/01/2022	16:04	Kestrel	1	38	10	28	0	0	lowland blanket bog and improved agricultural grassland; flying	ZE
K023	VP3	15/02/2022	10:51	Kestrel	1	240	0	60	180	0	cutover bog; flying	NS
K024	VP4	16/02/2022	10:11	Kestrel	1	30	0	30	0	0	lowland blanket bog; flying	NS
K025	VP6	17/02/2022	13:05	Kestrel	1	30	0	30	0	0	lowland blanket bog; flying, no hovering just flying	NS
K026	VP4	10/03/2022	15:22	Kestrel	1	86	0	0	86	0	cutover bog; flying	NS
K027	VP1	15/03/2022	15:49	Kestrel	1	420	0	0	420	0	cutover bog; flying	NS
K028	VP1	15/03/2022	17:03	Kestrel	1	20	0	20	0	0	cutover bog; flying	NS
K029	VP5	22/03/2022	14:04	Kestrel	1	120	0	20	100	0	improved agricultural grassland; hunting	ZOC

Table 1-37 Kestrel Breeding Raptor Survey Data

Breeding Raptor Surveys								
Map Ref.	BRVP	Date	Time	Species	Number	Habitat and activity	Breeding status	Surveyor
K001	BRVP5	29/04/2021	09:07	Kestrel	1	conifer plantation, hunting	flyover; non-breeding	PM
K002	BRVP2	30/04/2021	09:23	Kestrel	1	improved agricultural grassland, travelling	flyover; non-breeding	PM

Breeding Raptor Surveys								
Map Ref.	BRVP	Date	Time	Species	Number	Habitat and activity	Breeding status	Surveyor
K003	BRVP1	30/04/2021	13:11	Kestrel	1	mixed broadleaved/conifer woodland and improved agricultural grassland, hunting	flyover; non-breeding	PM
K004	BRVP6	04/06/2021	17:42	Kestrel	1	cutover bog, hunting	flyover; non-breeding	PM
K005	BRVP6	04/06/2021	18:25	Kestrel	1	conifer plantation, hunting	flyover; non-breeding	PM
K006	BRVP6	13/07/2021	09:25	Kestrel	1	highly modified/non-native woodland, hunting, hovering, diving	suitable nesting habitat; possible breeder	TRea
K007	BRVP6	13/07/2021	10:37	Kestrel	1	bogs and highly modified/non-native woodland, hunting, hovering, diving	suitable nesting habitat; possible breeder	TRea
K008	BRVP1	19/07/2021	12:48	Kestrel	1	bogs and highly modified/non-native woodland, flying, hovering, soaring, perched on tree, flew off hovering and soaring over bog	suitable nesting habitat; possible breeder	TRea

Breeding Raptor Surveys								
Map Ref.	BRVP	Date	Time	Species	Number	Habitat and activity	Breeding status	Surveyor
	BRVP6	06/05/2022	15:39	Kestrel	1	scrub and bogs, hunting, female observed hunting before descending beyond row of trees heading north west.	suitable nesting habitat; possible breeder	CR
	BRVP6	06/05/2022	16:06	Kestrel	1	scrub, bogs and conifer plantation, hunting, female kestrel last seen heading west.	suitable nesting habitat; possible breeder	CR
	BRVP2	23/05/2022	14:05	Kestrel	1	cutover bog, hunting and hovering over bog	flyover; non-breeding	NM
	BRVP1	26/05/2022	10:40	Kestrel	1	highly modified/non-native woodland and cutover bog, flying over bog wetland	flyover; non-breeding	NM
	BRVP1	26/05/2022	11:21	Kestrel	1	mixed conifer woodland and scrub, hunting and hovering	suitable nesting habitat; possible breeder	NM
	BRVP6	26/05/2022	16:30	Kestrel	1	bogs, flying across bog	flyover; non-breeding	NM

Table 1-38 Kestrel Winter Walkover Survey Data

Winter Walkover Surveys						
Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
K001	27/01/2022	14:55	Kestrel	1	cutover bog; fly/perch, k male (wintering)	AOD

Table 1-39 Kestrel Incidental Observation Data

Incidental Records							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
K001	Wildfowl Distribution Survey, lough bane 2	16/09/2021	14:06	Kestrel	1	cutover bog, scrub and immature woodland; soaring high above scrubby bog wetland, moving n, hassled by sl & mp	NM
K002	Wildfowl Distribution Survey,	16/09/2021	14:19	Kestrel	2	cutover bog; flying low over bog, individuals then started chasing each other and flying rapidly low to w	NM
K003	Wildfowl Distribution Survey,	16/09/2021	15:39	Kestrel	1	improved agricultural grassland and hedgerows; flying low across farmland	NM
K004	Wildfowl Distribution Survey,	16/09/2021	16:17	Kestrel	1	scrub and dry meadows and grassy verges; perched on telephone wire along road	NM
K005	Wildfowl Distribution Survey,	17/09/2021	19:18	Kestrel	1	marsh and immature woodland; hunting and hovering over s marsh of lake	NM

Incidental Records							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
K006	Wildfowl Distribution Survey,	12/10/2021	10:41	Kestrel	1	raised bog and scrub; hunting and hovering over scrubby bog fringes	NM
K007	Winter Walkover Survey,	20/10/2021	13:00	Kestrel	1	semi-natural grassland, depositing/lowland rivers and cutover bog; hunting and hovering over grassland along river	NM
K008	Winter Walkover Survey,	21/10/2021	13:44	Kestrel	1	immature woodland and cutover bog; flying low over scrubby woodland / farmland near bog fringes	NM
K009	Winter Walkover Survey,	21/10/2021	13:00	Kestrel	1	semi-natural grassland, depositing/lowland rivers and cutover bog; hunting and hovering over grassland along river	NM
K010	Winter Walkover Survey,	21/10/2021	15:25	Kestrel	1	semi-natural grassland, improved agricultural grassland and scrub; hunting and hovering over grassland	NM
K011	Wildfowl Distribution Survey,	26/10/2021	11:29	Kestrel	1	semi-natural grassland and mixed broadleaved woodland; flying across woodland	NM
K12	Wildfowl Distribution Survey,	26/10/2021	12:41	Kestrel	1	cutover bog and scrub; hunting and hovering over bog wetland and fringes	NM
K013	Wildfowl Distribution Survey, derragh lough	23/11/2021	10:40	Kestrel	1	improved agricultural grassland, semi-natural grassland and mixed broadleaved woodland; hunting and hovering over grassland	NM

Incidental Records							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
K014	Wildfowl Distribution Survey,	10/12/2021	08:54	Kestrel	1	bogs and scrub; hunting and hovering over bog and scrubland	NM
K015	Wildfowl Distribution Survey,	22/12/2021	15:31	Kestrel	1	cutover bog and scrub; flying across bog and scrub fringes	NM
K016	Wildfowl Distribution Survey,	17/01/2022	15:20	Kestrel	1	cutover bog and scrub; flying across bog	NM
K017	Wildfowl Distribution Survey,	17/01/2022	16:30	Kestrel	1	cutover bog and scrub; commuting across bog and wetland	NM
K018	Wildfowl Distribution Survey,	18/01/2022	11:31	Kestrel	1	improved agricultural grassland and scrub; hunting and hovering over farmland	NM

Table 1-40 Lapwing Vantage Point Survey Data

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
L001	VP6	22/11/2021	12:05	Lapwing	25	151	70	81	0	0	cutover bog; flying, flock of 25 birds observed flying in circles before heading east.	CR

Table 1-41 Lapwing Winter Walkover Survey Data

Winter Walkover Surveys						
Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
L007	15/03/2022	12:27	Lapwing	8	scrub; nest building (nest building; probable breeding)	NS

Table 1-42 Lapwing Wildfowl Distribution Survey Data

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
L002	L. D'varagh	17/09/2021	13:17	Lapwing	32	mesotrophic lakes; flying in v shaped flock low across water - heading nw up length of length	NM
L001		17/09/2021	13:09	Lapwing	81	mesotrophic lakes, mixed broadleaved woodland and improved agricultural grassland; flying in lare flock over narrow 'foot' of lake - heading ne across farmland	NM
L003		25/10/2021	16:36	Lapwing	43	improved agricultural grassland; grazing on grassland to s of lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
L006		26/10/2021	12:50	Lapwing	32	cutover bog; perched on bog wetland, dispersed across area	NM
L004		26/10/2021	09:34	Lapwing	79	lakes and ponds and improved agricultural grassland; flying and swirling low over lake edge, landing on grassy edge	NM
L005		26/10/2021	12:43	Lapwing	54	cutover bog and scrub; flying across bog wetland	NM
L007		09/11/2021	09:32	Lapwing	18	scrub and bogs; circling over bog / scrubland to w	NM
L011	L. Sheelin	23/11/2021	08:46	Lapwing	145	lakes and ponds and semi-natural grassland; roosting on grassy shore + occasionally smaller groups would fly low across lake and return to land	NM
L010		23/11/2021	12:45	Lapwing	23	improved agricultural grassland; roosting and foraging within rushy wetland area - turlough? wetland?, habitat??	NM
L008		23/11/2021	09:56	Lapwing	8	lakes and ponds, scrub and semi-natural grassland; flying over shore of lake	NM
L012	L. Sheelin	23/11/2021	09:15	Lapwing	34	lakes and ponds; flying e across lake	NM
L009	L. D'varagh	23/11/2021	15:39	Lapwing	86	lakes and ponds; flying across lake	NM
L013	L. Sheelin	10/12/2021	08:45	Lapwing	28	lakes and ponds and scrub; swirling over w shore area	NM
L014	BN2	10/12/2021	15:41	Lapwing	19	cutover bog; roosting and foraging on bare peat within bog wetland area	NM
L016		22/12/2021	14:34	Lapwing	31	lakes and ponds and improved agricultural grassland; foraging and roosting at edge of pool within field, turlough?	NM
L015	L. D'varagh	22/12/2021	08:43	Lapwing	78	lakes and ponds; flying low across lake - heading w	NM
L017		23/12/2021	15:35	Lapwing	245	semi-natural grassland and scrub; flying high across grassland and scrub to n of lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
L018		23/12/2021	15:37	Lapwing	87	improved agricultural grassland; flying across grassland to nw of lake	NM
L020		04/01/2022	14:15	Lapwing	38	improved agricultural grassland; grazing on field	NM
L019		04/01/2022	13:57	Lapwing	158	improved agricultural grassland, hedgerows and lakes and ponds; flock wheeling and flying high over farmland and lake edges	NM
L021	BN2	05/01/2022	09:43	Lapwing	23	cutover bog; roosting on bog wetland	NM
L023		17/01/2022	13:52	Lapwing	7	improved agricultural grassland and semi-natural grassland; roosting on flooding	NM
L024	L. Sheelin	17/01/2022	08:36	Lapwing	38	lakes and ponds; flying low across lake - heading se	NM
L022	L. Sheelin	17/01/2022	09:45	Lapwing	26	lakes and ponds; flying low across lake	NM
L025	Lough Sheelin centre	14/02/2022	11:00	Lapwing	76	lakes and ponds; flying over	KB
L027	Flooded cutaway bog on site	26/02/2022	12:58	Lapwing	6	cutover bog; foraging on ground and flying over	KB
L026	Derragh Lough	26/02/2022	11:04	Lapwing	1	wet grassland; foraging	KB
L028	Flooded bog on site	31/03/2022	11:20	Lapwing	2	cutover bog; foraging and alarm calling	KB

Table 1-43 Pochard Wildfowl Distribution Survey Data

Wildfowl Distribution Surveys							
Map Ref.	**Location**	**Date**	**Time**	**Species**	**Number**	**Habitat and activity**	**Surveyor**
PO001	L. Kinale	29/09/2021	10:23	Pochard	5	mesotrophic lakes; swimming and diving on lake	NM
PO002	L. Sheelin	26/10/2021	14:21	Pochard	5	lakes and ponds; swimming and diving on lake	NM
PO003	L. D'varagh	08/11/2021	12:23	Pochard	12	lakes and ponds; swimming on lake	NM
PO004	L. Sheelin	09/11/2021	09:15	Pochard	7	lakes and ponds; swimming and diving on lake	NM
PO005	L. Kinale	23/11/2021	09:52	Pochard	12	lakes and ponds; swimming on lake	NM
PO006	L. D'varagh	23/11/2021	15:42	Pochard	24	lakes and ponds; swimming on lake	NM
PO007	L. Sheelin	23/11/2021	09:10	Pochard	4	lakes and ponds; swimming and diving on lake	NM
PO008	L. Kinale	22/12/2021	12:20	Pochard	16	lakes and ponds; swimming on lake	NM
PO009	L. Sheelin	22/12/2021	13:52	Pochard	9	lakes and ponds; swimming and diving on lake	NM
PO010	L. D'varagh	04/01/2022	10:08	Pochard	5	lakes and ponds; swimming on lake	NM
PO011	L. Kinale	17/01/2022	10:41	Pochard	7	lakes and ponds; swimming on lake	NM
PO012	L. Sheelin	17/01/2022	08:59	Pochard	12	lakes and ponds; swimming and diving on lake	NM
PO013	Bracklagh Lough	14/02/2022	12:20	Pochard	1	lakes and ponds; foraging	KB
PO014	Lough Sheelin west	26/02/2022	09:20	Pochard	177	lakes and ponds; foraging	KB

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
PO015	Lough Sheelin centre	26/02/2022	09:53	Pochard	182	lakes and ponds; foraging	KB
PO016	Lough Derravaragh south	28/02/2022	11:45	Pochard	6	lakes and ponds; foraging	KB
PO017	Brackagh Lough	07/03/2022	09:00	Pochard	76	lakes and ponds; foraging	KB
PO018	Derragh Lough	31/03/2022	09:32	Pochard	4	lakes and ponds; foraging	KB

Table 1-44 Snipe Vantage Point Survey Data

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
SN001	VP6	06/04/2021	20:31	Snipe	1	10	10	0	0	0	cutover bog; flew from long grass	PM
SN002	VP6	26/05/2021	06:20	Snipe	1	15	15	0	0	0	cutover bog; travelling; landed in vegetation	PM
SN003	VP5	19/11/2021	12:03	Snipe	1	81	11	70	0	0	improved grassland; flying, landed in grassland to the north.	CR
SN004	VP6	31/01/2022	15:17	Snipe	1	10	10	0	0	0	improved agricultural grassland; flying, flushed	ZE
SN005	VP5	22/03/2022	19:25	Snipe	2	30	0	30	0	0	improved agricultural grassland; flying	ZOC

Table 1-45 Snipe Vantage Point Non-flight Survey Data

Vantage Point Surveys							
Map Ref.	VP	Date	Time	Species	Number	Habitat and activity	Surveyor
SN004	VP6	06/04/2021	20:44	Snipe	1	cutover bog; calling	PM
SN005	VP4	28/04/2021	21:29	Snipe	1	cutover bog; drumming, not seen	PM
SN007	VP4	28/04/2021	21:33	Snipe	1	cutover bog; drumming, second male; not seen	PM

Vantage Point Surveys							
Map Ref.	VP	Date	Time	Species	Number	Habitat and activity	Surveyor
SN006	VP4	28/04/2021	21:39	Snipe	1	cutover bog; drumming, not seen; possibly same bird as earlier	PM
SN008	VP3	15/11/2021	17:07	Snipe	1	cutover bog; calling	CR
SN009	VP3	15/11/2021	17:15	Snipe	1	cutover bog; calling	CR
SN010	VP3	15/11/2021	17:19	Snipe	1	cutover bog; calling	CR
SN011	VP5	19/11/2021	17:07	Snipe	1	improved grassland; calling	CR
SN012	VP6	22/11/2021	15:54	Snipe	1	depositing/lowland rivers; calling	CR
SN013	VP6	22/11/2021	16:42	Snipe	1	improved grassland and depositing/lowland rivers; calling	CR
SN014	VP6	22/11/2021	17:12	Snipe	1	cutover bog; calling	CR
SN015	VP6	31/01/2022	17:47	Snipe	1	lowland blanket bog; calling	ZE

Table 1-46 Snipe Breeding Walkover Survey Data

Breeding Walkover Surveys						
Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
SN001	07/04/2021	07:23	Snipe	1	wet grassland; flushed (flyover; non-breeding)	PM
SN002	07/04/2021	11:32	Snipe	2	cutover bog; flushed (summering; non-breeding)	PM

Breeding Walkover Surveys						
Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
SN003	07/04/2021	12:39	Snipe	1	cutover bog; flushed (suitable nesting habitat; possible breeder)	PM
SN004	07/04/2021	12:39	Snipe	1	cutover bog; flushed (suitable nesting habitat; possible breeder)	PM
SN005	18/06/2021	07:22	Snipe	1	cutover bog; flushed (suitable nesting habitat; possible breeder)	PM
SN006	18/06/2021	07:49	Snipe	1	cutover bog; flying (flyover; non-breeding)	PM
SN007	18/06/2021	10:40	Snipe	1	cutover bog; flushed (suitable nesting habitat; possible breeder)	PM
SN008	18/06/2021	10:40	Snipe	1	cutover bog; displaying (courtship and display; probable breeding)	PM

Table 1-47 Snipe Winter Walkover Survey Data

Winter Walkover Surveys						
Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
SN009	21/10/2021	11:52	Snipe	1	cutover bog, semi-natural grassland and depositing/lowland rivers; flushed from wet grassland along river (wintering)	NM
SN010	21/10/2021	11:57	Snipe	4	cutover bog; flushed from cutover bog fringes (wintering)	NM
SN011	28/01/2022	13:03	Snipe	2	raised bog; fly, flushed (wintering)	AOD
SN012	28/01/2022	16:56	Snipe	2	lakes and ponds; flushed (wintering)	AOD
SN013	22/02/2022	17:01	Snipe	4	lakes and ponds; flushed (wintering)	AOD
SN014	23/02/2022	17:08	Snipe	1	cutover bog; flushed (wintering)	AOD

Winter Walkover Surveys						
Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
SN015	23/02/2022	16:08	Snipe	1	cutover bog; flushed (wintering)	AOD
SN016	15/03/2022	15:10	Snipe	1	cutover bog; flying, flushed while walking (nest building; probable breeding)	NS

Table 1-48 Snipe Waterfowl Survey Data

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
SN001		29/09/2021	08:43	Snipe	1	raised bog; flushed from bog	NM
SN002		12/10/2021	13:27	Snipe	4	improved agricultural grassland and hedgerows; flying over farmland	NM
SN003		23/11/2021	14:18	Snipe	1	semi-natural grassland; flushed from wet grassland	NM
SN004		22/12/2021	15:46	Snipe	2	scrub and bogs; flushed from saturated fringes of lake, willow shrubs - wn7?	NM
SN005	L. D'varagh	04/01/2022	12:50	Snipe	2	highly modified/non-native woodland and semi-natural grassland; flushed from wet grass within woodland	NM
SN006	L. D'varagh	04/01/2022	13:30	Snipe	2	improved agricultural grassland; flushed from partially flooded field along lake edge	NM
SN008	BN1	17/01/2022	15:46	Snipe	1	scrub and semi-natural grassland; flushed from wet willow scrub	NM
SN009		17/01/2022	15:53	Snipe	1	transition mire and quaking bog and semi-natural grassland; flushed from saturated fringes	NM
SN007		17/01/2022	11:16	Snipe	1	improved agricultural grassland; flushed from disturbed farmland	NM
SN010	Lough Sheelin centre	14/02/2022	11:00	Snipe	1	raised bog; flushed	KB

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
SN011	Lough Sheelin centre	26/02/2022	09:53	Snipe	1	raised bog; flushed	KB
SN012	Lough Bane	26/02/2022	12:50	Snipe	1	bogs and lakes and ponds; flushed	KB
SN013	Lough Derravaragh north	08/03/2022	13:32	Snipe	1	lakes and ponds; flushed	KB

Table 1-49 Snipe Incidental Observation Data

Incidental Records							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
SN001	Breeding Woodcock Survey, t1	06/05/2021	22:39	Snipe	1	cutover bog; drumming	PM
SN002	Breeding Woodcock Survey, t1	06/05/2021	22:10	Snipe	1	cutover bog; drumming	PM
SN003	Breeding Woodcock Survey, t1	06/05/2021	22:30	Snipe	1	cutover bog and conifer plantation; drumming	PM
SN004	Breeding Woodcock Survey, t1 coole	03/06/2021	22:37	Snipe	2	bogs and woodland and scrub; drumming, 2 individuals drumming	TRea
SN005	Breeding Woodcock Survey, wkt1	28/06/2021	23:28	Snipe	1	bogs; drumming	TRea
SN006	Vantage Point Survey, vp6	06/09/2021	17:28	Snipe	1	cutover bog; travelling, took off from scrub as hh passed over	TRea

Incidental Records							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
SN007	Vantage Point Survey, walking to vp6	15/12/2021	07:37	Snipe	1	cutover bog; flushed	KB
SN008	Vantage Point Survey, walking from vp6	15/12/2021	14:13	Snipe	1	cutover bog; flushed	KB
SN009	Vantage Point Survey, doon	31/01/2022	11:37	Snipe	1	lowland blanket bog; flying - flushed	ZE
SN010	Vantage Point Survey, coole westmeath	17/02/2022	13:17	Snipe	1	lowland blanket bog; flying, flushed while walking back from vp	NS

Table 1-50 Woodcock Vantage Point Survey Data

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
WK001	VP4	31/03/2021	20:26	Woodcock	1	10	10	0	0	0	mixed broadleaved/conifer woodland; roding, displaying bird	AOD
WK002	VP4	31/03/2021	20:36	Woodcock	1	10	10	0	0	0	mixed broadleaved/conifer woodland and cutover bog; roding, displaying male	AOD

Table 1-51 Breeding Woodcock Survey Data

Breeding Woodcock Surveys							
Map Ref.	Transect	Date	Time	Species	Number	Habitat and activity	Surveyor
WK001	T1	06/05/2021	21:35	Woodcock	1	short rotation coppice, roding, t1 bird 1	PM
WK002	T1	06/05/2021	21:37	Woodcock	1	short rotation coppice, roding, t1 bird 1	PM
WK003	T1	06/05/2021	21:41	Woodcock	1	short rotation coppice, roding, t1 bird 2	PM
WK004	T1	06/05/2021	21:43	Woodcock	1	short rotation coppice, roding, t1 bird 2	PM
WK005	T1	06/05/2021	21:48	Woodcock	1	short rotation coppice, roding, t1 bird 2	PM
WK006	T1	06/05/2021	21:52	Woodcock	1	short rotation coppice, roding, t1 bird 3	PM
WK007	T1	06/05/2021	21:54	Woodcock	1	short rotation coppice, roding, t1 possible 4th bird	PM
WK008	T1	06/05/2021	21:58	Woodcock	1	short rotation coppice, roding, t1 possible 4th bird	PM

Breeding Woodcock Surveys							
Map Ref.	Transect	Date	Time	Species	Number	Habitat and activity	Surveyor
WK009	T3	18/05/2021	21:50	Woodcock	1	mixed broadleaved/conifer woodland, roding, t3 bird 1	PM
WK010	T3	18/05/2021	21:53	Woodcock	1	mixed broadleaved/conifer woodland, roding, t3 bird 1	PM
WK011	T2	24/05/2021	22:22	Woodcock	1	mixed broadleaved/conifer woodland, roding, t2 bird 1	PM
WK012	T2	24/05/2021	22:30	Woodcock	1	mixed broadleaved/conifer woodland and cutover bog, roding, t2 bird 2	PM
WK013	T2	03/06/2021	21:42	Woodcock	2	mixed broadleaved/conifer woodland, chasing each other	PM
WK014	T2	03/06/2021	22:14	Woodcock	1	conifer plantation, roding	PM
WK015	T2	03/06/2021	22:34	Woodcock	1	conifer plantation, roding	PM
WK016	T1	03/06/2021	21:45	Woodcock	1	woodland and scrub and bogs, roding, 1 of 2 individuals flying over terriotry to fields and woods east of lake.	TRea
WK017	T1	03/06/2021	21:54	Woodcock	1	woodland and scrub and bogs, roding, 1 of 2 individuals flying over terriotry to fields and woods east of lake.	TRea
WK018	T1	03/06/2021	21:56	Woodcock	1	woodland and scrub and bogs, roding, 1 of 2 individuals flying over terriotry to fields and woods east of lake.	TRea
WK019	T1	03/06/2021	22:10	Woodcock	1	woodland and scrub and bogs, roding, 1 of 2 individuals flying over terriotry to fields and woods east of lake.	TRea
WK020	T1	03/06/2021	22:16	Woodcock	1	woodland and scrub and bogs, roding, 1 of 2 individuals flying over terriotry to fields and woods east of lake.	TRea
WK021	T1	03/06/2021	22:22	Woodcock	1	woodland and scrub and bogs, roding, 1 of 2 individuals flying over wooded area to the west of the lake	TRea
WK022	T1	03/06/2021	22:24	Woodcock	1	woodland and scrub and bogs, roding, 1 of 2 individuals flying over wooded area to the west of the lake	TRea
WK023	T1	03/06/2021	22:42	Woodcock	1	woodland and scrub and bogs, roding, 1 of 2 individuals flying over wooded area to the west of the lake	TRea

Breeding Woodcock Surveys							
Map Ref.	Transect	Date	Time	Species	Number	Habitat and activity	Surveyor
WK024	T1	03/06/2021	22:19	Woodcock	1	woodland and scrub and bogs, roding, 1 of 2 individuals flying over wooded area to the west of the lake	TRea
WK025	T1	03/06/2021	22:50	Woodcock	1	woodland and scrub and bogs, roding, 1 of 2 individuals flying over wooded area to the west of the lake	TRea
WK026	T3	04/06/2021	21:58	Woodcock	1	conifer plantation and bogs, roding	TRea
WK027	T3	04/06/2021	22:51	Woodcock	1	conifer plantation and bogs, roding	TRea
WK028	T3	04/06/2021	22:19	Woodcock	1	conifer plantation and bogs, roding	TRea
WK029	T3	04/06/2021	22:31	Woodcock	1	conifer plantation and bogs, roding	TRea
WK030	T1	28/06/2021	22:35	Woodcock	2	highly modified/non-native woodland and bogs, roding, 2 flying in loop aa individuals	TRea

Table 1-52 Buzzard Vantage Point Survey Data

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
BZ002	VP6	06/04/2021	15:00	Buzzard	1	117	0	0	117	0	cutover bog and conifer plantation; soaring	PM
BZ003	VP6	06/04/2021	15:31	Buzzard	1	244	0	0	244	0	conifer plantation and cutover bog; soaring before dropping down to land in tree	PM
BZ004	VP6	06/04/2021	16:17	Buzzard	1	155	0	0	155	0	conifer plantation and cutover bog; hunting/travelling	PM
BZ005	VP6	26/05/2021	10:18	Buzzard	1	20	20	0	0	0	improved agricultural grassland; travelling; being mobbed by hc	PM
BZ006	VP4	17/06/2021	15:03	Buzzard	2	200	0	0	100	100	conifer plantation and improved agricultural grassland; soaring	PM
BZ007	VP4	17/06/2021	15:32	Buzzard	1	450	0	0	400	50	cutover bog, conifer plantation and improved agricultural grassland; hunting; then soaring	PM
BZ008	VP4	17/06/2021	15:38	Buzzard	1	60	60	0	0	0	cutover bog; travelling	PM
BZ009	VP4	17/06/2021	15:42	Buzzard	1	23	23	0	0	0	cutover bog; travelling	PM
BZ010	VP4	17/06/2021	15:49	Buzzard	1	17	17	0	0	0	cutover bog; hunting	PM
BZ011	VP6	30/07/2021	12:48	Buzzard	1	19	0	19	0	0	cutover bog; hunting	PM
BZ012	VP6	30/07/2021	15:15	Buzzard	1	52	52	0	0	0	wet grassland; hunting	PM
BZ013	VP6	19/08/2021	11:00	Buzzard	1	787	0	127	660	0	cutover bog and semi-natural woodland; travelling, soaring	TRea
BZ014	VP6	19/08/2021	14:42	Buzzard	1	220	0	0	220	0	cutover bog; travelling	TRea
BZ015	VP6	19/08/2021	16:10	Buzzard	1	521	0	15	516	0	cutover bog; hunting	TRea
BZ016	VP4	26/08/2021	11:22	Buzzard	1	354	0	0	354	0	cutover bog; hunting	TRea
BZ017	VP4	26/08/2021	12:09	Buzzard	1	277	0	0	277	0	cutover bog and treelines; soaring	TRea
BZ018	VP4	26/08/2021	12:13	Buzzard	1	249	0	72	177	0	cutover bog and linear woodland/scrub; hunting	TRea

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
BZ019	VP4	26/08/2021	12:47	Buzzard	1	77	0	77	0	0	cutover bog; travelling	TRea
BZ020	VP4	26/08/2021	14:46	Buzzard	2	360	0	41	319	0	cutover bog and treelines; hunting	TRea
BZ021	VP4	26/08/2021	14:59	Buzzard	1	208	0	0	208	0	cutover bog; soaring	TRea
BZ022	VP4	26/08/2021	15:58	Buzzard	1	5	5	0	0	0	cutover bog and treelines; fighting k.	TRea
BZ023	VP5	08/10/2021	11:01	Buzzard	1	240	0	0	60	180	improved agricultural grassland, mixed conifer woodland and cutover bog; soaring over forestry and bog fringes	NM
BZ024	VP4	19/10/2021	11:28	Buzzard	1	120	0	50	70	0	bogs and highly modified/non-native woodland; soaring over woodland on bog	NM
BZ025	VP6	22/10/2021	11:59	Buzzard	1	560	65	150	330	20	scrub, treelines and cutover bog; soaring and hunting over bog and scrub fringes, perched for period	NM
BZ026	VP3	23/10/2021	12:03	Buzzard	1	160	0	0	140	20	cutover bog and scrub; soaring over bog and fringes	NM
BZ027	VP3	23/10/2021	12:24	Buzzard	1	70	0	0	70	0	mixed broadleaved woodland, improved agricultural grassland and cutover bog; flying across hazel woodland and farmland	NM
BZ028	VP3	15/11/2021	12:06	Buzzard	1	465	0	0	115	350	highly modified/non-native woodland, improved grassland and cutover bog; soaring, observed heading north west.	CR
BZ029	VP6	22/11/2021	11:06	Buzzard	1	40	40	0	0	0	highly modified/non-native woodland and cutover bog; flying, observed heading north west before descending beyond line of trees.	CR

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
BZ030	VP6	22/11/2021	14:49	Buzzard	1	80	80	0	0	0	cutover bog, improved grassland and highly modified/non-native woodland; flying, adult buzzard observed heading south before landing on tree top.	CR
BZ031	VP6	22/11/2021	15:00	Buzzard	1	42	20	22	0	0	highly modified/non-native woodland and improved grassland; flying, last seen heading south west.	CR
BZ032	VP6	15/12/2021	08:53	Buzzard	1	30	10	20	0	0	mixed broadleaved woodland; foraging	KB
BZ033	VP6	15/12/2021	09:42	Buzzard	1	10	10	0	0	0	semi-natural grassland; foraging	KB
BZ034	VP5	25/01/2022	14:57	Buzzard	1	5	0	5	0	0	improved agricultural grassland; flying	ZE
BZ035	VP5	25/01/2022	15:25	Buzzard	1	3	0	5	0	0	improved agricultural grassland and treelines; flying	ZE
BZ036	VP5	25/01/2022	16:20	Buzzard	1	19	19	0	0	0	improved agricultural grassland and hedgerows; flying	ZE
BZ037	VP3	26/01/2022	11:50	Buzzard	1	50	40	10	0	0	conifer plantation and treelines; flying, circling	ZE
BZ038	VP3	26/01/2022	13:24	Buzzard	1	3	3	0	0	0	conifer plantation and treelines; flying, landed on the field	ZE
BZ039	VP3	26/01/2022	12:43	Buzzard	2	85	0	85	0	0	conifer plantation and treelines; flying, displaying	ZE
BZ040	VP4	27/01/2022	14:13	Buzzard	2	180	10	10	160	0	conifer plantation; flying, displaying, one flew south after two minutes	ZE
BZ041	VP6	31/01/2022	14:25	Buzzard	1	26	0	26	0	0	conifer plantation; flying	ZE
BZ042	VP4	10/03/2022	13:47	Buzzard	2	50	8	0	0	50	cutover bog; flying, soaring high. lost sight behind clouds	NS
BZ043	VP4	10/03/2022	13:57	Buzzard	1	319	0	0	0	319	cutover bog; flying	NS
BZ044	VP4	10/03/2022	14:23	Buzzard	1	78	0	0	78	0	cutover bog; flying	NS

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
BZ045	VP4	10/03/2022	14:46	Buzzard	2	136	30	106	0	0	cutover bog; breeding behaviour	NS
BZ046	VP4	10/03/2022	15:15	Buzzard	2	500	0	200	300	0	cutover bog; flying	NS
BZ047	VP4	10/03/2022	17:30	Buzzard	1	30	0	30	0	0	cutover bog; flying	NS
BZ048	VP1	15/03/2022	15:46	Buzzard	2	68	0	68	0	0	cutover bog; flying	NS
BZ049	VP1	15/03/2022	15:53	Buzzard	1	8	8	0	0	0	cutover bog; flying	NS
BZ050	VP5	22/03/2022	13:47	Buzzard	1	60	0	10	50	0	oak-birch-holly woodland and improved agricultural grassland; soaring/ circling, soaring before dropping into woodland below	ZOC
BZ051	VP5	22/03/2022	14:00	Buzzard	1	190	0	0	190	0	dry calcareous and neutral grassland; travelling displaying, travelling and displaying briefly	ZOC
BZ052	VP5	22/03/2022	14:02	Buzzard	1	100	0	0	100	0	dry calcareous and neutral grassland; displaying, displaying	ZOC
BZ053	VP5	22/03/2022	16:55	Buzzard	1	50	5	10	35	0	improved agricultural grassland and oak-birch-holly woodland; travelling	ZOC
BZ054	VP3	23/03/2022	15:40	Buzzard	2	170	0	0	170	0	cutover bog and conifer plantation; flying, displaying	ZOC

Table 1-53 Buzzard Vantage Point Non-flight Survey Data

Vantage Point Surveys							
Map Ref.	VP	Date	Time	Species	Number	Habitat and activity	Surveyor
BZ023	VP4	26/08/2021	14:07	Buzzard	1	improved agricultural grassland and treelines; calling	TRea
BZ061	VP4	07/09/2021	15:16	Buzzard	1	cutover bog and woodland and scrub; calling	TRea
BZ055	VP6	22/11/2021	11:37	Buzzard	1	highly modified/non-native woodland and cutover bog; calling, no visual	CR
BZ056	VP6	22/11/2021	14:50	Buzzard	1	highly modified/non-native woodland and improved grassland; roosting, remained perched on tree top until 15:00.	CR
BZ057	VP5	25/01/2022	15:01	Buzzard	1	improved agricultural grassland and treelines; perching	ZE
BZ058	VP5	25/01/2022	15:33	Buzzard	1	improved agricultural grassland and treelines; perching	ZE
BZ059	VP5	08/02/2022	13:14	Buzzard	1	improved agricultural grassland; calling	NS
BZ060	VP4	10/03/2022	18:16	Buzzard	2	cutover bog; perched, perched in tree	NS

Table 1-54 Buzzard Breeding Walkover Survey Data

Breeding Walkover Surveys						
Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
BZ001	07/04/2021	10:16	Buzzard	1	mixed broadleaved/conifer woodland and cutover bog; flew from trees before circling (suitable nesting habitat; possible breeder)	PM

Breeding Walkover Surveys						
Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
BZ002	14/05/2021	11:30	Buzzard	1	mixed broadleaved/conifer woodland; calling (suitable nesting habitat; possible breeder)	PM
BZ003	18/06/2021	09:54	Buzzard	1	improved agricultural grassland; flying; calling (flyover; non-breeding)	PM
BZ004	23/07/2021	10:05	Buzzard	1	conifer plantation; calling, not seen (flyover; non-breeding)	PM

Table 1-55 Buzzard Winter Walkover Survey Data

Winter Walkover Surveys						
Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
BZ005	27/01/2022	14:05	Buzzard	2	cutover bog; fly, soaring over bog (wintering)	AOD
BZ006	22/02/2022	13:04	Buzzard	2	mixed broadleaved/conifer woodland; flying over, calling (wintering)	AOD
BZ007	22/02/2022	15:12	Buzzard	1	improved agricultural grassland and cutover bog; flying over (wintering)	AOD
BZ008	15/03/2022	13:06	Buzzard	1	bog woodland; flying (nest building; probable breeding)	NS
BZ009	15/03/2022	13:23	Buzzard	1	wet willow-alder-ash woodland; flying (nest building; probable breeding)	NS
BZ010	15/03/2022	14:58	Buzzard	1	cutover bog; flying (nest building; probable breeding)	NS
BZ011	16/03/2022	12:51	Buzzard	2	cutover bog; flying (nest building; probable breeding)	NS

Table 1-56 Buzzard Breeding Raptor Survey Data

Breeding Raptor Surveys								
Map Ref.	BRVP	Date	Time	Species	Number	Habitat and activity	Breeding status	Surveyor
BZ001	BRVP5	29/04/2021	09:51	Buzzard	1	raised bog, travelling	flyover; non-breeding	PM
BZ002	BRVP5	29/04/2021	10:09	Buzzard	1	conifer plantation, travelling	flyover; non-breeding	PM
BZ003	BRVP5	29/04/2021	10:29	Buzzard	2	improved agricultural grassland and conifer plantation, soaring, being mobbed by hc	flyover; non-breeding	PM
BZ004	BRVP5	29/04/2021	12:53	Buzzard	1	mixed broadleaved/conifer woodland, hunting	flyover; non-breeding	PM
BZ005	BRVP1	06/05/2021	17:07	Buzzard	1	improved agricultural grassland and mixed broadleaved/conifer woodland, travelling	flyover; non-breeding	PM
BZ006	BRVP1	06/05/2021	17:18	Buzzard	1	mixed broadleaved/conifer woodland, rising and travelling away from forestry	suitable nesting habitat; possible breeder	PM
BZ007	BRVP1	06/05/2021	17:33	Buzzard	1	mixed broadleaved/conifer woodland, travelling	flyover; non-breeding	PM
BZ008	BRVP1	06/05/2021	18:39	Buzzard	1	mixed broadleaved/conifer woodland, hunting/travelling	suitable nesting habitat; possible breeder	PM
BZ009	BRVP1	06/05/2021	19:06	Buzzard	1	mixed broadleaved/conifer woodland, travelling	flyover; non-breeding	PM

Breeding Raptor Surveys								
Map Ref.	BRVP	Date	Time	Species	Number	Habitat and activity	Breeding status	Surveyor
BZ010	BRVP1	06/05/2021	19:22	Buzzard	1	mixed broadleaved/conifer woodland, travelling	suitable nesting habitat; possible breeder	PM
BZ011	BRVP2	24/05/2021	18:22	Buzzard	1	improved agricultural grassland and mixed broadleaved/conifer woodland, hunting	flyover; non-breeding	PM
BZ012	BRVP2	24/05/2021	19:54	Buzzard	1	mixed broadleaved/conifer woodland, hunting	flyover; non-breeding	PM
BZ013	BRVP1	03/06/2021	19:43	Buzzard	1	conifer plantation, travelling; being mobbed by hc and bh	flyover; non-breeding	PM
BZ014	BRVP1	03/06/2021	19:48	Buzzard	1	conifer plantation, travelling	flyover; non-breeding	PM
BZ015	BRVP6	04/06/2021	18:25	Buzzard	1	conifer plantation, travelling; mobbed by crows	flyover; non-breeding	PM
BZ016	BRVP2	28/06/2021	17:39	Buzzard	2	conifer plantation and improved agricultural grassland, circling	pair; probable breeding	PM
BZ017	BRVP2	28/06/2021	18:07	Buzzard	1	improved agricultural grassland, circling	flyover; non-breeding	PM
BZ018	BRVP6	29/06/2021	17:28	Buzzard	1	mixed broadleaved/conifer woodland, circling low	suitable nesting habitat; possible breeder	PM
BZ019	BRVP6	29/06/2021	18:05	Buzzard	1	mixed broadleaved/conifer woodland and improved agricultural grassland, hunting	flyover; non-breeding	PM
BZ020	BRVP6	29/06/2021	18:15	Buzzard	1	improved agricultural grassland, soaring	flyover; non-breeding	PM
BZ021	BRVP6	29/06/2021	18:40	Buzzard	1	improved agricultural grassland, soaring	flyover; non-breeding	PM

Breeding Raptor Surveys								
Map Ref.	BRVP	Date	Time	Species	Number	Habitat and activity	Breeding status	Surveyor
BZ022	BRVP6	29/06/2021	18:40	Buzzard	1	improved agricultural grassland, travelling	flyover; non-breeding	PM
BZ023	BRVP6	29/06/2021	18:55	Buzzard	1	improved agricultural grassland and mixed broadleaved/conifer woodland, soaring	flyover; non-breeding	PM
BZ024	BRVP6	13/07/2021	09:25	Buzzard	1	highly modified/non-native woodland, soaring	suitable nesting habitat; possible breeder	TRea
BZ025	BRVP5	13/07/2021	13:42	Buzzard	1	mixed broadleaved/conifer woodland and bogs, soaring, travelling	suitable nesting habitat; possible breeder	TRea
BZ026	BRVP6	13/07/2021	14:34	Buzzard	2	highly modified/non-native woodland and bogs, soaring	pair; probable breeding	TRea
BZ027	BRVP6	13/07/2021	14:34	Buzzard	1	highly modified/non-native woodland and bogs, soaring	suitable nesting habitat; possible breeder	TRea
BZ028	BRVP1	19/07/2021	10:27	Buzzard	1	bogs and highly modified/non-native woodland, soaring, divinng behind treeline	suitable nesting habitat; possible breeder	TRea
BZ029	BRVP1	19/07/2021	11:46	Buzzard	1	bogs and highly modified/non-native woodland, travelling	suitable nesting habitat; possible breeder	TRea
BZ030	BRVP2	19/07/2021	14:20	Buzzard	2	mixed broadleaved/conifer woodland and improved grassland, fighting white tailed eagle, calling and diving at eagle	agitated behaviour; probable breeding	TRea
BZ031	BRVP2	19/07/2021	15:16	Buzzard	1	improved grassland and highly modified/non-native woodland, soaring	suitable nesting habitat; possible breeder	TRea

Table 1-57 Buzzard Incidental Observation Data

Incidental Records							
Map Ref.	**Location**	**Date**	**Time**	**Species**	**Number**	**Habitat and activity**	**Surveyor**
BZ001	Wildfowl Distribution Survey,	16/09/2021	12:53	Buzzard	1	immature woodland, mixed broadleaved woodland and mesotrophic lakes; soaring over woodland	NM
BZ002	Wildfowl Distribution Survey,	16/09/2021	14:26	Buzzard	1	conifer plantation and cutover bog; soaring over forestry fringes of bog	NM
BZ003	Wildfowl Distribution Survey,	16/09/2021	16:49	Buzzard	1	scrub, immature woodland and mixed conifer woodland; perched in scrubby trees along track	NM
BZ004	Wildfowl Distribution Survey,	16/09/2021	16:58	Buzzard	1	mixed conifer woodland, mixed broadleaved woodland and mesotrophic lakes; flying and circling	NM
BZ005	Wildfowl Distribution Survey, s2	16/09/2021	09:14	Buzzard	1	raised bog, mixed conifer woodland and scrub; soaring over bog and forestry	NM
BZ006	Wildfowl Distribution Survey,	17/09/2021	15:00	Buzzard	1	improved agricultural grassland, scrub and hedgerows; soaring and circling over farmland	NM
BZ007	Wildfowl Distribution Survey,	29/09/2021	12:23	Buzzard	1	mesotrophic lakes, mixed conifer woodland and mixed broadleaved woodland; soaring over forestry and s fringes of derragh lough	NM
BZ008	Wildfowl Distribution Survey,	12/10/2021	12:43	Buzzard	1	improved agricultural grassland and hedgerows; soaring and circling over farmland + calling	NM

Incidental Records							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
BZ009	Wildfowl Distribution Survey,	12/10/2021	16:33	Buzzard	2	improved agricultural grassland and hedgerows; soaring over farmland - appeared to be harrying we for a time	NM
BZ010	Winter Walkover Survey,	20/10/2021	10:55	Buzzard	2	scrub and bogs; soaring over scrubby bog areas	NM
BZ011	Winter Walkover Survey,	21/10/2021	12:13	Buzzard	1	improved agricultural grassland, mixed broadleaved woodland and scrub; soaring over woodland and farmland	NM
BZ012	Winter Walkover Survey,	21/10/2021	14:56	Buzzard	1	treelines and improved agricultural grassland; perched low in ashe along road, flushed	NM
BZ013	Wildfowl Distribution Survey,	26/10/2021	10:31	Buzzard	1	improved agricultural grassland; perched in tree in farmland	NM
BZ014	Wildfowl Distribution Survey,	26/10/2021	13:08	Buzzard	2	improved agricultural grassland and hedgerows; soaring over farmland	NM
BZ015	Wildfowl Distribution Survey,	26/10/2021	14:04	Buzzard	1	raised bog and immature woodland; soaring over bog and woody fringes	NM
BZ016	Wildfowl Distribution Survey,	22/12/2021	10:20	Buzzard	1	scrub, improved agricultural grassland and mixed conifer woodland; disturbed from perch along river, flew away low over farmland and woodland	NM
BZ017	Wildfowl Distribution Survey,	22/12/2021	12:18	Buzzard	1	lakes and ponds, scrub and improved agricultural grassland; soaring and circling over lake fringes	NM
BZ018	Wildfowl Distribution Survey,	22/12/2021	14:14	Buzzard	1	bogs and scrub; flying low across bog and scrub	NM

Incidental Records							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
BZ019	Wildfowl Distribution Survey,	22/12/2021	14:30	Buzzard	1	improved agricultural grassland and hedgerows; flying across field	NM
BZ020	Wildfowl Distribution Survey,	23/12/2021	15:27	Buzzard	2	improved agricultural grassland and hedgerows; calling and flying low along hedgerows within farmland	NM
BZ021	Wildfowl Distribution Survey,	23/12/2021	16:11	Buzzard	1	improved agricultural grassland and hedgerows; flying low along hedgerows within farmland, perching briefly within tree	NM
BZ022	Wildfowl Distribution Survey,	04/01/2022	09:01	Buzzard	1	improved agricultural grassland and hedgerows; flying across farmland	NM
BZ023	Wildfowl Distribution Survey,	04/01/2022	13:20	Buzzard	1	improved agricultural grassland and hedgerows; perched on telephone line before flying away over farmland	NM
BZ024	Wildfowl Distribution Survey,	04/01/2022	14:05	Buzzard	1	improved agricultural grassland, hedgerows and mixed conifer woodland; flying across fields	NM
BZ025	Wildfowl Distribution Survey,	05/01/2022	09:28	Buzzard	2	cutover bog, mixed conifer woodland and scrub; soaring over bog	NM
BZ026	Wildfowl Distribution Survey,	17/01/2022	09:35	Buzzard	1	improved agricultural grassland; flying low across farmland	NM
BZ027	Wildfowl Distribution Survey, l. sheelin	17/01/2022	10:20	Buzzard	1	lakes and ponds; flying high and ne across lake	NM
BZ028	Wildfowl Distribution Survey,	17/01/2022	10:27	Buzzard	1	mixed conifer woodland and scrub; perched within forestry before flying off	NM

Incidental Records							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
BZ029	Wildfowl Distribution Survey,	18/01/2022	10:23	Buzzard	1	improved agricultural grassland, hedgerows and scrub; soaring over farmland	NM
BZ030	Vantage Point Survey, coole vp4	16/02/2022	08:00	Buzzard	1	cutover bog; flying	NS
BZ031	Waterfowl Distribution Survey,	08/03/2022	15:24	Buzzard	1	cutover bog; foraging	KB
BZ032	Waterfowl Distribution Survey,	31/03/2022	11:25	Buzzard	1	lakes and ponds; foraging	KB

Table 1-58 Sparrowhawk Vantage Point Survey Data

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
SH001	VP4	28/04/2021	16:28	Sparrowhawk	1	12	12	0	0	0	mixed broadleaved/conifer woodland; flew to perch on tree; known nest site, flew from woods to perch on top of tree near nest site	PM
SH002	VP4	28/04/2021	16:34	Sparrowhawk	1	5	5	0	0	0	mixed broadleaved/conifer woodland; flew between perches at known nest site, male	PM
SH003	VP4	28/04/2021	16:39	Sparrowhawk	1	10	10	0	0	0	mixed broadleaved/conifer woodland; flew from perch at known nest site and flew off low, male	PM
SH004	VP4	09/12/2021	09:22	Sparrowhawk	1	10	10	0	0	0	cutover bog and immature woodland; foraging	KB
SH005	VP4	09/12/2021	09:22	Sparrowhawk	2	5	2	3	0	0	cutover bog and immature woodland; foraging	KB
SH006	VP4	09/12/2021	09:22	Sparrowhawk	1	8	8	0	0	0	cutover bog and immature woodland; foraging	KB
SH007	VP4	10/03/2022	13:41	Sparrowhawk	1	190	30	60	100	0	cutover bog; flying	NS

Table 1-59 Sparrowhawk Winter Walkover Survey Data

Winter Walkover Surveys						
Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
SH001	07/04/2021	08:50	Sparrowhawk	1	mixed broadleaved/conifer woodland; carrying nest material into trees (nest building; probable breeding)	PM

Table 1-60 Sparrowhawk Breeding Raptor Survey Data

Breeding Raptor Surveys								
Map Ref.	BRVP	Date	Time	Species	Number	Habitat and activity	Breeding status	Surveyor
SH001	BRVP1	30/04/2021	13:15	Sparrowhawk	1	cutover bog, travelling; landed in tree	suitable nesting habitat; possible breeder	PM
SH002	BRVP1	06/05/2021	18:16	Sparrowhawk	1	mixed broadleaved/conifer woodland and cutover bog, travelling	flyover; non-breeding	PM
SH003	BRVP6	18/05/2021	18:52	Sparrowhawk	1	mixed broadleaved/conifer woodland, travelling, male	flyover; non-breeding	PM

Table 1-61 Sparrowhawk Incidental Observation Data

Incidental Records							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
SH001	Winter Walkover Survey,	21/10/2021	12:04	Sparrowhawk	1	improved agricultural grassland and semi-natural grassland; flying low across grassland	NM
SH002	Wildfowl Distribution Survey,	26/10/2021	12:38	Sparrowhawk	1	scrub and cutover bog; flying over scrubby bog fringes + perched	NM

Incidental Records							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
SH003	Wildfowl Distribution Survey,	08/11/2021	12:15	Sparrowhawk	1	improved agricultural grassland and hedgerows; flying low between hedgerows of farmland	NM
SH004	Vantage Point Survey, vp6	22/11/2021	14:03	Sparrowhawk	1	improved grassland and depositing/lowland rivers; flying, female observed during lunch break. last seen heading north.	CR
SH005	Vantage Point Survey, vp6	22/11/2021	14:06	Sparrowhawk	1	improved grassland and depositing/lowland rivers; flying, possibly same female bird observed three minutes earlier. last seen heading north.	CR
SH006	Wildfowl Distribution Survey,	17/01/2022	13:13	Sparrowhawk	1	lakes and ponds, scrub and reed and large sedge swamps; flying low and acrobatically across wetland - may have caused wn and t to be flushed	NM

Table 1-62 Vantage Point Non-target Species Survey Data

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
	VP4	21/05/2021	10:04	Black-headed Gull	1	50	0	50	0	0	cutover bog and mixed broadleaved/conifer woodland; travelling	PM
	VP5	08/10/2021	10:15	Black-headed Gull	6	125	15	80	30	0	improved agricultural grassland and hedgerows; flying and swirling across farmland - heading w	NM
	VP5	08/10/2021	08:47	Black-headed Gull	2	60	0	0	55	5	improved agricultural grassland and mixed conifer woodland; flying n and e across famrland	NM
	VP3	23/10/2021	08:15	Cormorant	2	55	15	40	0	0	mixed conifer woodland, depositing/lowland rivers and scrub; flying along sw boundary	NM
	VP4	16/11/2021	13:44	Cormorant	1	43	0	0	43	0	highly modified/non-native woodland and cutover bog; flying, heading north west	CR
	VP6	22/11/2021	15:34	Cormorant	1	291	0	0	214	77	improved grassland, depositing/lowland rivers and highly modified/non-native woodland; flying, last seen heading north at high altitude.	CR
	VP4	09/12/2021	11:38	Cormorant	1	12	0	12	0	0	cutover bog; travelling	KB
	VP6	15/12/2021	11:39	Cormorant	1	30	0	0	30	0	cutover bog and semi-natural grassland; travelling	KB
	VP6	15/12/2021	12:11	Cormorant	1	35	0	0	35	0	semi-natural grassland; travelling	KB

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
	VP6	15/12/2021	12:31	Cormorant	1	25	10	15	0	0	semi-natural grassland; travelling - descended	KB
	VP6	15/12/2021	13:52	Cormorant	1	20	0	20	0	0	semi-natural grassland; travelling	KB
	VP1	15/03/2022	15:57	Cormorant	1	50	0	50	0	0	cutover bog; flying	NS
	VP1	15/03/2022	17:00	Cormorant	1	29	0	29	0	0	cutover bog; flying	NS
GE001	VP6	22/11/2021	15:04	Green Sandpiper	1	18	2	4	12	0	improved grassland and depositing/lowland rivers; flying/calling, observed descending into river.	CR
	VP6	22/10/2021	11:18	Grey Heron	1	80	0	80	0	0	improved agricultural grassland and cutover bog; flying across bog	NM
	VP6	22/10/2021	11:55	Grey Heron	1	25	25	0	0	0	depositing/lowland rivers and semi-natural grassland; flying low along river	NM
	VP4	16/11/2021	12:27	Grey Heron	1	60	60	0	0	0	cutover bog and highly modified/non-native woodland; flying, heading east	CR
	VP4	16/11/2021	14:51	Grey Heron	1	48	48	0	0	0	highly modified/non-native woodland; flying	CR
	VP4	16/11/2021	15:48	Grey Heron	1	27	27	0	0	0	highly modified/non-native woodland; flying	CR

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
	VP4	16/11/2021	16:33	Grey Heron	1	40	40	0	0	0	cutover bog and highly modified/non-native woodland; flying	CR
	VP1	15/03/2022	16:42	Grey Heron	1	46	9	37	0	0	cutover bog; flying	NS
	VP6	06/04/2021	16:47	Grey Heron	1	17	0	17	0	0	conifer plantation; travelling along river	PM
	VP6	06/04/2021	16:52	Grey Heron	1	57	0	57	0	0	cutover bog and conifer plantation; travelling; dropped into drain	PM
	VP4	28/04/2021	17:31	Grey Heron	1	25	25	0	0	0	cutover bog; travelling along large drain	PM
	VP4	17/06/2021	13:19	Grey Heron	1	30	30	0	0	0	depositing/lowland rivers and conifer plantation; travelling; landed in river	PM
	VP4	17/06/2021	13:24	Grey Heron	1	14	14	0	0	0	cutover bog; travelling; landed in drain	PM
	VP4	17/06/2021	13:26	Grey Heron	64	0	64	0	0	0	cutover bog; travelling; landed in drain	PM
	VP6	30/07/2021	09:24	Grey Heron	1	52	52	0	0	0	cutover bog; travelling	PM
	VP6	07/09/2021	15:14	Grey Heron	1	14	14	0	0	0	cutover bog and treelines; travelling, roosting	TRea
	VP6	31/01/2022	16:01	Grey Heron	1	61	20	41	0	0	improved agricultural grassland and bogs; flying, ze	ZE

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
	VP6	31/01/2022	17:09	Grey Heron	1	34	34	0	0	0	improved agricultural grassland; flying	ZE
	VP4	21/05/2021	06:58	Lesser Black-backed Gull	1	32	0	32	0	0	cutover bog; travelling	PM
	VP6	26/05/2021	05:43	Lesser Black-backed Gull	1	100	0	100	0	0	cutover bog and wet grassland; travelling	PM
	VP6	26/05/2021	05:44	Lesser Black-backed Gull	1	577	0	577	0	0	cutover bog and wet grassland; travelling/circling bog	PM
	VP6	26/05/2021	08:05	Lesser Black-backed Gull	3	20	0	20	0	0	cutover bog and mixed broadleaved/conifer woodland; travelling	PM
	VP4	17/06/2021	17:00	Lesser Black-backed Gull	2	173	0	0	173	0	improved agricultural grassland; travelling/soaring	PM
	VP6	30/06/2021	15:26	Lesser Black-backed Gull	1	120	0	120	0	0	improved agricultural grassland; circling field where grass was being mown	PM
	VP4	27/07/2021	09:33	Lesser Black-backed Gull	1	51	0	0	61	0	cutover bog and mixed broadleaved/conifer woodland; travelling	PM
	VP6	06/04/2021	18:58	Mallard	3	20	5	15	0	0	conifer plantation; travelling; dropped behind trees toward river	PM
	VP4	28/04/2021	16:55	Mallard	1	47	27	20	0	0	cutover bog; travelling; landed in drain, male	PM
	VP4	28/04/2021	20:12	Mallard	1	25	0	5	20	0	cutover bog; travelling; landed in drain	PM
	VP4	28/04/2021	20:12	Mallard	2	36	0	0	36	0	cutover bog; travelling	PM
	VP4	28/04/2021	21:11	Mallard	2	30	30	0	0	0	cutover bog; travelling; landed in drain	PM

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
	VP6	26/05/2021	06:14	Mallard	2	27	27	0	0	0	cutover bog and depositing/lowland rivers; travelling; landed in river, 2 males	PM
	VP6	26/05/2021	06:41	Mallard	3	126	0	26	100	0	depositing/lowland rivers and cutover bog; travelling, 3 males	PM
	VP6	30/07/2021	09:50	Mallard	1	75	0	0	75	0	cutover bog and conifer plantation; travelling	PM
	VP6	30/07/2021	11:36	Mallard	2	80	0	80	0	0	cutover bog; travelling	PM
	VP5	08/10/2021	08:12	Mallard	3	85	0	25	60	0	cutover bog and mixed conifer woodland; flying in wide circle over cutover bog and adjacent area	NM
	VP5	08/10/2021	12:43	Mallard	2	45	0	45	0	0	improved agricultural grassland; flying s across farmalnd	NM
	VP4	09/12/2021	07:51	Mallard	2	10	10	0	0	0	cutover bog and immature woodland; travelling	KB
	VP4	09/12/2021	08:05	Mallard	10	14	14	0	0	0	cutover bog and immature woodland; travelling	KB
	VP1	08/03/2022	14:16	Mallard	2	120	0	120	0	0	cutover bog; flying	NS
	VP1	15/03/2022	18:49	Mallard	2	24	24	0	0	0	cutover bog; flying	NS
	VP1	15/03/2022	19:02	Mallard	2	15	15	0	0	0	cutover bog; flying	NS
	VP1	15/03/2022	17:07	Mallard	2	25	0	25	0	0	cutover bog; flying	NS
	VP4	27/01/2022	11:54	Meadow Pipit	1	41	41	0	0	0	cutover bog; flying, perching on top of a floodlight	ZE
	VP4	27/01/2022	13:50	Meadow Pipit	1	21	21	0	0	0	cutover bog; flying	ZE
	VP6	31/01/2022	12:15	Meadow Pipit	1	4	4	0	0	0	lowland blanket bog; flying	ZE

Vantage Point Surveys												
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
	VP4	16/02/2022	11:17	Meadow Pipit	3	15	15	0	0	0	lowland blanket bog; flying	NS
	VP6	18/02/2022	12:25	Meadow Pipit	4	10	10	0	0	0	lowland blanket bog; flying, 6 flying around throughout the day	NS
	VP3	23/03/2022	15:10	Meadow Pipit	2	15	5	10	0	0	cutover bog; flying	ZOC
	VP3	23/03/2022	17:19	Meadow Pipit	3	20	20	0	0	0	cutover bog; flying	ZOC
	VP6	26/05/2021	06:37	Mute Swan	1	15	15	0	0	0	depositing/lowland rivers; flew along river before landing again	PM
	VP4	17/06/2021	16:16	Mute Swan	1	67	67	0	0	0	cutover bog, depositing/lowland rivers and conifer plantation; travelling; landed in river	PM
	VP5	08/10/2021	07:43	Mute Swan	16	65	0	65	0	0	improved agricultural grassland and hedgerows; flying e - low across farmalnd and hedgerows	NM
	VP4	27/01/2022	17:55	Mute Swan	5	13	0	13	0	0	cutover bog and conifer plantation; flying	ZE
	VP1	15/03/2022	18:57	Mute Swan	2	40	0	0	40	0	cutover bog; flying, not seen only heard	NS
	VP5	25/01/2022	13:58	Redwing	25	35	0	35	0	0	improved agricultural grassland; flying	ZE
	VP6	31/01/2022	12:32	Redwing	13	15	15	0	0	0	lowland blanket bog; flying	ZE
	VP6	31/01/2022	13:55	Redwing	12	20	0	20	0	0	lowland blanket bog; flying	ZE
	VP5	08/02/2022	10:18	Redwing	25	25	25	0	0	0	improved agricultural grassland; flying	NS
	VP4	16/02/2022	07:44	Redwing	30	20	0	20	0	0	lowland blanket bog; flying	NS
	VP5	22/03/2022	16:10	Redwing	2	10	10	0	0	0	hedgerows; flying	ZOC

Table 1-63 Vantage Point Survey Non-target Species Non-flight Data

Vantage Point Surveys							
Map Ref.	VP	Date	Time	Species	Number	Habitat and activity	Surveyor
	VP6	22/11/2021	17:03	Grey Heron	1	depositing/lowland rivers, improved grassland and cutover bog; calling	CR
	VP6	06/04/2021	20:43	Grey Heron	1	depositing/lowland rivers; calling from river	PM
	VP6	26/05/2021	05:34	Grey Heron	1	depositing/lowland rivers; calling from river, not seen	PM
	VP6	26/05/2021	06:21	Grey Heron	1	depositing/lowland rivers; calling from river, not seen	PM
	VP6	26/05/2021	09:30	Grey Heron	1	depositing/lowland rivers; calling, not seen	PM
	VP3	15/11/2021	16:42	Mistle Thrush	4	cutover bog; flying	CR
	VP6	22/11/2021	12:18	Mistle Thrush	10	improved grassland, cutover bog and highly modified/non-native woodland; flying/calling, observed throughout survey	CR
	VP4	28/04/2021	21:39	Mallard	1	cutover bog; calling, not seen	PM
	VP6	22/10/2021	12:07	Mallard	4	depositing/lowland rivers; swimming on river	NM
	VP4	16/11/2021	17:09	Mallard	1	lakes and ponds and cutover bog; calling, no visual	CR
	VP4	16/11/2021	17:14	Mallard	1	lakes and ponds and cutover bog; calling	CR
	VP4	28/04/2021	20:57	Moorhen	1	lakes and ponds; calling	PM
	VP6	15/12/2021	12:05	Moorhen	1	watercourses; calling heard	KB
	VP6	06/04/2021		Meadow Pipit			PM
	VP6	26/05/2021	05:45	Meadow Pipit	1	cutover bog; displaying	PM
	VP4	17/06/2021	17:12	Meadow Pipit	1	cutover bog; singing intermittently throughout the survey	PM
	VP6	30/06/2021	15:27	Meadow Pipit	2	cutover bog; displaying periodically throughout survey	PM
	VP6	30/07/2021	15:16	Meadow Pipit	4	cutover bog; present throughout survey	PM

Vantage Point Surveys							
Map Ref.	VP	Date	Time	Species	Number	Habitat and activity	Surveyor
	VP6	06/09/2021		Meadow Pipit			TRea
	VP4	07/09/2021		Meadow Pipit			TRea
	VP6	22/10/2021		Meadow Pipit			NM
	VP3	23/10/2021		Meadow Pipit			NM
	VP3	15/11/2021	11:29	Meadow Pipit	11	cutover bog; flying/calling, observed throughout survey	CR
	VP4	16/11/2021	12:00	Meadow Pipit	9	cutover bog; flying/calling	CR
	VP5	19/11/2021	13:30	Meadow Pipit	5	improved grassland; flying/calling	CR
	VP6	22/11/2021	11:05	Meadow Pipit	21	cutover bog and improved grassland; flying/calling, observed throughout the survey.	CR
	VP6	15/12/2021	09:50	Meadow Pipit	2	cutover bog and scrub; foraging	KB
	VP4	16/02/2022	10:13	Meadow Pipit	2	cutover bog; calling	NS
	VP1	08/03/2022	14:28	Meadow Pipit	8	cutover bog; calling, some displaying activity	NS
	VP4	10/03/2022	14:18	Meadow Pipit	20	cutover bog; flying and calling, up to 20 seen flying and calling in the area	NS
	VP6	30/07/2021	10:49	Mute Swan	1	depositing/lowland rivers; call	PM
	VP3	23/10/2021	11:41	Mute Swan	3	depositing/lowland rivers; swimming on river	NM
	VP6	17/02/2022	11:08	Mute Swan	1	depositing/lowland rivers; feeding	NS
	VP6	22/10/2021		Redwing			NM

Vantage Point Surveys							
Map Ref.	VP	Date	Time	Species	Number	Habitat and activity	Surveyor
	VP3	15/11/2021		Redwing			CR
	VP4	16/11/2021		Redwing			CR
	VP5	19/11/2021		Redwing			CR
	VP6	22/11/2021		Redwing			CR
	VP3	23/12/2021	11:21	Redwing	22	hedgerows; foraging	KB
	VP5	03/01/2022	08:08	Redwing	270	hedgerows; foraging	KB
	VP6	22/11/2021	15:59	Water Rail	2	depositing/lowland rivers; calling, at least two water rails heard calling continuously until 16:30.	CR
	VP4	19/10/2021	10:06	Yellowhammer	1	scrub, highly modified/non-native woodland and cutover bog; calling within willow scrub on fringes of bog	NM

Table 1-64 Non-target species data (Vantage Point and Walkover survey Records)

Non-Target Species Records				
Date	**Survey**	**Species**	**Notes**	**Surveyor**
06/04/2021	Vantage Point Survey, VP6	Skylark		PM
06/04/2021	Vantage Point Survey, VP6	Blackbird		PM
06/04/2021	Vantage Point Survey, VP6	Barn Swallow		PM
06/04/2021	Vantage Point Survey, VP6	Sand Martin		PM
06/04/2021	Vantage Point Survey, VP6	Hooded Crow		PM
06/04/2021	Vantage Point Survey, VP6	Magpie		PM
06/04/2021	Vantage Point Survey, VP6	Pheasant		PM
06/04/2021	Vantage Point Survey, VP6	Woodpigeon		PM
06/04/2021	Vantage Point Survey, VP6	Pied Wagtail		PM
06/04/2021	Vantage Point Survey, VP6	Raven		PM
07/04/2021	Breeding Walkover Survey, 500M Survey Radius	Hooded Crow		PM
07/04/2021	Breeding Walkover Survey, 500M Survey Radius	Jackdaw		PM
07/04/2021	Breeding Walkover Survey, 500M Survey Radius	Wren		PM
07/04/2021	Breeding Walkover Survey, 500M Survey Radius	Robin		PM
07/04/2021	Breeding Walkover Survey, 500M Survey Radius	Chaffinch		PM
07/04/2021	Breeding Walkover Survey, 500M Survey Radius	Blackbird		PM
07/04/2021	Breeding Walkover Survey, 500M Survey Radius	Great Tit		PM
07/04/2021	Breeding Walkover Survey, 500M Survey Radius	Chiffchaff		PM
07/04/2021	Breeding Walkover Survey, 500M Survey Radius	Raven		PM

Non-Target Species Records				
Date	Survey	Species	Notes	Surveyor
07/04/2021	Breeding Walkover Survey, 500M Survey Radius	Woodpigeon		PM
07/04/2021	Breeding Walkover Survey, 500M Survey Radius	Song Thrush		PM
07/04/2021	Breeding Walkover Survey, 500M Survey Radius	Linnet		PM
07/04/2021	Breeding Walkover Survey, 500M Survey Radius	Skylark		PM
07/04/2021	Breeding Walkover Survey, 500M Survey Radius	Great Tit		PM
07/04/2021	Breeding Walkover Survey, 500M Survey Radius	Goldfinch		PM
07/04/2021	Breeding Walkover Survey, 500M Survey Radius	Starling		PM
07/04/2021	Breeding Walkover Survey, 500M Survey Radius	Willow Warbler		PM
07/04/2021	Breeding Walkover Survey, 500M Survey Radius	Bullfinch		PM
07/04/2021	Breeding Walkover Survey, 500M Survey Radius	Jay		PM
07/04/2021	Breeding Walkover Survey, 500M Survey Radius	Lesser Redpoll		PM
07/04/2021	Breeding Walkover Survey, 500M Survey Radius	Barn Swallow		PM
07/04/2021	Breeding Walkover Survey, 500M Survey Radius	Goldcrest		PM
28/04/2021	Vantage Point Survey, VP4	Raven		PM
28/04/2021	Vantage Point Survey, VP4	Hooded Crow		PM
28/04/2021	Vantage Point Survey, VP4	Woodpigeon		PM
28/04/2021	Vantage Point Survey, VP4	Barn Swallow		PM

Non-Target Species Records				
Date	Survey	Species	Notes	Surveyor
28/04/2021	Vantage Point Survey, VP4	Sand Martin		PM
28/04/2021	Vantage Point Survey, VP4	Chaffinch		PM
28/04/2021	Vantage Point Survey, VP4	Robin		PM
28/04/2021	Vantage Point Survey, VP4	Blackbird		PM
28/04/2021	Vantage Point Survey, VP4	Cuckoo		PM
28/04/2021	Vantage Point Survey, VP4	Song Thrush		PM
28/04/2021	Vantage Point Survey, VP4	Great Tit		PM
28/04/2021	Vantage Point Survey, VP4	Chiffchaff		PM
28/04/2021	Vantage Point Survey, VP4	Wren		PM
14/05/2021	Breeding Walkover Survey, 500m Survey Radius	House Sparrow		PM
14/05/2021	Breeding Walkover Survey, 500m Survey Radius	Woodpigeon		PM
14/05/2021	Breeding Walkover Survey, 500m Survey Radius	Hooded Crow		PM
14/05/2021	Breeding Walkover Survey, 500m Survey Radius	Wren		PM
14/05/2021	Breeding Walkover Survey, 500m Survey Radius	Robin		PM
14/05/2021	Breeding Walkover Survey, 500m Survey Radius	Cuckoo		PM
14/05/2021	Breeding Walkover Survey, 500m Survey Radius	Song Thrush		PM
14/05/2021	Breeding Walkover Survey, 500m Survey Radius	Dunnock		PM
14/05/2021	Breeding Walkover Survey, 500m Survey Radius	Chaffinch		PM
14/05/2021	Breeding Walkover Survey, 500m Survey Radius	Skylark		PM

Non-Target Species Records				
Date	Survey	Species	Notes	Surveyor
14/05/2021	Breeding Walkover Survey, 500m Survey Radius	Willow Warbler		PM
14/05/2021	Breeding Walkover Survey, 500m Survey Radius	Stonechat		PM
14/05/2021	Breeding Walkover Survey, 500m Survey Radius	Pheasant		PM
14/05/2021	Breeding Walkover Survey, 500m Survey Radius	Sedge Warbler		PM
14/05/2021	Breeding Walkover Survey, 500m Survey Radius	Chiffchaff		PM
14/05/2021	Breeding Walkover Survey, 500m Survey Radius	Goldfinch		PM
14/05/2021	Breeding Walkover Survey, 500m Survey Radius	Blackbird		PM
14/05/2021	Breeding Walkover Survey, 500m Survey Radius	Starling		PM
14/05/2021	Breeding Walkover Survey, 500m Survey Radius	Goldcrest		PM
14/05/2021	Breeding Walkover Survey, 500m Survey Radius	Barn Swallow		PM
14/05/2021	Breeding Walkover Survey, 500m Survey Radius	Raven		PM
14/05/2021	Breeding Walkover Survey, 500m Survey Radius	Blue Tit		PM
14/05/2021	Breeding Walkover Survey, 500m Survey Radius	Great Tit		PM
14/05/2021	Breeding Walkover Survey, 500m Survey Radius	Sand Martin		PM
14/05/2021	Breeding Walkover Survey, 500m Survey Radius	Coal Tit		PM

Non-Target Species Records				
Date	Survey	Species	Notes	Surveyor
21/05/2021	Vantage Point Survey, VP4	Woodpigeon		PM
21/05/2021	Vantage Point Survey, VP4	Raven		PM
21/05/2021	Vantage Point Survey, VP4	Hooded Crow		PM
21/05/2021	Vantage Point Survey, VP4	Mistle Thrush		PM
21/05/2021	Vantage Point Survey, VP4	Song Thrush		PM
21/05/2021	Vantage Point Survey, VP4	Blackbird		PM
21/05/2021	Vantage Point Survey, VP4	Willow Warbler		PM
21/05/2021	Vantage Point Survey, VP4	Robin		PM
21/05/2021	Vantage Point Survey, VP4	Wren		PM
21/05/2021	Vantage Point Survey, VP4	Chaffinch		PM
21/05/2021	Vantage Point Survey, VP4	Barn Swallow		PM
21/05/2021	Vantage Point Survey, VP4	Sand Martin		PM
26/05/2021	Vantage Point Survey, VP6	Blackbird		PM
26/05/2021	Vantage Point Survey, VP6	Robin		PM
26/05/2021	Vantage Point Survey, VP6	Barn Swallow		PM
26/05/2021	Vantage Point Survey, VP6	Sand Martin		PM
26/05/2021	Vantage Point Survey, VP6	Song Thrush		PM
26/05/2021	Vantage Point Survey, VP6	Skylark		PM
26/05/2021	Vantage Point Survey, VP6	Chaffinch		PM
26/05/2021	Vantage Point Survey, VP6	Chiffchaff		PM
26/05/2021	Vantage Point Survey, VP6	Goldfinch		PM
26/05/2021	Vantage Point Survey, VP6	Hooded Crow		PM
26/05/2021	Vantage Point Survey, VP6	Raven		PM
26/05/2021	Vantage Point Survey, VP6	Woodpigeon		PM
26/05/2021	Vantage Point Survey, VP6	Cuckoo		PM
17/06/2021	Vantage Point Survey, VP4	Mistle Thrush		PM
17/06/2021	Vantage Point Survey, VP4	Song Thrush		PM
17/06/2021	Vantage Point Survey, VP4	Robin		PM

Non-Target Species Records				
Date	Survey	Species	Notes	Surveyor
17/06/2021	Vantage Point Survey, VP4	Great Tit		PM
17/06/2021	Vantage Point Survey, VP4	Blue Tit		PM
17/06/2021	Vantage Point Survey, VP4	Sand Martin		PM
17/06/2021	Vantage Point Survey, VP4	Barn Swallow		PM
17/06/2021	Vantage Point Survey, VP4	House Martin		PM
17/06/2021	Vantage Point Survey, VP4	Hooded Crow		PM
17/06/2021	Vantage Point Survey, VP4	Raven		PM
17/06/2021	Vantage Point Survey, VP4	Woodpigeon		PM
17/06/2021	Vantage Point Survey, VP4	Starling		PM
17/06/2021	Vantage Point Survey, VP4	Chaffinch		PM
17/06/2021	Vantage Point Survey, VP4	Cuckoo		PM
18/06/2021	Breeding Walkover Survey, 500m Survey Radius	Wren		PM
18/06/2021	Breeding Walkover Survey, 500m Survey Radius	Hooded Crow		PM
18/06/2021	Breeding Walkover Survey, 500m Survey Radius	Raven		PM
18/06/2021	Breeding Walkover Survey, 500m Survey Radius	Cuckoo		PM
18/06/2021	Breeding Walkover Survey, 500m Survey Radius	House Sparrow		PM
18/06/2021	Breeding Walkover Survey, 500m Survey Radius	Blackbird		PM
18/06/2021	Breeding Walkover Survey, 500m Survey Radius	Robin		PM
18/06/2021	Breeding Walkover Survey, 500m Survey Radius	Blue Tit		PM
18/06/2021	Breeding Walkover Survey, 500m Survey Radius	Chiffchaff		PM

Non-Target Species Records				
Date	Survey	Species	Notes	Surveyor
18/06/2021	Breeding Walkover Survey, 500m Survey Radius	Chaffinch		PM
18/06/2021	Breeding Walkover Survey, 500m Survey Radius	Willow Warbler		PM
18/06/2021	Breeding Walkover Survey, 500m Survey Radius	Skylark		PM
18/06/2021	Breeding Walkover Survey, 500m Survey Radius	Sedge Warbler		PM
18/06/2021	Breeding Walkover Survey, 500m Survey Radius	Woodpigeon		PM
18/06/2021	Breeding Walkover Survey, 500m Survey Radius	Pied Wagtail		PM
18/06/2021	Breeding Walkover Survey, 500m Survey Radius	Song Thrush		PM
18/06/2021	Breeding Walkover Survey, 500m Survey Radius	Sand Martin		PM
18/06/2021	Breeding Walkover Survey, 500m Survey Radius	Barn Swallow		PM
18/06/2021	Breeding Walkover Survey, 500m Survey Radius	Whitethroat		PM
18/06/2021	Breeding Walkover Survey, 500m Survey Radius	Mistle Thrush		PM
18/06/2021	Breeding Walkover Survey, 500m Survey Radius	Goldcrest		PM
18/06/2021	Breeding Walkover Survey, 500m Survey Radius	Jay		PM
18/06/2021	Breeding Walkover Survey, 500m Survey Radius	Lesser Redpoll		PM
30/06/2021	Vantage Point Survey, VP6	Sand Martin		PM
30/06/2021	Vantage Point Survey, VP6	Barn Swallow		PM

Non-Target Species Records				
Date	Survey	Species	Notes	Surveyor
30/06/2021	Vantage Point Survey, VP6	House Martin		PM
30/06/2021	Vantage Point Survey, VP6	Skylark		PM
30/06/2021	Vantage Point Survey, VP6	Woodpigeon		PM
30/06/2021	Vantage Point Survey, VP6	Raven		PM
30/06/2021	Vantage Point Survey, VP6	Robin		PM
30/06/2021	Vantage Point Survey, VP6	Wren		PM
30/06/2021	Vantage Point Survey, VP6	Blackbird		PM
30/06/2021	Vantage Point Survey, VP6	Whitethroat		PM
30/06/2021	Vantage Point Survey, VP6	Dunnock		PM
30/06/2021	Vantage Point Survey, VP6	Starling		PM
30/06/2021	Vantage Point Survey, VP6	Willow Warbler		PM
23/07/2021	Breeding Walkover Survey, 500m Survey Radius	House Sparrow		PM
23/07/2021	Breeding Walkover Survey, 500m Survey Radius	Jackdaw		PM
23/07/2021	Breeding Walkover Survey, 500m Survey Radius	Blackbird		PM
23/07/2021	Breeding Walkover Survey, 500m Survey Radius	Woodpigeon		PM
23/07/2021	Breeding Walkover Survey, 500m Survey Radius	Wren		PM
23/07/2021	Breeding Walkover Survey, 500m Survey Radius	Robin		PM
23/07/2021	Breeding Walkover Survey, 500m Survey Radius	Chaffinch		PM
23/07/2021	Breeding Walkover Survey, 500m Survey Radius	Linnet		PM
23/07/2021	Breeding Walkover Survey, 500m Survey Radius	Goldfinch		PM

Non-Target Species Records				
Date	Survey	Species	Notes	Surveyor
23/07/2021	Breeding Walkover Survey, 500m Survey Radius	Stonechat		PM
23/07/2021	Breeding Walkover Survey, 500m Survey Radius	Coal Tit		PM
23/07/2021	Breeding Walkover Survey, 500m Survey Radius	Barn Swallow		PM
23/07/2021	Breeding Walkover Survey, 500m Survey Radius	Chiffchaff		PM
23/07/2021	Breeding Walkover Survey, 500m Survey Radius	Pied Wagtail		PM
23/07/2021	Breeding Walkover Survey, 500m Survey Radius	Great Tit		PM
23/07/2021	Breeding Walkover Survey, 500m Survey Radius	Blue Tit		PM
23/07/2021	Breeding Walkover Survey, 500m Survey Radius	Lesser Redpoll		PM
23/07/2021	Breeding Walkover Survey, 500m Survey Radius	Raven		PM
23/07/2021	Breeding Walkover Survey, 500m Survey Radius	Jay		PM
23/07/2021	Breeding Walkover Survey, 500m Survey Radius	Skylark		PM
23/07/2021	Breeding Walkover Survey, 500m Survey Radius	Hooded Crow		PM
27/07/2021	Vantage Point Survey, VP4	Hooded Crow		PM
27/07/2021	Vantage Point Survey, VP4	Raven		PM
27/07/2021	Vantage Point Survey, VP4	Woodpigeon		PM
27/07/2021	Vantage Point Survey, VP4	Jay		PM
27/07/2021	Vantage Point Survey, VP4	Sand Martin		PM

Non-Target Species Records				
Date	Survey	Species	Notes	Surveyor
27/07/2021	Vantage Point Survey, VP4	Barn Swallow		PM
27/07/2021	Vantage Point Survey, VP4	Song Thrush		PM
27/07/2021	Vantage Point Survey, VP4	Chaffinch		PM
27/07/2021	Vantage Point Survey, VP4	Wren		PM
27/07/2021	Vantage Point Survey, VP4	Pied Wagtail		PM
27/07/2021	Vantage Point Survey, VP4	Blackbird		PM
27/07/2021	Vantage Point Survey, VP4	Great Tit		PM
30/07/2021	Vantage Point Survey, VP6	Raven		PM
30/07/2021	Vantage Point Survey, VP6	Hooded Crow		PM
30/07/2021	Vantage Point Survey, VP6	Woodpigeon		PM
30/07/2021	Vantage Point Survey, VP6	Song Thrush		PM
30/07/2021	Vantage Point Survey, VP6	Barn Swallow		PM
30/07/2021	Vantage Point Survey, VP6	Sand Martin		PM
30/07/2021	Vantage Point Survey, VP6	Goldfinch		PM
30/07/2021	Vantage Point Survey, VP6	Skylark		PM
19/08/2021	Vantage Point Survey, VP6	Hooded Crow		TRea
19/08/2021	Vantage Point Survey, VP6	Raven		TRea
19/08/2021	Vantage Point Survey, VP6	Woodpigeon		TRea
19/08/2021	Vantage Point Survey, VP6	Barn Swallow		TRea
19/08/2021	Vantage Point Survey, VP6	Mistle Thrush		TRea
19/08/2021	Vantage Point Survey, VP6	Stonechat		TRea
19/08/2021	Vantage Point Survey, VP6	Whitethroat		TRea
19/08/2021	Vantage Point Survey, VP6	Sand Martin		TRea
19/08/2021	Vantage Point Survey, VP6	Willow Warbler		TRea
19/08/2021	Vantage Point Survey, VP6	Barn Swallow		TRea
26/08/2021	Vantage Point Survey, VP4	Sand Martin		TRea
26/08/2021	Vantage Point Survey, VP4	Woodpigeon		TRea
26/08/2021	Vantage Point Survey, VP4	Raven		TRea

Non-Target Species Records				
Date	Survey	Species	Notes	Surveyor
26/08/2021	Vantage Point Survey, VP4	Dunnock		TRea
26/08/2021	Vantage Point Survey, VP4	Robin		TRea
26/08/2021	Vantage Point Survey, VP4	Stonechat		TRea
06/09/2021	Vantage Point Survey, VP6	Hooded Crow		TRea
06/09/2021	Vantage Point Survey, VP6	Woodpigeon		TRea
06/09/2021	Vantage Point Survey, VP6	Raven		TRea
06/09/2021	Vantage Point Survey, VP6	Stonechat		TRea
06/09/2021	Vantage Point Survey, VP6	Sand Martin		TRea
06/09/2021	Vantage Point Survey, VP6	Mistle Thrush		TRea
06/09/2021	Vantage Point Survey, VP6	Whitethroat		TRea
07/09/2021	Vantage Point Survey, VP4	Woodpigeon		TRea
07/09/2021	Vantage Point Survey, VP4	Raven		TRea
07/09/2021	Vantage Point Survey, VP4	Robin		TRea
07/09/2021	Vantage Point Survey, VP4	Stonechat		TRea
07/09/2021	Vantage Point Survey, VP4	Wren		TRea
07/09/2021	Vantage Point Survey, VP4	Willow Warbler		TRea
07/09/2021	Vantage Point Survey, VP4	Goldfinch		TRea
07/09/2021	Vantage Point Survey, VP4	Sand Martin		TRea
07/09/2021	Vantage Point Survey, VP4	Goldcrest		TRea
07/09/2021	Vantage Point Survey, VP4	Great Tit		TRea
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Jay		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Mistle Thrush		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Blue Tit		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Long-tailed Tit		NM

Non-Target Species Records				
Date	Survey	Species	Notes	Surveyor
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Wren		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Magpie		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Linnet		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Robin		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Raven		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Woodpigeon		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Pheasant		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Goldcrest		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Great Tit		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Chaffinch		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Hooded Crow		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Stonechat		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Pied Wagtail		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Reed Bunting		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Dunnock		NM

Non-Target Species Records				
Date	Survey	Species	Notes	Surveyor
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Song Thrush		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Starling		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Skylark		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Bullfinch		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Goldfinch		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Siskin		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Chaffinch		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Jackdaw		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Rook		NM
21/10/2021	Winter Walkover Survey, 500m Survey Radius	Collared Dove		NM
22/10/2021	Vantage Point Survey, VP6	Blackbird		NM
22/10/2021	Vantage Point Survey, VP6	Raven		NM
22/10/2021	Vantage Point Survey, VP6	Wren		NM
22/10/2021	Vantage Point Survey, VP6	Stonechat		NM
22/10/2021	Vantage Point Survey, VP6	Linnet		NM
22/10/2021	Vantage Point Survey, VP6	Chaffinch		NM
22/10/2021	Vantage Point Survey, VP6	Pied Wagtail		NM
22/10/2021	Vantage Point Survey, VP6	Rook		NM
22/10/2021	Vantage Point Survey, VP6	Jackdaw		NM

Non-Target Species Records				
Date	Survey	Species	Notes	Surveyor
22/10/2021	Vantage Point Survey, VP6	Pheasant		NM
22/10/2021	Vantage Point Survey, VP6	Starling		NM
22/10/2021	Vantage Point Survey, VP6	Goldfinch		NM
22/10/2021	Vantage Point Survey, VP6	Reed Bunting		NM
22/10/2021	Vantage Point Survey, VP6	Woodpigeon		NM
22/10/2021	Vantage Point Survey, VP6	Jay		NM
22/10/2021	Vantage Point Survey, VP6	Mistle Thrush		NM
22/10/2021	Vantage Point Survey, VP6	Great Tit		NM
23/10/2021	Vantage Point Survey, VP3	Chaffinch		NM
23/10/2021	Vantage Point Survey, VP3	Raven		NM
23/10/2021	Vantage Point Survey, VP3	Pied Wagtail		NM
23/10/2021	Vantage Point Survey, VP3	Robin		NM
23/10/2021	Vantage Point Survey, VP3	Blackbird		NM
23/10/2021	Vantage Point Survey, VP3	Wren		NM
23/10/2021	Vantage Point Survey, VP3	Linnet		NM
23/10/2021	Vantage Point Survey, VP3	Hooded Crow		NM
23/10/2021	Vantage Point Survey, VP3	Great Tit		NM
23/10/2021	Vantage Point Survey, VP3	Woodpigeon		NM
23/10/2021	Vantage Point Survey, VP3	Collared Dove		NM
23/10/2021	Vantage Point Survey, VP3	Rook		NM
15/11/2021	Vantage Point Survey, VP3	Magpie		CR
15/11/2021	Vantage Point Survey, VP3	Linnet		CR
15/11/2021	Vantage Point Survey, VP3	Jay		CR
15/11/2021	Vantage Point Survey, VP3	Great Tit		CR
15/11/2021	Vantage Point Survey, VP3	Blue Tit		CR
15/11/2021	Vantage Point Survey, VP3	Bullfinch		CR
15/11/2021	Vantage Point Survey, VP3	Dunnock		CR
15/11/2021	Vantage Point Survey, VP3	Woodpigeon		CR

Non-Target Species Records				
Date	Survey	Species	Notes	Surveyor
15/11/2021	Vantage Point Survey, VP3	Jackdaw		CR
15/11/2021	Vantage Point Survey, VP3	Rook		CR
15/11/2021	Vantage Point Survey, VP3	Robin		CR
15/11/2021	Vantage Point Survey, VP3	Pied Wagtail		CR
15/11/2021	Vantage Point Survey, VP3	Wren		CR
15/11/2021	Vantage Point Survey, VP3	Blackbird		CR
15/11/2021	Vantage Point Survey, VP3	Hooded Crow		CR
16/11/2021	Vantage Point Survey, VP4	Jackdaw		CR
16/11/2021	Vantage Point Survey, VP4	Hooded Crow		CR
16/11/2021	Vantage Point Survey, VP4	Linnet		CR
16/11/2021	Vantage Point Survey, VP4	Raven		CR
16/11/2021	Vantage Point Survey, VP4	Wren		CR
16/11/2021	Vantage Point Survey, VP4	Magpie		CR
16/11/2021	Vantage Point Survey, VP4	Woodpigeon		CR
16/11/2021	Vantage Point Survey, VP4	Stonechat		CR
16/11/2021	Vantage Point Survey, VP4	Starling		CR
16/11/2021	Vantage Point Survey, VP4	Blackbird		CR
19/11/2021	Vantage Point Survey, VP5	Chaffinch		CR
19/11/2021	Vantage Point Survey, VP5	Hooded Crow		CR
19/11/2021	Vantage Point Survey, VP5	Magpie		CR
19/11/2021	Vantage Point Survey, VP5	Blackbird		CR
19/11/2021	Vantage Point Survey, VP5	Robin		CR
19/11/2021	Vantage Point Survey, VP5	Jackdaw		CR
19/11/2021	Vantage Point Survey, VP5	Woodpigeon		CR
19/11/2021	Vantage Point Survey, VP5	Dunnock		CR
19/11/2021	Vantage Point Survey, VP5	Wren		CR
19/11/2021	Vantage Point Survey, VP5	Blue Tit		CR
19/11/2021	Vantage Point Survey, VP5	Starling		CR

Non-Target Species Records				
Date	Survey	Species	Notes	Surveyor
19/11/2021	Vantage Point Survey, VP5	Bullfinch		CR
19/11/2021	Vantage Point Survey, VP5	Rook		CR
19/11/2021	Vantage Point Survey, VP5	Jay		CR
19/11/2021	Vantage Point Survey, VP5	Raven		CR
19/11/2021	Vantage Point Survey, VP5	Great Tit		CR
19/11/2021	Vantage Point Survey, VP5	Pied Wagtail		CR
19/11/2021	Vantage Point Survey, VP5	Coal Tit		CR
22/11/2021	Vantage Point Survey, VP6	Starling		CR
22/11/2021	Vantage Point Survey, VP6	Song Thrush		CR
22/11/2021	Vantage Point Survey, VP6	Blackbird		CR
22/11/2021	Vantage Point Survey, VP6	Stonechat		CR
22/11/2021	Vantage Point Survey, VP6	Chaffinch		CR
22/11/2021	Vantage Point Survey, VP6	Raven		CR
22/11/2021	Vantage Point Survey, VP6	Woodpigeon		CR
22/11/2021	Vantage Point Survey, VP6	Dunnock		CR
22/11/2021	Vantage Point Survey, VP6	Wren		CR
22/11/2021	Vantage Point Survey, VP6	Long-tailed Tit		CR
22/11/2021	Vantage Point Survey, VP6	Hooded Crow		CR
22/11/2021	Vantage Point Survey, VP6	Blue Tit		CR
22/11/2021	Vantage Point Survey, VP6	Reed Bunting		CR
22/11/2021	Vantage Point Survey, VP6	Pheasant		CR
09/12/2021	Vantage Point Survey, VP4	Blue Tit		KB
09/12/2021	Vantage Point Survey, VP4	Robin		KB
09/12/2021	Vantage Point Survey, VP4	Blackbird		KB
09/12/2021	Vantage Point Survey, VP4	Woodpigeon		KB
09/12/2021	Vantage Point Survey, VP4	Starling		KB
09/12/2021	Vantage Point Survey, VP4	Wren		KB
09/12/2021	Vantage Point Survey, VP4	Long-tailed Tit		KB

Non-Target Species Records				
Date	Survey	Species	Notes	Surveyor
09/12/2021	Vantage Point Survey, VP4	Hooded Crow		KB
09/12/2021	Vantage Point Survey, VP4	Raven		KB
09/12/2021	Vantage Point Survey, VP4	Great Tit		KB
09/12/2021	Vantage Point Survey, VP4	Bullfinch		KB
15/12/2021	Vantage Point Survey, VP6	Wren		KB
15/12/2021	Vantage Point Survey, VP6	Blackbird		KB
15/12/2021	Vantage Point Survey, VP6	Starling		KB
15/12/2021	Vantage Point Survey, VP6	Bullfinch		KB
15/12/2021	Vantage Point Survey, VP6	Hooded Crow		KB
15/12/2021	Vantage Point Survey, VP6	Raven		KB
15/12/2021	Vantage Point Survey, VP6	Reed Bunting		KB
15/12/2021	Vantage Point Survey, VP6	Lesser Redpoll		KB
15/12/2021	Vantage Point Survey, VP6	Fieldfare		KB
15/12/2021	Vantage Point Survey, VP6	Pheasant		KB
15/12/2021	Vantage Point Survey, VP6	Stonechat		KB
15/12/2021	Vantage Point Survey, VP6	Blue Tit		KB
15/12/2021	Vantage Point Survey, VP6	Song Thrush		KB
15/12/2021	Vantage Point Survey, VP6	Great Tit		KB
23/12/2021	Vantage Point Survey, VP3	Robin		KB
23/12/2021	Vantage Point Survey, VP3	Wren		KB
23/12/2021	Vantage Point Survey, VP3	Starling		KB
23/12/2021	Vantage Point Survey, VP3	Pied Wagtail		KB
23/12/2021	Vantage Point Survey, VP3	Reed Bunting		KB
23/12/2021	Vantage Point Survey, VP3	Mistle Thrush		KB
23/12/2021	Vantage Point Survey, VP3	Blackbird		KB
23/12/2021	Vantage Point Survey, VP3	Lesser Redpoll		KB
23/12/2021	Vantage Point Survey, VP3	Raven		KB
23/12/2021	Vantage Point Survey, VP3	Blue Tit		KB

Non-Target Species Records				
Date	Survey	Species	Notes	Surveyor
23/12/2021	Vantage Point Survey, VP3	Coal Tit		KB
23/12/2021	Vantage Point Survey, VP3	Bullfinch		KB
23/12/2021	Vantage Point Survey, VP3	Great Tit		KB
23/12/2021	Vantage Point Survey, VP3	Woodpigeon		KB
03/01/2022	Vantage Point Survey, VP5	Blackbird		KB
03/01/2022	Vantage Point Survey, VP5	Robin		KB
03/01/2022	Vantage Point Survey, VP5	Wren		KB
03/01/2022	Vantage Point Survey, VP5	Magpie		KB
03/01/2022	Vantage Point Survey, VP5	Rook		KB
03/01/2022	Vantage Point Survey, VP5	Coal Tit		KB
03/01/2022	Vantage Point Survey, VP5	Long-tailed Tit		KB
03/01/2022	Vantage Point Survey, VP5	Starling		KB
03/01/2022	Vantage Point Survey, VP5	Woodpigeon		KB
03/01/2022	Vantage Point Survey, VP5	Jackdaw		KB
03/01/2022	Vantage Point Survey, VP5	Raven		KB
03/01/2022	Vantage Point Survey, VP5	Hooded Crow		KB
03/01/2022	Vantage Point Survey, VP5	Fieldfare		KB
03/01/2022	Vantage Point Survey, VP5	Song Thrush		KB
03/01/2022	Vantage Point Survey, VP5	Chaffinch		KB
03/01/2022	Vantage Point Survey, VP5	Blue Tit		KB
03/01/2022	Vantage Point Survey, VP5	Great Tit		KB
03/01/2022	Vantage Point Survey, VP5	Dunnock		KB
25/01/2022	Vantage Point Survey, VP5	Raven		ZE
25/01/2022	Vantage Point Survey, VP5	Wren		ZE
25/01/2022	Vantage Point Survey, VP5	Robin		ZE
25/01/2022	Vantage Point Survey, VP5	Blackbird		ZE
25/01/2022	Vantage Point Survey, VP5	Rook		ZE
25/01/2022	Vantage Point Survey, VP5	House Sparrow		ZE

Non-Target Species Records				
Date	Survey	Species	Notes	Surveyor
25/01/2022	Vantage Point Survey, VP5	Starling	large flocks over the fields	ZE
25/01/2022	Vantage Point Survey, VP5	Song Thrush		ZE
25/01/2022	Vantage Point Survey, VP5	Great Tit		ZE
25/01/2022	Vantage Point Survey, VP5	Magpie		ZE
25/01/2022	Vantage Point Survey, VP5	Jackdaw		ZE
25/01/2022	Vantage Point Survey, VP5	Woodpigeon		ZE
25/01/2022	Vantage Point Survey, VP5	Hooded Crow		ZE
25/01/2022	Vantage Point Survey, VP5	Goldcrest		ZE
25/01/2022	Vantage Point Survey, VP5	Blue Tit		ZE
25/01/2022	Vantage Point Survey, VP5	Dunnock		ZE
25/01/2022	Vantage Point Survey, VP5	Chiffchaff		ZE
25/01/2022	Vantage Point Survey, VP5	Pied Wagtail		ZE
26/01/2022	Vantage Point Survey, VP3	Rook		ZE
26/01/2022	Vantage Point Survey, VP3	Raven		ZE
26/01/2022	Vantage Point Survey, VP3	Magpie		ZE
26/01/2022	Vantage Point Survey, VP3	Hooded Crow		ZE
26/01/2022	Vantage Point Survey, VP3	Pied Wagtail		ZE
26/01/2022	Vantage Point Survey, VP3	Woodpigeon		ZE
26/01/2022	Vantage Point Survey, VP3	Starling	large flocks over the fields	ZE
27/01/2022	Vantage Point Survey, VP4	Raven		ZE
27/01/2022	Vantage Point Survey, VP4	Rook		ZE
27/01/2022	Vantage Point Survey, VP4	Woodpigeon		ZE
27/01/2022	Vantage Point Survey, VP4	Blackbird		ZE
27/01/2022	Vantage Point Survey, VP4	Wren		ZE
27/01/2022	Vantage Point Survey, VP4	Song Thrush		ZE
27/01/2022	Vantage Point Survey, VP4	Long-tailed Tit		ZE
27/01/2022	Vantage Point Survey, VP4	Coal Tit		ZE
27/01/2022	Vantage Point Survey, VP4	Magpie		ZE

Non-Target Species Records				
Date	Survey	Species	Notes	Surveyor
27/01/2022	Vantage Point Survey, VP4	Robin		ZE
27/01/2022	Vantage Point Survey, VP4	Dunnock		ZE
27/01/2022	Vantage Point Survey, VP4	Blue Tit		ZE
27/01/2022	Vantage Point Survey, VP4	Robin		ZE
27/01/2022	Vantage Point Survey, VP4	Hooded Crow		ZE
27/01/2022	Vantage Point Survey, VP4	Starling	large flocks flying north	ZE
27/01/2022	Vantage Point Survey, VP4	Reed Bunting		ZE
31/01/2022	Vantage Point Survey, VP6	Great Tit		ZE
31/01/2022	Vantage Point Survey, VP6	Raven		ZE
31/01/2022	Vantage Point Survey, VP6	Rook		ZE
31/01/2022	Vantage Point Survey, VP6	Wren		ZE
31/01/2022	Vantage Point Survey, VP6	Fieldfare		ZE
31/01/2022	Vantage Point Survey, VP6	Woodpigeon		ZE
31/01/2022	Vantage Point Survey, VP6	Robin		ZE
31/01/2022	Vantage Point Survey, VP6	Magpie		ZE
31/01/2022	Vantage Point Survey, VP6	Starling		ZE
31/01/2022	Vantage Point Survey, VP6	Goldfinch		ZE
31/01/2022	Vantage Point Survey, VP6	Reed Bunting		ZE
31/01/2022	Vantage Point Survey, VP6	Blue Tit		ZE
31/01/2022	Vantage Point Survey, VP6	Song Thrush		ZE
31/01/2022	Vantage Point Survey, VP6	Lesser Redpoll		ZE
08/02/2022	Vantage Point Survey, VP5	Blackbird	flying	NS
08/02/2022	Vantage Point Survey, VP5	Wren	calling	NS
08/02/2022	Vantage Point Survey, VP5	Raven	flying and calling	NS
08/02/2022	Vantage Point Survey, VP5	Woodpigeon	flying and calling	NS
08/02/2022	Vantage Point Survey, VP5	Hooded Crow	flying	NS
08/02/2022	Vantage Point Survey, VP5	Magpie	flying and calling	NS
08/02/2022	Vantage Point Survey, VP5	Bullfinch	perched in hedge	NS

Non-Target Species Records				
Date	Survey	Species	Notes	Surveyor
08/02/2022	Vantage Point Survey, VP5	Blue Tit	flying	NS
08/02/2022	Vantage Point Survey, VP5	Woodpigeon	flying and calling	NS
08/02/2022	Vantage Point Survey, VP5	Dunnock	calling, flying and in hedge	NS
08/02/2022	Vantage Point Survey, VP5	Great Tit	flying	NS
08/02/2022	Vantage Point Survey, VP5	Pied Wagtail	flying and calling	NS
08/02/2022	Vantage Point Survey, VP5	Jackdaw	flying and calling	NS
08/02/2022	Vantage Point Survey, VP5	Mistle Thrush	flying	NS
08/02/2022	Vantage Point Survey, VP5	Robin	flying	NS
08/02/2022	Vantage Point Survey, VP5	Rook	flying and calling	NS
08/02/2022	Vantage Point Survey, VP5	Starling	flying and in field	NS
15/02/2022	Vantage Point Survey, VP3	Robin	flying	NS
15/02/2022	Vantage Point Survey, VP3	Wren	calling and flying	NS
15/02/2022	Vantage Point Survey, VP3	Song Thrush	calling and perched in tree	NS
15/02/2022	Vantage Point Survey, VP3	Raven	flying and calling	NS
15/02/2022	Vantage Point Survey, VP3	Hooded Crow	flying	NS
15/02/2022	Vantage Point Survey, VP3	Rook	flying	NS
15/02/2022	Vantage Point Survey, VP3	Woodpigeon	flying and calling	NS
15/02/2022	Vantage Point Survey, VP3	Magpie	flying	NS
16/02/2022	Vantage Point Survey, VP4	Robin	flying	NS
16/02/2022	Vantage Point Survey, VP4	Hooded Crow	flying	NS
16/02/2022	Vantage Point Survey, VP4	Raven	flying and calling	NS
16/02/2022	Vantage Point Survey, VP4	Fieldfare	flying	NS
16/02/2022	Vantage Point Survey, VP4	Blackbird	flying	NS
16/02/2022	Vantage Point Survey, VP4	Siskin	flying, calling and perched in tree	NS
17/02/2022	Vantage Point Survey, VP6	Wren	calling	NS

Non-Target Species Records				
Date	Survey	Species	Notes	Surveyor
17/02/2022	Vantage Point Survey, VP6	Raven	flying and calling	NS
17/02/2022	Vantage Point Survey, VP6	Rook	flying	NS
17/02/2022	Vantage Point Survey, VP6	Great Tit	flying	NS
17/02/2022	Vantage Point Survey, VP6	Reed Bunting	flying and perched on bush	NS
17/02/2022	Vantage Point Survey, VP6	Fieldfare	flying	NS
17/02/2022	Vantage Point Survey, VP6	Goldfinch	flying	NS
17/02/2022	Vantage Point Survey, VP6	Magpie	flying	NS
17/02/2022	Vantage Point Survey, VP6	Blackbird	flying	NS
17/02/2022	Vantage Point Survey, VP6	Woodpigeon	calling	NS
17/02/2022	Vantage Point Survey, VP6	Robin	flying	NS
17/02/2022	Vantage Point Survey, VP6	Starling	flying	NS
09/03/2022	Vantage Point Survey, VP6	Hooded Crow		NS
09/03/2022	Vantage Point Survey, VP6	Magpie		NS
09/03/2022	Vantage Point Survey, VP6	Woodpigeon		NS
09/03/2022	Vantage Point Survey, VP6	Blue Tit		NS
09/03/2022	Vantage Point Survey, VP6	Long-tailed Tit		NS
09/03/2022	Vantage Point Survey, VP6	Raven		NS
09/03/2022	Vantage Point Survey, VP6	Stonechat		NS
09/03/2022	Vantage Point Survey, VP6	Wren		NS
09/03/2022	Vantage Point Survey, VP6	Dunnock		NS
09/03/2022	Vantage Point Survey, VP6	Chaffinch		NS
09/03/2022	Vantage Point Survey, VP6	Robin		NS
10/03/2022	Vantage Point Survey, VP4	Rook		NS
10/03/2022	Vantage Point Survey, VP4	Lesser Redpoll		NS
10/03/2022	Vantage Point Survey, VP4	Siskin		NS
10/03/2022	Vantage Point Survey, VP4	Wren		NS
10/03/2022	Vantage Point Survey, VP4	Hooded Crow		NS

Non-Target Species Records				
Date	Survey	Species	Notes	Surveyor
10/03/2022	Vantage Point Survey, VP4	Starling	large flock c1000	NS
10/03/2022	Vantage Point Survey, VP4	Song Thrush		NS
10/03/2022	Vantage Point Survey, VP4	Raven		NS
10/03/2022	Vantage Point Survey, VP4	Stonechat		NS
10/03/2022	Vantage Point Survey, VP4	Chaffinch		NS
22/03/2022	Vantage Point Survey, VP5	Raven		ZOC
22/03/2022	Vantage Point Survey, VP5	Robin		ZOC
22/03/2022	Vantage Point Survey, VP5	Hooded Crow		ZOC
22/03/2022	Vantage Point Survey, VP5	Dunnock		ZOC
22/03/2022	Vantage Point Survey, VP5	Great Tit		ZOC
22/03/2022	Vantage Point Survey, VP5	Rook		ZOC
22/03/2022	Vantage Point Survey, VP5	Woodpigeon		ZOC
22/03/2022	Vantage Point Survey, VP5	Wren		ZOC
22/03/2022	Vantage Point Survey, VP5	Starling		ZOC
22/03/2022	Vantage Point Survey, VP5	Magpie		ZOC
22/03/2022	Vantage Point Survey, VP5	Blackbird		ZOC
23/03/2022	Vantage Point Survey, VP3	Raven		ZOC
23/03/2022	Vantage Point Survey, VP3	Jay		ZOC
23/03/2022	Vantage Point Survey, VP3	Wren		ZOC
23/03/2022	Vantage Point Survey, VP3	Hooded Crow		ZOC
23/03/2022	Vantage Point Survey, VP3	Rook		ZOC

Table 1-65 Walkover Non-target Species Data

Walkover Survey Records						
Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
	07/04/2021	07:11	Grey Heron	2	wet grassland; travelling (flyover; non-breeding)	PM
	07/04/2021	07:13	Mallard	1	wet grassland; circling/travelling (flyover; non-breeding)	PM
	07/04/2021	07:16	Mallard	2	wet grassland; circling (flyover; non-breeding)	PM
	07/04/2021	09:15	Mute Swan	1	lakes and ponds; feeding (suitable nesting habitat; possible breeder)	PM
	07/04/2021	09:21	Ringed Plover	1	cutover bog; feeding (suitable nesting habitat; possible breeder)	PM
	07/04/2021	09:21	Mute Swan	1	cutover bog and lakes and ponds; feeding (suitable nesting habitat; possible breeder)	PM
	07/04/2021	09:32	Mallard	1	cutover bog; travelling (flyover; non-breeding)	PM
	07/04/2021	09:32	Grey Heron	1	cutover bog and immature woodland; travelling (flyover; non-breeding)	PM
	07/04/2021	09:36	Mute Swan	2	cutover bog; travelling (flyover; non-breeding)	PM
	07/04/2021	09:21	Moorhen	1	cutover bog and lakes and ponds; calling (suitable nesting habitat; possible breeder)	PM
	07/04/2021	10:33	Mute Swan	3	depositing/lowland rivers; feeding, one farmyard goose present also (summering; non-breeding)	PM
	07/04/2021	10:33	Mallard	2	cutover bog; flushed, 2 males (summering; non-breeding)	PM
	07/04/2021	10:33	Lesser Black-backed Gull	1	cutover bog; travelling (flyover; non-breeding)	PM
	07/04/2021	12:38	Mallard	1	cutover bog; flushed from reeds, female (suitable nesting habitat; possible breeder)	PM
	07/04/2021		Meadow Pipit			PM
	14/05/2021	07:41	Meadow Pipit	1	cutover bog; carrying food (adult carrying food/faecal sac; confirmed breeding)	PM

Walkover Survey Records						
Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
	14/05/2021	07:59	Grey Heron	1	recently-felled woodland; travelling (flyover; non-breeding)	PM
	14/05/2021	08:05	Black-headed Gull	2	cutover bog; being mobbed by l. (flyover; non-breeding)	PM
	14/05/2021	08:18	Meadow Pipit	1	raised bog; displaying (courtship and display; probable breeding)	PM
	14/05/2021	09:23	Mallard	1	depositing/lowland rivers; flushed (flyover; non-breeding)	PM
	14/05/2021	09:26	Mallard	2	cutover bog; flushed (flyover; non-breeding)	PM
	14/05/2021	09:26	Mute Swan	1	depositing/lowland rivers; preening on bank, 2cy; with a white farmyard goose (summering; non-breeding)	PM
	14/05/2021	09:28	Meadow Pipit	1	cutover bog; perched (suitable nesting habitat; possible breeder)	PM
	14/05/2021	10:05	Meadow Pipit	1	cutover bog; displaying (courtship and display; probable breeding)	PM
	14/05/2021	10:13	Meadow Pipit	1	cutover bog; displaying (courtship and display; probable breeding)	PM
	14/05/2021	10:22	Mallard	2	cutover bog; flushed from drain (summering; non-breeding)	PM
	18/06/2021	05:24	Meadow Pipit	1	wet grassland; singing (singing male; possible breeder)	PM
	18/06/2021	07:20	Meadow Pipit	1	cutover bog; singing (singing male; possible breeder)	PM
	18/06/2021	07:49	Ringed Plover	1	cutover bog; feeding (suitable nesting habitat; possible breeder)	PM
	18/06/2021	07:49	Grey Heron	1	cutover bog; feeding (summering; non-breeding)	PM
	18/06/2021	07:49	Mallard	2	cutover bog; circling; calling, 2 males (summering; non-breeding)	PM

Walkover Survey Records						
Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
	18/06/2021	07:49	Black-headed Gull	1	cutover bog; calling (summering; non-breeding)	PM
	18/06/2021	09:09	Meadow Pipit	2	cutover bog; singing (singing male; possible breeder)	PM
	18/06/2021	09:54	Meadow Pipit	1	cutover bog; singing (singing male; possible breeder)	PM
	23/07/2021	08:01	Grey Heron	3	cutover bog; feeding (summering; non-breeding)	PM
	23/07/2021	08:01	Mallard	5	cutover bog; flew from flood (summering; non-breeding)	PM
	23/07/2021	08:01	Little Grebe	1	cutover bog; calling (suitable nesting habitat; possible breeder)	PM
	23/07/2021	08:01	Mallard	4	cutover bog; flushed (summering; non-breeding)	PM
	23/07/2021	08:01	Grey Heron	1	cutover bog; flushed (summering; non-breeding)	PM
	23/07/2021	08:27	Grey Heron	1	conifer plantation and cutover bog; travelling (flyover; non-breeding)	PM
	23/07/2021	09:10	Grey Heron	2	cutover bog and depositing/lowland rivers; travelling (flyover; non-breeding)	PM
	23/07/2021	09:14	Mute Swan	5	depositing/lowland rivers; feeding, 2ad & 3 juv (fledged young; confirmed breeding)	PM
	23/07/2021	09:41	Meadow Pipit	5	cutover bog; on bog, possibly a family flock (flyover; non-breeding)	PM
	20/10/2021	10:29	Grey Heron	1	scrub and cutover bog; flying across scrubby bog fringes and wetland (wintering)	NM
	21/10/2021	09:37	Mallard	5	lakes and ponds; swimming and calling on lake, fl (wintering)	NM
	21/10/2021	11:10	Mute Swan	1	depositing/lowland rivers; swimming on river (wintering)	NM
	21/10/2021		Meadow Pipit			NM
	27/01/2022	14:55	Redwing	8	conifer plantation; fly (wintering)	AOD
	27/01/2022	13:30	Meadow Pipit	6	cutover bog; fly (wintering)	AOD

Walkover Survey Records						
Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
	27/01/2022	13:40	Grey Heron	1	depositing/lowland rivers; fly, flew from inny (wintering)	AOD
	27/01/2022	14:57	Mute Swan	2	depositing/lowland rivers; foraging, pair on inny (wintering)	AOD
	28/01/2022	13:12	Meadow Pipit	2	wet grassland; fly (wintering)	AOD
	28/01/2022	15:12	Little Grebe	5	lakes and ponds; flying (wintering)	AOD
	28/01/2022	15:12	Mute Swan	1	lakes and ponds; feeding (wintering)	AOD
	28/01/2022	16:56	Mute Swan	11	lakes and ponds; foraging (wintering)	AOD
	22/02/2022	16:11	Mute Swan	2	lakes and ponds; feeding (wintering)	AOD
	22/02/2022	17:11	Mute Swan	2	cutover bog; feeding (wintering)	AOD
	22/02/2022	14:13	Meadow Pipit	4	cutover bog and wet grassland; fly (wintering)	AOD
	22/02/2022	17:13	Meadow Pipit	3	cutover bog; fly (wintering)	AOD
	23/02/2022	14:22	Redwing	30	wet grassland; fly (wintering)	AOD
	23/02/2022	14:22	Meadow Pipit	2	wet grassland; fly (wintering)	AOD
	23/02/2022	17:09	Meadow Pipit	2	cutover bog; displaying, display (courtship and display; probable breeding)	AOD
	23/02/2022	17:28	Mute Swan	2	lakes and ponds; flying (wintering)	AOD
	23/02/2022	17:28	Little Grebe	2	lakes and ponds; flying (wintering)	AOD

Table 1-66 Wildfowl Distribution Non-target Species Data

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
BH001	L. Kinale	16/09/2021	10:49	Black-headed Gull	13	mesotrophic lakes; flying and swooping over lake	NM
CM002	L. Sheelin	16/09/2021	08:49	Common Gull	5	mesotrophic lakes; swirliong and circling over lake - often diving and landing briefly on lake surface	NM
CM004	L. Kinale	16/09/2021	10:57	Common Gull	2	mesotrophic lakes; flying over lake	NM
CM003	L. Sheelin	16/09/2021	10:05	Common Gull	3	mesotrophic lakes; flying and wheeling over lake	NM
CM001		16/09/2021	08:47	Common Gull	6	mesotrophic lakes; flying across lake - numerous flyovers near s3	NM
GA001	Derragh Lough	16/09/2021	12:15	Gadwall	24	mesotrophic lakes; swimming and dabbling along lake fringes, all along s shore	NM
GG007	L. Sheelin	16/09/2021	10:00	Great Crested Grebe	15	mesotrophic lakes; swimming on lake (with juveniles present)	NM
GG004	L. Sheelin	16/09/2021	08:50	Great Crested Grebe	5	mesotrophic lakes; swimming on lake (including 2x juveniles)	NM
GG001		16/09/2021	16:26	Great Crested Grebe	5	mesotrophic lakes; swimming on lake	NM
GG002	L. Sheelin	16/09/2021	08:34	Great Crested Grebe	3	mesotrophic lakes; swimming on lake	NM
GG003	L. Sheelin	16/09/2021	08:37	Great Crested Grebe	7	mesotrophic lakes; swimming on lake	NM
GG005	L. Sheelin	16/09/2021	08:55	Great Crested Grebe	1	mesotrophic lakes; swimming on lake	NM
GG009	L. Kinale	16/09/2021	11:28	Great Crested Grebe	5	mesotrophic lakes; swimming and diving on lake (with 1 juvenile present)	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
GG006	S2	16/09/2021	09:16	Great Crested Grebe	8	mesotrophic lakes; swimming and diving on lake (+ 1 juvenile)	NM
GG008	L. Kinale	16/09/2021	10:52	Great Crested Grebe	13	mesotrophic lakes; swimming and diving on lake	NM
H001	L. Bracklagh	16/09/2021	10:40	Grey Heron	1	mesotrophic lakes; wading on edge of reedbed at lake fringe	NM
H002	BN2	16/09/2021	14:23	Grey Heron	1	cutover bog; perched within bog wetland	NM
H003	R. Inny	16/09/2021	15:25	Grey Heron	1	amenity grassland (improved) and depositing/lowland rivers; perched on grassy bank of river	NM
H004	Derragh Lough	16/09/2021	12:28	Grey Heron	1	mixed broadleaved woodland and mesotrophic lakes; flying s along w side of lake	NM
H005	L. Kinale	16/09/2021	11:12	Grey Heron	1	mesotrophic lakes; flying s across reedy lake fringes	NM
H006		16/09/2021	08:33	Grey Heron	2	mesotrophic lakes; flying n along lake shore	NM
H007	L. Sheelin	16/09/2021	08:47	Grey Heron	1	mesotrophic lakes; calling within reeds along lake shore	NM
LB001		16/09/2021	16:26	Lesser Black-backed Gull	1	mixed conifer woodland; flying w	NM
LB006	L. Kinale	16/09/2021	11:31	Lesser Black-backed Gull	2	mesotrophic lakes; flying sw across lake - swooping close to surface on occasion	NM
LB001		16/09/2021	09:39	Lesser Black-backed Gull	2	immature woodland and cutover bog; flying sw across bog and woodland	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
LB002		16/09/2021	09:27	Lesser Black-backed Gull	1	mixed conifer woodland, hedgerows and improved agricultural grassland; flying se	NM
LB005	L. Kinale	16/09/2021	10:08	Lesser Black-backed Gull	1	mesotrophic lakes and scrub; flying s along w lake shore	NM
LB003		16/09/2021	09:48	Lesser Black-backed Gull	5	raised bog and immature woodland; flying over land just to s of lake	NM
LB004	S1	16/09/2021	09:47	Lesser Black-backed Gull	2	mesotrophic lakes, immature woodland and mixed broadleaved woodland; flying e along lake shore	NM
LB002		16/09/2021	08:46	Lesser Black-backed Gull	3	mesotrophic lakes; flying across lake	NM
LG003		16/09/2021	13:24	Little Grebe	3	dystrophic lakes and cutover bog; swimming on diving on flooded bog - bog pool	NM
LG002		16/09/2021	16:30	Little Grebe	2	depositing/lowland rivers; swimming and diving on river	NM
LG008	L. Sheelin	16/09/2021	10:03	Little Grebe	9	mesotrophic lakes; swimming and diving on lake - close to reed bed border	NM
LG001	L. Bracklagh	16/09/2021	10:40	Little Grebe	7	mesotrophic lakes; swimming and diving on lake	NM
LG004	Derragh Lough	16/09/2021	12:23	Little Grebe	11	mesotrophic lakes; calling within reedbeds	NM
LG006	S1	16/09/2021	10:07	Little Grebe	3	mesotrophic lakes; calling and swimming within edge reeds	NM
LG005	L. Sheelin	16/09/2021	09:17	Little Grebe	3	mesotrophic lakes; calling and diving within overhanging boughs of willow and ashe	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
LG007	L. Sheelin	16/09/2021	09:47	Little Grebe	4	mesotrophic lakes and reed and large sedge swamps; calling along lake shore	NM
MA001	L. Sheelin	16/09/2021	09:17	Mallard	7	mesotrophic lakes; swimming on lake and around weedy fringes	NM
MA002		16/09/2021	17:00	Mallard	12	mesotrophic lakes; swimming on lake	NM
MA003	L. Kinale	16/09/2021	11:32	Mallard	11	mesotrophic lakes; swimming and dabbling within reeds and floating vegetation	NM
MA004	BN2	16/09/2021	14:12	Mallard	6	cutover bog; roosting on bare peat within flooded bog area	NM
MA005	Derragh Lough	16/09/2021	12:15	Mallard	49	mesotrophic lakes; dabbling on lake, throughout lake	NM
MA006	L. Sheelin	16/09/2021	08:50	Mallard	4	mesotrophic lakes; calling and frequent noise from reedy fringes	NM
MH001	L. Bracklagh	16/09/2021	10:40	Moorhen	6	mesotrophic lakes; wading within reedbed at lake fringe, most likely a lot more individuals around reedbed perimeter of lake	NM
MH002	L. Sheelin	16/09/2021	08:37	Moorhen	7	reed and large sedge swamps and mesotrophic lakes; wading at reedy fringes of lake	NM
MH003	R. Inny - Carnagh Br.	16/09/2021	15:25	Moorhen	3	depositing/lowland rivers; swimming on weedy river	NM
MH004		16/09/2021	16:30	Moorhen	2	depositing/lowland rivers; swimming on river	NM
MH005		16/09/2021	16:27	Moorhen	18	mesotrophic lakes; swimming at reedbed fringe on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
MH006	BN2	16/09/2021	14:21	Moorhen	2	cutover bog; calling within reedy part of bog wetland	NM
MH007	L. Sheelin	16/09/2021	09:19	Moorhen	3	mesotrophic lakes; calling within reedy fringes of lake	NM
MH008	L. Sheelin	16/09/2021	10:12	Moorhen	5	mesotrophic lakes; calling within reeds and overhanging trees at edge of lake	NM
MH009	L. Sheelin	16/09/2021	08:30	Moorhen	3	mesotrophic lakes and reed and large sedge swamps; calling within reeds	NM
MH010	L. Sheelin	16/09/2021	09:57	Moorhen	13	mesotrophic lakes; calling from lakes edge + swimming amongst reed beds	NM
MH011	L. Sheelin	16/09/2021	09:50	Moorhen	3	mesotrophic lakes; calling from edge of lake	NM
MH012	Derragh Lough	16/09/2021	12:17	Moorhen	26	mesotrophic lakes; calling and wading within reedy lake fringes, throughout lake	NM
	R. Inny	16/09/2021	16:10	Mute Swan	3	depositing/lowland rivers; swimming on river - 2 adults + 1 juvenile	NM
	R. Inny	16/09/2021	15:53	Mute Swan	5	depositing/lowland rivers; swimming on river	NM
	L. Sheelin	16/09/2021	09:58	Mute Swan	8	mesotrophic lakes; swimming on lake and around small islands	NM
	Derrach Lough	16/09/2021	12:14	Mute Swan	88	mesotrophic lakes; swimming on lake + social calls (+ with 4 juveniles), throughout lake	NM
	L. Bracklagh	16/09/2021	10:41	Mute Swan	9	mesotrophic lakes; swimming on lake, 5 adults + 4 juveniles	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
		16/09/2021	16:27	Mute Swan	19	mesotrophic lakes; swimming on lake	NM
	L. Sheelin	16/09/2021	08:34	Mute Swan	5	mesotrophic lakes; swimming on lake	NM
	L. Sheelin	16/09/2021	08:40	Mute Swan	37	mesotrophic lakes; swimming on lake	NM
	L. Sheelin	16/09/2021	08:51	Mute Swan	6	mesotrophic lakes; swimming on lake	NM
	L. Sheelin	16/09/2021	08:45	Mute Swan	18	mesotrophic lakes; swimming on lake	NM
	L. Sheelin	16/09/2021	08:54	Mute Swan	5	mesotrophic lakes; swimming on lake	NM
	L. Sheelin	16/09/2021	09:18	Mute Swan	29	mesotrophic lakes; swimming on lake	NM
	L. Sheelin	16/09/2021	09:27	Mute Swan	3	mesotrophic lakes; swimming on lake	NM
	L. Sheelin	16/09/2021	10:23	Mute Swan	5	mesotrophic lakes; swimming on lake	NM
	L. Kinale	16/09/2021	10:50	Mute Swan	5	mesotrophic lakes; swimming on lake	NM
	L. Kinale	16/09/2021	10:50	Mute Swan	10	mesotrophic lakes; swimming on lake	NM
	L. Kinale	16/09/2021	10:50	Mute Swan	63	mesotrophic lakes; swimming on lake	NM
	L. Kinale	16/09/2021	10:52	Mute Swan	41	mesotrophic lakes; swimming on lake	NM
	L. Kinale	16/09/2021	11:28	Mute Swan	12	mesotrophic lakes; swimming on lake	NM
	L. Kinale	16/09/2021	11:45	Mute Swan	2	mesotrophic lakes; noisily taking off from lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
WA001	BN2	16/09/2021	14:16	Water Rail	1	cutover bog; pig calls coming from far side of bog wetland	NM
WA002	L. Sheelin	16/09/2021	08:43	Water Rail	2	reed and large sedge swamps and mesotrophic lakes; pig calls coming from edge reeds	NM
BH012	L. D'varagh	17/09/2021	15:45	Black-headed Gull	12	mesotrophic lakes; swirling over n side of lake	NM
BH011	L. D'varagh	17/09/2021	15:54	Black-headed Gull	8	mesotrophic lakes; swirling over lake + diving to surface on occasion	NM
BH015	L. D'varagh	17/09/2021	15:58	Black-headed Gull	7	mesotrophic lakes; swirling over lake	NM
BH017	L. D'varagh	17/09/2021	13:04	Black-headed Gull	2	mesotrophic lakes; swirling over lake	NM
BH009	L. Iron	17/09/2021	18:34	Black-headed Gull	5	mesotrophic lakes; swirling and swooping over nw side of lake before flying away n	NM
BH007		17/09/2021	14:45	Black-headed Gull	49	mesotrophic lakes and improved agricultural grassland; perched and preening on grassy lake edge - some individuals flying low and chasing each other near	NM
BH016		17/09/2021	16:00	Black-headed Gull	23	mesotrophic lakes; flying over lake, numerous flyovers throughout	NM
BH018	L. D'varagh	17/09/2021	13:50	Black-headed Gull	3	mesotrophic lakes; flying low over edge of lake - perching on pontoon and landing on water (+ calling)	NM
BH004	L. D'varagh	17/09/2021	13:00	Black-headed Gull	1	mesotrophic lakes; flying across lake	NM
BH010	L. D'varagh	17/09/2021	15:45	Black-headed Gull	17	mesotrophic lakes; flying across lake, numerous flyovers	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
BH013	L. D'varagh	17/09/2021	15:54	Black-headed Gull	25	mesotrophic lakes; flying across lake, numerous flyovers	NM
BH014	L. D'varagh	17/09/2021	15:43	Black-headed Gull	9	mesotrophic lakes; flying across lake, numerous flyovers	NM
BH003	L. D'varagh	17/09/2021	13:02	Black-headed Gull	5	mesotrophic lakes; circling over narrow end of lake	NM
BH006		17/09/2021	14:54	Black-headed Gull	6	mesotrophic lakes, reed and large sedge swamps and scrub; circling over lake and adjacent land	NM
BH005	L. D'varagh	17/09/2021	13:11	Black-headed Gull	3	mesotrophic lakes; circling over lake	NM
BH002	L. D'varagh	17/09/2021	13:35	Black-headed Gull	2	mesotrophic lakes; circling low over small floating jetty - landing briefly on water and on jetty	NM
BH008	L. D'varagh	17/09/2021	14:32	Black-headed Gull	4	mesotrophic lakes; circling and diving over lake	NM
CA001	L. D'varagh	17/09/2021	13:21	Cormorant	1	mesotrophic lakes; swimming and diving on lake	NM
CA002	L. D'varagh	17/09/2021	15:53	Cormorant	1	mesotrophic lakes; flying e across lake	NM
CA003	L. D'varagh	17/09/2021	13:19	Cormorant	1	mesotrophic lakes; flying along lake	NM
CM005		17/09/2021	13:58	Common Gull	2	improved agricultural grassland and treelines; flying nw along far side of lake	NM
GA002	L. Iron	17/09/2021	19:00	Gadwall	24	mesotrophic lakes; swimming and foraging on lake	NM
GG018	L. D'varagh	17/09/2021	15:41	Great Crested Grebe	23	mesotrophic lakes; swimming on lake (+ with present juveniles)	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
GG023	L. D'varagh	17/09/2021	13:16	Great Crested Grebe	5	mesotrophic lakes; swimming on lake (+ constant calling by juvenile)	NM
GG017	L. D'varagh	17/09/2021	14:40	Great Crested Grebe	16	mesotrophic lakes; swimming on lake - n section of lake	NM
GG011	L. D'varagh	17/09/2021	12:58	Great Crested Grebe	2	mesotrophic lakes; swimming on lake	NM
GG012	L. D'varagh	17/09/2021	13:03	Great Crested Grebe	9	mesotrophic lakes; swimming on lake	NM
GG015	L. D'varagh	17/09/2021	13:09	Great Crested Grebe	3	mesotrophic lakes; swimming on lake	NM
GG016	L. D'varagh	17/09/2021	13:22	Great Crested Grebe	3	mesotrophic lakes; swimming on lake	NM
GG019	L. D'varagh	17/09/2021	16:10	Great Crested Grebe	14	mesotrophic lakes; swimming on lake	NM
GG020	L. D'varagh	17/09/2021	16:14	Great Crested Grebe	7	mesotrophic lakes; swimming on lake	NM
GG022	L. D'varagh	17/09/2021	13:10	Great Crested Grebe	4	mesotrophic lakes; swimming on lake	NM
GG024	L. D'varagh	17/09/2021	13:56	Great Crested Grebe	3	mesotrophic lakes; swimming on lake	NM
GG025	L. Iron	17/09/2021	19:17	Great Crested Grebe	3	mesotrophic lakes; swimming on lake	NM
GG010	L. D'varagh	17/09/2021	12:55	Great Crested Grebe	5	mesotrophic lakes; swimming and diving on lake (with young calling)	NM
GG021	L. D'varagh	17/09/2021	13:07	Great Crested Grebe	3	mesotrophic lakes; swimming (resting) on lake	NM
GG013	L. D'varagh	17/09/2021	13:21	Great Crested Grebe	2	mesotrophic lakes; resting on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
GG014	L. D'varagh	17/09/2021	13:35	Great Crested Grebe	4	mesotrophic lakes; adults and young on lake - constant chirping from juveniles	NM
H008	L. D'varagh	17/09/2021	12:56	Grey Heron	1	mesotrophic lakes; perched on floating jetty	NM
H009	L. D'varagh	17/09/2021	14:59	Grey Heron	1	mesotrophic lakes and reed and large sedge swamps; calling from edge of lake	NM
LB008		17/09/2021	14:45	Lesser Black-backed Gull	23	mesotrophic lakes and improved agricultural grassland; perched and preening on grassy lake edge	NM
LB009		17/09/2021	18:47	Lesser Black-backed Gull	2	improved agricultural grassland and hedgerows; flying nw over farmland	NM
LB007		17/09/2021	14:35	Lesser Black-backed Gull	1	mesotrophic lakes; flying ne across w edge of lake	NM
LB010	L. D'varagh	17/09/2021	15:51	Lesser Black-backed Gull	2	mesotrophic lakes; flying ne across lake	NM
LG009		17/09/2021	12:38	Little Grebe	1	cutover bog; swimming on flooded bog pool	NM
LG012	L. Iron	17/09/2021	19:00	Little Grebe	23	mesotrophic lakes; swimming and foraging on lake	NM
LG010	L. D'varagh	17/09/2021	15:40	Little Grebe	15	mesotrophic lakes; swimming and calling within reedy islets on lake	NM
LG011	L. D'varagh	17/09/2021	16:32	Little Grebe	4	mesotrophic lakes; calling and diving on lake	NM
MA007	L. Iron	17/09/2021	19:10	Mallard	46	mesotrophic lakes; swimming and foraging on lake	NM
MA008	L. D'varagh	17/09/2021	16:35	Mallard	2	mesotrophic lakes; flushed from edge reeds	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
MH013	L. Iron	17/09/2021	19:15	Moorhen	38	mesotrophic lakes and reed and large sedge swamps; wading along reedy edges and amonsgt weedy floating vegetation, most likely an underestimate of numbers	NM
MH014	L. D'varagh	17/09/2021	16:03	Moorhen	27	mesotrophic lakes; calling within fringe reed beds, most likely an underestimate	NM
MH015	L. D'varagh	17/09/2021	13:21	Moorhen	15	mesotrophic lakes; calling within edge reed beds (throughout narrow part of lake)	NM
MH016	L. D'varagh	17/09/2021	15:47	Moorhen	16	mesotrophic lakes; calling and waqding within reed islets on lake fringe	NM
MH017	L. D'varagh	17/09/2021	14:43	Moorhen	6	mesotrophic lakes and reed and large sedge swamps; calling and wading within fringe reedbeds	NM
MH018	L. D'varagh	17/09/2021	16:33	Moorhen	3	mesotrophic lakes; calling and ading in reedy lake fringes	NM
	L. D'varagh	17/09/2021	12:59	Mute Swan	6	mesotrophic lakes; swimming on lake and along reed fringes (2 adults + 4 juveniles)	NM
	L. D'varagh	17/09/2021	16:35	Mute Swan	5	mesotrophic lakes; swimming on lake (+ 2 juveniles)	NM
	Bracklagh Lough	17/09/2021	12:30	Mute Swan	7	mesotrophic lakes; swimming on lake	NM
	L. D'varagh	17/09/2021	15:47	Mute Swan	30	mesotrophic lakes; swimming on lake	NM
	L. D'varagh	17/09/2021	15:47	Mute Swan	17	mesotrophic lakes; swimming on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
	L. D'varagh	17/09/2021	15:49	Mute Swan	41	mesotrophic lakes; swimming on lake	NM
	L. D'varagh	17/09/2021	15:39	Mute Swan	14	mesotrophic lakes; swimming on lake	NM
	L. D'vaagh	17/09/2021	16:09	Mute Swan	4	mesotrophic lakes; swimming on lake	NM
	L. D'varagh	17/09/2021	13:06	Mute Swan	2	mesotrophic lakes; swimming on lake	NM
	L. Iron	17/09/2021	19:15	Mute Swan	38	mesotrophic lakes; swimming and foraging on lake	NM
WA003	L. D'varagh	17/09/2021	15:52	Water Rail	2	mesotrophic lakes; pig calls from lake fringes	NM
BH023	L. D'varagh	29/09/2021	15:58	Black-headed Gull	12	mesotrophic lakes; swirling and swooping over lake	NM
BH021	L. D'varagh	29/09/2021	15:38	Black-headed Gull	2	mesotrophic lakes and mixed broadleaved woodland; flying over sw of lake and adjacent woodland	NM
BH019	Bracklagh Lough	29/09/2021	09:25	Black-headed Gull	3	mesotrophic lakes; flying over and swimming on lake	NM
BH020	L. Kinale	29/09/2021	10:04	Black-headed Gull	6	mesotrophic lakes; flying and swooping over lake	NM
BH022	L' D'varagh	29/09/2021	16:00	Black-headed Gull	1	mesotrophic lakes; flying and swooping over lake	NM
BH024	L. Sheelin	29/09/2021	08:07	Black-headed Gull	5	lakes and ponds; flying across lake	NM
BH026	L. Sheelin	29/09/2021	08:16	Black-headed Gull	6	lakes and ponds; flying across lake	NM
BH028	L. Sheelin	29/09/2021	08:45	Black-headed Gull	4	lakes and ponds; flying across lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
BH027		29/09/2021	08:36	Black-headed Gull	2	raised bog and scrub; flying across bog and scrub	NM
BH025	L. Sheelin	29/09/2021	08:17	Black-headed Gull	16	lakes and ponds; circlng and swooping over lake	NM
CA004	L. Sheelin	29/09/2021	08:11	Cormorant	1	lakes and ponds; flying low across lake	NM
CA005	L. Sheelin	29/09/2021	08:20	Cormorant	2	lakes and ponds; flying low across lake	NM
GA003	Derragh Lough	29/09/2021	11:04	Gadwall	35	mesotrophic lakes; swimming and foraging on lake	NM
GG031	L. Sheelin	29/09/2021	08:03	Great Crested Grebe	3	lakes and ponds; swimming on lake (w/ 2x juveniles)	NM
GG030	L. Sheelin	29/09/2021	08:12	Great Crested Grebe	3	lakes and ponds; swimming on lake	NM
GG033	L. Sheelin	29/09/2021	08:45	Great Crested Grebe	3	lakes and ponds; swimming on lake	NM
GG027	L. D'varagh	29/09/2021	15:56	Great Crested Grebe	3	mesotrophic lakes; swimming at lake fringes (+ 2 juveniles calling)	NM
GG026	L. Kinale	29/09/2021	10:16	Great Crested Grebe	7	mesotrophic lakes; swimming and diving on lake	NM
GG028	L. D'varagh	29/09/2021	15:58	Great Crested Grebe	3	mesotrophic lakes; swimming and diving on lake	NM
GG029	L. Sheelin	29/09/2021	08:00	Great Crested Grebe	2	lakes and ponds; swimming and diving on lake	NM
GG032	L. Sheelin	29/09/2021	08:19	Great Crested Grebe	6	lakes and ponds; swimming and diving on lake	NM
GG034	L. Sheelin	29/09/2021	08:53	Great Crested Grebe	1	lakes and ponds; swimming and diving on lake	NM
H010		29/09/2021	09:24	Grey Heron	1	mesotrophic lakes; flying low across lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
H011	L. Kinale	29/09/2021	12:10	Grey Heron	1	mesotrophic lakes; calling from lake edge	NM
LB012	L. Sheelin	29/09/2021	08:10	Lesser Black-backed Gull	3	lakes and ponds; flying over lake	NM
LB011		29/09/2021	16:02	Lesser Black-backed Gull	1	mesotrophic lakes; flying across lake	NM
LG014	L. D'varagh	29/09/2021	15:58	Little Grebe	13	mesotrophic lakes; swimming and diving within reedy fringes	NM
LG015	Derragh Lough	29/09/2021	10:57	Little Grebe	38	mesotrophic lakes; swimming and diving on lake	NM
LG017	L. Sheelin	29/09/2021	08:13	Little Grebe	5	lakes and ponds; swimming and diving on lake	NM
LG013		29/09/2021	13:10	Little Grebe	3	cutover bog; swimming and diving on bog pool	NM
LG018	L. Sheelin	29/09/2021	08:46	Little Grebe	8	lakes and ponds; swimming and diving near lake edge	NM
LG016	L. Sheelin	29/09/2021	08:12	Little Grebe	6	lakes and ponds; calling within reedy margins of lake	NM
MA009	L. Sheelin	29/09/2021	08:24	Mallard	5	lakes and ponds; swimming on lake	NM
MA010	L. Sheelin	29/09/2021	08:46	Mallard	7	lakes and ponds; swimming on lake	NM
MA011	L. D'varagh	29/09/2021	16:17	Mallard	19	mesotrophic lakes; swimming and foraging on lake	NM
MA012	Derragh Lough	29/09/2021	10:55	Mallard	57	mesotrophic lakes; swimming and foraging on lake	NM
MA013	L. D'varagh	29/09/2021	15:42	Mallard	24	mesotrophic lakes; swimming and dabbling on lake	NM
MA014	L. D'varagh	29/09/2021	16:15	Mallard	9	mesotrophic lakes; swimming and dabbling in weedy edge	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
MA015	L. Kinale	29/09/2021	10:03	Mallard	23	mesotrophic lakes; swimming and dabbling along lake fringes	NM
MA016	Derragh Lough	29/09/2021	12:45	Mallard	7	mesotrophic lakes; flying over lake	NM
MA017		29/09/2021	12:43	Mallard	18	mesotrophic lakes; flying in wide circles over w of derragh lough	NM
MA018	L. D'varagh	29/09/2021	15:09	Mallard	2	mesotrophic lakes; calling within reeds	NM
MA019	L. Kinale	29/09/2021	12:15	Mallard	2	mesotrophic lakes; calling from lake edge	NM
MA020	L. Sheelin	29/09/2021	08:13	Mallard	5	lakes and ponds; calling and swimming within reedy edges of lake	NM
MH019	L. Sheelin	29/09/2021	08:18	Moorhen	3	lakes and ponds; wading on edge of reedbed	NM
MH020	Derragh Lough	29/09/2021	11:00	Moorhen	22	mesotrophic lakes; swimming and wading within reedy fringes, approx. count - likely that some were missed	NM
MH021	L. Sheelin	29/09/2021	08:02	Moorhen	7	lakes and ponds; calling within reedy margins of lake	NM
MH022	L. Sheelin	29/09/2021	08:23	Moorhen	3	lakes and ponds; calling within reedy edges of lake	NM
MH023	Bracklagh Lough	29/09/2021	09:34	Moorhen	1	mesotrophic lakes and reed and large sedge swamps; calling within reeds along fringes of lake	NM
MH024	L. Kinale	29/09/2021	12:16	Moorhen	2	mesotrophic lakes; calling from lake edge	NM
	L. D'varagh	29/09/2021	16:06	Mute Swan	6	mesotrophic lakes; swimming within reedy lake fringes	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
	L. Kinale	29/09/2021	10:00	Mute Swan	6	mesotrophic lakes; swimming on lake and within reedy fringes	NM
	L. Kinale	29/09/2021	10:02	Mute Swan	56	mesotrophic lakes and reed and large sedge swamps; swimming on lake + roosting within reedy edges	NM
	L. Sheelin	29/09/2021	08:20	Mute Swan	29	lakes and ponds; swimming on lake (n shore)	NM
	Bracklagh Lough	29/09/2021	09:25	Mute Swan	16	mesotrophic lakes; swimming on lake	NM
	L. Kinale	29/09/2021	10:00	Mute Swan	12	mesotrophic lakes; swimming on lake	NM
	L. Kinale	29/09/2021	10:00	Mute Swan	14	mesotrophic lakes; swimming on lake	NM
	L. Kinale	29/09/2021	10:06	Mute Swan	18	mesotrophic lakes; swimming on lake	NM
	L. D'varagh	29/09/2021	15:32	Mute Swan	17	mesotrophic lakes; swimming on lake	NM
	L. D'varagh	29/09/2021	15:55	Mute Swan	28	mesotrophic lakes; swimming on lake	NM
	L. D'varagh	29/09/2021	16:16	Mute Swan	7	mesotrophic lakes; swimming on lake	NM
	L. Sheelin	29/09/2021	07:57	Mute Swan	4	lakes and ponds; swimming on lake	NM
	L. Sheelin	29/09/2021	08:05	Mute Swan	6	lakes and ponds; swimming on lake	NM
	L. Sheelin	29/09/2021	07:04	Mute Swan	18	lakes and ponds; swimming on lake	NM
	L. Sheelin	29/09/2021	08:15	Mute Swan	4	lakes and ponds; swimming on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
	L. Sheelin	29/09/2021	08:45	Mute Swan	12	lakes and ponds; swimming on lake	NM
	L. Sheelin	29/09/2021	08:50	Mute Swan	4	lakes and ponds; swimming on lake	NM
	L. Sheelin	29/09/2021	08:57	Mute Swan	46	lakes and ponds; swimming on lake	NM
	Derragh Lough	29/09/2021	10:56	Mute Swan	155	mesotrophic lakes; swimming and foraging on lake, approx count	NM
	L. Sheelin	29/09/2021	08:22	Mute Swan	8	lakes and ponds; swimmiming on lake	NM
WA004	L. Sheelin	29/09/2021	08:19	Water Rail	3	lakes and ponds; calling from within reedy margins	NM
BH029	L. Iron	30/09/2021	17:51	Black-headed Gull	6	lakes and ponds, reed and large sedge swamps and scrub; flying around lake perimeter	NM
GG035	L. Iron	30/09/2021	18:12	Great Crested Grebe	6	lakes and ponds; swimming on lake	NM
LG019	L. Iron	30/09/2021	18:27	Little Grebe	21	lakes and ponds; swimming and diving on lake	NM
MA021	L. Iron	30/09/2021	18:30	Mallard	79	lakes and ponds; swimming and dabbling on lake	NM
	L. Iron	30/09/2021	18:30	Mute Swan	28	lakes and ponds; swimming on lake	NM
H012	L. Iron	11/10/2021	17:02	Grey Heron	1	lakes and ponds and reed and large sedge swamps; flying low and calling along lake shore	NM
LG020	L. Iron	11/10/2021	17:30	Little Grebe	14	lakes and ponds; swimming on lake	NM
MA022	L. Iron	11/10/2021	17:30	Mallard	56	lakes and ponds; swimming and dabbling on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
	L. Iron	11/10/2021	17:30	Mute Swan	24	lakes and ponds; swimming on lake	NM
BH035	L. D'varagh	12/10/2021	16:33	Black-headed Gull	9	lakes and ponds; swirling over lake	NM
BH031	L. Sheelin	12/10/2021	08:06	Black-headed Gull	7	lakes and ponds; roosting near lake edge + flying around spot	NM
BH032	L. Sheelin	12/10/2021	08:16	Black-headed Gull	32	lakes and ponds; flying out over open water - not as open group but as frequent individuals	NM
BH030	Bracklagh Lough	12/10/2021	08:57	Black-headed Gull	7	lakes and ponds; flying and diving over lake and around fringes	NM
BH033	L. Sheelin	12/10/2021	08:20	Black-headed Gull	2	lakes and ponds and scrub; flying along s shore	NM
BH034	L. D'varagh	12/10/2021	16:20	Black-headed Gull	25	lakes and ponds; flying across lake - not as one large group but as frequent individuals	NM
CA006	Derragh Lough	12/10/2021	11:08	Cormorant	3	lakes and ponds; swimming and flying over lake	NM
CA007	L. D'varagh	12/10/2021	16:35	Cormorant	2	lakes and ponds; flying low across lake	NM
CA008		12/10/2021	09:25	Cormorant	1	depositing/lowland rivers and mixed broadleaved woodland; flying	NM
CA009		12/10/2021	09:29	Cormorant	1	mixed broadleaved woodland and lakes and ponds; flying	NM
GG036	L. Kinale	12/10/2021	10:09	Great Crested Grebe	2	lakes and ponds; swimming on lake	NM
GG037	L. Kinale	12/10/2021	12:02	Great Crested Grebe	4	lakes and ponds; swimming on lake	NM
GG038	L. Sheelin	12/10/2021	08:03	Great Crested Grebe	1	lakes and ponds; swimming on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
GG039	L. Sheelin	12/10/2021	08:06	Great Crested Grebe	3	lakes and ponds; swimming on lake	NM
GG040	L. Sheelin	12/10/2021	08:12	Great Crested Grebe	2	lakes and ponds; swimming on lake	NM
GG041	L. Sheelin	12/10/2021	08:15	Great Crested Grebe	2	lakes and ponds; swimming on lake	NM
GG042	L. Sheelin	12/10/2021	08:24	Great Crested Grebe	3	lakes and ponds; swimming on lake	NM
GG043	L. D'varagh	12/10/2021	16:05	Great Crested Grebe	4	lakes and ponds; swimming on lake	NM
GG045	L. D'varagh	12/10/2021	16:36	Great Crested Grebe	2	lakes and ponds; swimming on lake	NM
GG044	L. D'varagh	12/10/2021	16:17	Great Crested Grebe	3	lakes and ponds; swimming and diving on lake	NM
GN001	L. D'varagh	12/10/2021	16:23	Goldeneye	12	lakes and ponds; swimming on lake	NM
GN002	L. D'varagh	12/10/2021	16:31	Goldeneye	13	lakes and ponds; flying at mid height (~15m) across lake - heading se	NM
H013	R. Inny	12/10/2021	09:21	Grey Heron	1	depositing/lowland rivers; perched on bridge	NM
H014		12/10/2021	09:26	Grey Heron	1	depositing/lowland rivers and mixed broadleaved woodland; perched in tree along river	NM
H015		12/10/2021	09:30	Grey Heron	1	lakes and ponds; foraging within reeds	NM
H016	L. D'varagh	12/10/2021	16:57	Grey Heron	1	lakes and ponds; flying across lake and calling	NM
H017	L. Sheelin	12/10/2021	08:18	Grey Heron	2	lakes and ponds; flying across lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
H018	L. D'varagh	12/10/2021	16:15	Grey Heron	1	lakes and ponds; flying across lake	NM
H019	L. D'varagh	12/10/2021	16:12	Grey Heron	2	lakes and ponds and scrub; flushed from edges of lake	NM
H020	L. Sheelin	12/10/2021	08:20	Grey Heron	1	lakes and ponds and reed and large sedge swamps; calling within reedy margins	NM
LB013	L. Sheelin	12/10/2021	08:09	Lesser Black-backed Gull	2	lakes and ponds; flying across sw corner of lake	NM
LB014	L. D'varagh	12/10/2021	16:21	Lesser Black-backed Gull	3	lakes and ponds; flying across lake	NM
LG029	L. D'varagh	12/10/2021	16:12	Little Grebe	4	lakes and ponds; swimming and diving with complex of reedy islets	NM
LG024	Derragh Lough	12/10/2021	11:10	Little Grebe	18	lakes and ponds; swimming and diving on lake (+ calling)	NM
LG023	L. Kinale	12/10/2021	10:18	Little Grebe	2	lakes and ponds; swimming and diving on lake	NM
LG027	L. Sheelin	12/10/2021	08:26	Little Grebe	2	lakes and ponds; swimming and diving on lake	NM
LG028	L. D'varagh	12/10/2021	16:05	Little Grebe	14	lakes and ponds; swimming and diving on lake	NM
LG030	L. D'varagh	12/10/2021	16:18	Little Grebe	6	lakes and ponds; swimming and diving near lake shore	NM
LG022	L. Kinale	12/10/2021	10:06	Little Grebe	5	lakes and ponds; swimming and diving along reedy fringes	NM
LG031	L. D'varagh	12/10/2021	16:09	Little Grebe	8	lakes and ponds; calling within reedy margins of lake	NM
LG025	L. Sheelin	12/10/2021	08:03	Little Grebe	5	lakes and ponds; calling within reedy margins	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
LG026	L. Sheelin	12/10/2021	08:20	Little Grebe	6	lakes and ponds; calling within reedy margins	NM
LG021	L. Kinale	12/10/2021	09:51	Little Grebe	3	lakes and ponds; calling within reeds along lake fringe	NM
MA023	L. Kinale	12/10/2021	12:06	Mallard	6	lakes and ponds; swimming on lake	NM
MA024	L. D'varagh	12/10/2021	16:04	Mallard	12	lakes and ponds; swimming on lake	NM
MA025	L. D'varagh	12/10/2021	16:30	Mallard	6	lakes and ponds; swimming on lake	NM
MA026	L. Kinale	12/10/2021	10:12	Mallard	7	lakes and ponds; swimming and dabbling on lake	NM
MA027	Derragh Lough	12/10/2021	11:10	Mallard	18	lakes and ponds; swimming and dabbling mostly along lake fringes	NM
MA028	L. D'varagh	12/10/2021	16:07	Mallard	5	lakes and ponds; flushed from lake edge	NM
MA029	L. Sheelin	12/10/2021	08:23	Mallard	12	lakes and ponds; calling within reedy fringes of lake	NM
MH025	L. Sheelin	12/10/2021	08:26	Moorhen	2	lakes and ponds; swimming near reedy lake edges	NM
MH026	L. Sheelin	12/10/2021	08:18	Moorhen	7	lakes and ponds; swimming and calling near lake edge - around r. inny exit	NM
MH027	L. Sheelin	12/10/2021	08:02	Moorhen	2	lakes and ponds; calling within reedy margins of lake	NM
MH028	L. Sheelin	12/10/2021	08:07	Moorhen	1	lakes and ponds; calling within reedy margins of lake	NM
MH029	Derragh Lough	12/10/2021	11:10	Moorhen	29	lakes and ponds; calling within reedy margins, all over lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
MH030	L. Sheelin	12/10/2021	08:21	Moorhen	3	lakes and ponds and reed and large sedge swamps; calling within reedy margins	NM
MH031		12/10/2021	10:08	Moorhen	9	lakes and ponds; calling within reedy lake margins	NM
MH032	L. D'varagh	12/10/2021	16:31	Moorhen	3	lakes and ponds; calling within reedy edges	NM
MH033		12/10/2021	09:51	Moorhen	4	lakes and ponds; calling with reedy margins of lake	NM
	L. Kinale	12/10/2021	12:00	Mute Swan	6	lakes and ponds; swimming within reedbeds	NM
	L. D'varagh	12/10/2021	16:14	Mute Swan	6	lakes and ponds; swimming within complex of reedy islets	NM
	L. Sheelin	12/10/2021	08:20	Mute Swan	27	lakes and ponds; swimming on lake - n side	NM
	L. Kinale	12/10/2021	10:05	Mute Swan	9	lakes and ponds; swimming on lake	NM
	Derragh Lough	12/10/2021	11:10	Mute Swan	156	lakes and ponds; swimming on lake, all over lake	NM
	L. Kinale	12/10/2021	12:00	Mute Swan	16	lakes and ponds; swimming on lake	NM
	L. Kinale	12/10/2021	12:03	Mute Swan	12	lakes and ponds; swimming on lake	NM
	L. Kinale	12/10/2021	12:04	Mute Swan	63	lakes and ponds; swimming on lake	NM
	L. D'varagh	12/10/2021	17:11	Mute Swan	39	lakes and ponds; swimming on lake	NM
	L. Sheelin	12/10/2021	08:05	Mute Swan	3	lakes and ponds; swimming on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
	L. Sheelin	12/10/2021	08:05	Mute Swan	5	lakes and ponds; swimming on lake	NM
	L. Sheelin	12/10/2021	08:08	Mute Swan	15	lakes and ponds; swimming on lake	NM
	L. Sheelin	12/10/2021	08:14	Mute Swan	3	lakes and ponds; swimming on lake	NM
	L. Sheelin	12/10/2021	08:23	Mute Swan	6	lakes and ponds; swimming on lake	NM
	L. D'varagh	12/10/2021	16:08	Mute Swan	17	lakes and ponds; swimming on lake	NM
	L. D'varagh	12/10/2021	16:06	Mute Swan	23	lakes and ponds; swimming on lake	NM
	L. D'varagh	12/10/2021	16:10	Mute Swan	7	lakes and ponds; swimming on lake	NM
	L. D'varagh	12/10/2021	16:24	Mute Swan	23	lakes and ponds; swimming on lake	NM
	L. D'varagh	12/10/2021	16:20	Mute Swan	3	lakes and ponds; swimming on lake	NM
	L. D'varagh	12/10/2021	16:29	Mute Swan	11	lakes and ponds; swimming on lake	NM
	L. D'varagh	12/10/2021	16:32	Mute Swan	5	lakes and ponds; swimming on lake	NM
	R. Inny	12/10/2021	15:24	Mute Swan	2	watercourses; swimming and feeding on river	NM
	Bracklagh Lough	12/10/2021	08:54	Mute Swan	16	lakes and ponds; swimming and feeding on lake	NM
	L. D'varagh	12/10/2021	15:36	Mute Swan	29	lakes and ponds; swimmimg on lake	NM
	L. Sheelin	12/10/2021	08:09	Mute Swan	3	lakes and ponds; flying low across lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
WA005		12/10/2021	10:15	Water Rail	2	lakes and ponds and reed and large sedge swamps; pig calls from wet reedy margins	NM
WA006	L. Sheelin	12/10/2021	08:07	Water Rail	3	lakes and ponds; pig calls from reedy margins	NM
BH036	L. Iron	25/10/2021	17:35	Black-headed Gull	15	lakes and ponds and reed and large sedge swamps; swirling over lake and adjacent wetland	NM
GG046	L. Iron	25/10/2021	17:50	Great Crested Grebe	3	lakes and ponds; swimming on lake	NM
LG032	L. Iron	25/10/2021	17:08	Little Grebe	20	lakes and ponds; swimming and diving on lake, ideal lg habitat	NM
MA030	L. Iron	25/10/2021	17:30	Mallard	59	lakes and ponds; swimming on lake	NM
MH034	L. Iron	25/10/2021	17:30	Moorhen	12	lakes and ponds and reed and large sedge swamps; calling and wading within wetland margins of lake	NM
	L. Iron	25/10/2021	17:32	Mute Swan	57	lakes and ponds; swimming on lake	NM
BH037		26/10/2021	09:16	Black-headed Gull	3	lakes and ponds; flying and swirling low over lake	NM
BH038	L. Sheelin	26/10/2021	14:18	Black-headed Gull	2	lakes and ponds; flying across lake	NM
CA010		26/10/2021	15:08	Cormorant	2	lakes and ponds; soaring over lake	NM
CA011	L. Sheelin	26/10/2021	14:02	Cormorant	6	lakes and ponds; roosting on buoys	NM
CA012	L. Sheelin	26/10/2021	15:01	Cormorant	1	lakes and ponds; perched on rock	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
CA013		26/10/2021	15:59	Cormorant	1	improved agricultural grassland and hedgerows; flying s across farmland	NM
CA014		26/10/2021	09:23	Cormorant	1	lakes and ponds; flying low across lake	NM
CA015		26/10/2021	09:35	Cormorant	2	lakes and ponds; flying high across lake	NM
CA016		26/10/2021	11:27	Cormorant	1	lakes and ponds, semi-natural grassland and mixed broadleaved woodland; flying high across lake	NM
GG050		26/10/2021	09:46	Great Crested Grebe	2	lakes and ponds; swimming on lake	NM
GG051	Derragh Lough	26/10/2021	11:23	Great Crested Grebe	2	lakes and ponds; swimming on lake	NM
GG052	L. Sheelin	26/10/2021	14:09	Great Crested Grebe	2	lakes and ponds; swimming on lake	NM
GG053	L. Sheelin	26/10/2021	14:52	Great Crested Grebe	3	lakes and ponds; swimming on lake	NM
GG054	L. Sheelin	26/10/2021	14:57	Great Crested Grebe	3	lakes and ponds; swimming on lake	NM
GG055	L. Sheelin	26/10/2021	14:56	Great Crested Grebe	7	lakes and ponds; swimming on lake	NM
GG056	L. Sheelin	26/10/2021	15:03	Great Crested Grebe	2	lakes and ponds; swimming on lake	NM
GG057	L. Sheelin	26/10/2021	15:13	Great Crested Grebe	3	lakes and ponds; swimming on lake	NM
GG058		26/10/2021	15:20	Great Crested Grebe	2	lakes and ponds; swimming on lake	NM
GG047		26/10/2021	09:11	Great Crested Grebe	6	lakes and ponds; swimming and diving on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
GG048		26/10/2021	09:14	Great Crested Grebe	2	lakes and ponds; swimming and diving on lake	NM
GG049		26/10/2021	09:15	Great Crested Grebe	5	lakes and ponds; swimming and diving on lake	NM
GG059	L. Kinale	26/10/2021	16:09	Great Crested Grebe	3	lakes and ponds; swimming and diving on lake	NM
H021		26/10/2021	12:47	Grey Heron	1	cutover bog; perched on flooded bog	NM
H022	Bracklagh Lough	26/10/2021	16:19	Grey Heron	1	lakes and ponds; perched along lake shore	NM
H023	Derragh Lough	26/10/2021	11:20	Grey Heron	1	lakes and ponds; flying across lake	NM
H024		26/10/2021	10:16	Grey Heron	1	depositing/lowland rivers; flushed from river	NM
H025		26/10/2021	12:45	Grey Heron	1	scrub; calling within wet scrub	NM
H026		26/10/2021	15:14	Grey Heron	1	lakes and ponds; calling from reedy fringes	NM
H027	L. Sheelin	26/10/2021	14:26	Grey Heron	1	lakes and ponds; calling from lake margin	NM
LG035	Derragh Lough	26/10/2021	11:24	Little Grebe	47	lakes and ponds; swimming and diving on lake + calling within reedy fringes	NM
LG037	L. Sheelin	26/10/2021	14:15	Little Grebe	13	lakes and ponds; swimming and diving on lake	NM
LG039	L. Sheelin	26/10/2021	14:18	Little Grebe	7	lakes and ponds; swimming and diving on lake	NM
LG038	L. Sheelin	26/10/2021	14:23	Little Grebe	2	lakes and ponds; diving on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
LG036		26/10/2021	12:15	Little Grebe	1	lakes and ponds and cutover bog; diving on bog drainage pond	NM
LG034		26/10/2021	09:33	Little Grebe	6	lakes and ponds; calling within reedy islets	NM
LG040		26/10/2021	14:54	Little Grebe	6	lakes and ponds; calling within reedy fringes	NM
LG033		26/10/2021	09:11	Little Grebe	7	lakes and ponds; calling within reed islets + diving	NM
MA031		26/10/2021	15:09	Mallard	6	lakes and ponds; swimming within reeds	NM
MA032		26/10/2021	09:45	Mallard	6	lakes and ponds; swimming on lake	NM
MA033		26/10/2021	09:47	Mallard	4	lakes and ponds; swimming on lake	NM
MA034		26/10/2021	10:21	Mallard	17	lakes and ponds; swimming and dabbling on lake	NM
MA035	Derragh Lough	26/10/2021	11:25	Mallard	15	lakes and ponds; swimming and dabbling on lake	NM
MA036	Lough Bane	26/10/2021	13:19	Mallard	16	lakes and ponds; swimming and calling on lake	NM
MA037	L. Sheelin	26/10/2021	14:01	Mallard	4	lakes and ponds; swimming and calling on lake	NM
MA038		26/10/2021	09:41	Mallard	12	lakes and ponds; flying n across lake	NM
MA039		26/10/2021	11:41	Mallard	2	lakes and ponds and mixed broadleaved woodland; flying across lake and woodland fringes	NM
MA040		26/10/2021	08:45	Mallard	2	lakes and ponds; calling within reedy fringes of lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
MH035	Derragh Lough	26/10/2021	11:25	Moorhen	4	lakes and ponds; wading within reedy fringes	NM
MH036		26/10/2021	14:53	Moorhen	6	lakes and ponds; calling within reedy fringes of lake	NM
MH037		26/10/2021	09:18	Moorhen	2	lakes and ponds; calling within reedy fringes	NM
MH038		26/10/2021	09:51	Moorhen	2	lakes and ponds; calling within reedy fringes	NM
MH039		26/10/2021	15:10	Moorhen	8	lakes and ponds; calling and swimming within reeds	NM
		26/10/2021	09:39	Mute Swan	16	lakes and ponds; wading and foraging along grassy fringe	NM
		26/10/2021	15:08	Mute Swan	1	lakes and ponds; swimming within reeds	NM
		26/10/2021	09:17	Mute Swan	12	lakes and ponds; swimming on lake	NM
		26/10/2021	09:36	Mute Swan	28	lakes and ponds; swimming on lake	NM
		26/10/2021	09:42	Mute Swan	19	lakes and ponds; swimming on lake	NM
		26/10/2021	09:48	Mute Swan	6	lakes and ponds; swimming on lake	NM
		26/10/2021	09:47	Mute Swan	36	lakes and ponds; swimming on lake	NM
		26/10/2021	09:45	Mute Swan	2	lakes and ponds; swimming on lake	NM
	Derragh Lough	26/10/2021	11:23	Mute Swan	202	lakes and ponds; swimming on lake	NM
	Lough Bane	26/10/2021	13:21	Mute Swan	6	lakes and ponds; swimming on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
	L. Sheelin	26/10/2021	14:05	Mute Swan	16	lakes and ponds; swimming on lake	NM
	L. Sheelin	26/10/2021	14:13	Mute Swan	8	lakes and ponds; swimming on lake	NM
	L. Sheelin	26/10/2021	14:51	Mute Swan	4	lakes and ponds; swimming on lake	NM
	L. Sheelin	26/10/2021	14:59	Mute Swan	18	lakes and ponds; swimming on lake	NM
	L. Sheelin	26/10/2021	15:03	Mute Swan	3	lakes and ponds; swimming on lake	NM
	L. Kinale	26/10/2021	16:08	Mute Swan	16	lakes and ponds; swimming on lake	NM
	Bracklagh Lough	26/10/2021	16:17	Mute Swan	24	lakes and ponds; swimming on lake	NM
		26/10/2021	09:35	Mute Swan	4	lakes and ponds; swimming near campsite	NM
		26/10/2021	09:10	Mute Swan	2	lakes and ponds; swimming and foraging on lake	NM
		26/10/2021	10:21	Mute Swan	34	lakes and ponds; swimming and foraging on lake	NM
		26/10/2021	14:14	Mute Swan	39	lakes and ponds; swimming along lake edge + grazing on shore	NM
WA007		26/10/2021	15:15	Water Rail	2	lakes and ponds; pig calls from reedy fringes	NM
BH039	L. D'varagh	08/11/2021	12:30	Black-headed Gull	56	lakes and ponds and mixed broadleaved woodland; swirling over lower narrow part of lake	NM
CA017	L. D'varagh	08/11/2021	12:31	Cormorant	1	lakes and ponds; swimming on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
CA018	L. D'varagh	08/11/2021	12:56	Cormorant	2	lakes and ponds; flying se low across lake	NM
GG060	L. D'varagh	08/11/2021	12:33	Great Crested Grebe	2	lakes and ponds; swimming on lake	NM
GG061	Bracklagh Lough	08/11/2021	14:34	Great Crested Grebe	3	lakes and ponds; swimming on lake	NM
LG041	L. D'varagh	08/11/2021	12:31	Little Grebe	3	lakes and ponds; calling within reeds along lake fringe	NM
	Bracklagh Lough	08/11/2021	14:33	Mute Swan	26	lakes and ponds; swimming on lake	NM
BH040	L. Sheelin	09/11/2021	09:37	Black-headed Gull	13	lakes and ponds; circling over lake - wheeling and descending regularly towards water	NM
CA019	L. Sheelin	09/11/2021	10:02	Cormorant	2	lakes and ponds; swimming and diving on lake	NM
CA020		09/11/2021	11:48	Cormorant	2	improved agricultural grassland and hedgerows; flyinfg n along adjacent area	NM
GA004	Derragh Lough	09/11/2021	11:32	Gadwall	9	lakes and ponds; swimming and feeding along lake edge	NM
GG063	L. Sheelin	09/11/2021	09:24	Great Crested Grebe	2	lakes and ponds; swimming on lake	NM
GG062	L. Sheelin	09/11/2021	09:14	Great Crested Grebe	4	lakes and ponds; swimming and diving on lake	NM
LB015	L. Sheelin	09/11/2021	09:38	Lesser Black-backed Gull	4	lakes and ponds; flying high across lake	NM
LB016		09/11/2021	10:12	Lesser Black-backed Gull	3	bogs and scrub; flying across bog and scrub to s of lake	NM
LG042	L. Iron	09/11/2021	16:21	Little Grebe	16	lakes and ponds; swimming and diving on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
LG044	Derragh Lough	09/11/2021	11:32	Little Grebe	4	lakes and ponds; swimming and diving on lake	NM
LG043	L. Sheelin	09/11/2021	09:23	Little Grebe	5	lakes and ponds; calling within reedy fringes of lake	NM
MA041	L. Iron	09/11/2021	10:56	Mallard	45	lakes and ponds; swimming on lake	NM
MA042	Derragh Lough	09/11/2021	09:35	Mallard	14	lakes and ponds; swimming and dabbling along reedy edges of lake	NM
MA043	L. Sheelin	09/11/2021	09:12	Mallard	5	lakes and ponds; swimming along reedy lake edge	NM
MA044	L. Sheelin	09/11/2021	09:21	Mallard	4	lakes and ponds; calling within reedy fringes of lake	NM
MH040	L. Iron	09/11/2021	16:32	Moorhen	5	lakes and ponds; swimming and calling within reedy margins	NM
	R. Inny	09/11/2021	14:02	Mute Swan	3	depositing/lowland rivers; swimming on river	NM
	L. Sheelin	09/11/2021	09:12	Mute Swan	6	lakes and ponds; swimming on lake	NM
	L. Sheelin	09/11/2021	09:13	Mute Swan	17	lakes and ponds; swimming on lake	NM
	L. Sheelin	09/11/2021	09:34	Mute Swan	17	lakes and ponds; swimming on lake	NM
	L. Sheelin	09/11/2021	09:57	Mute Swan	6	lakes and ponds; swimming on lake	NM
	Derragh Lough	09/11/2021	11:35	Mute Swan	68	lakes and ponds; swimming on lake	NM
	L. Iron	09/11/2021	16:30	Mute Swan	23	lakes and ponds; swimming on lake	NM
	L. Sheelin	09/11/2021	09:26	Mute Swan	7	lakes and ponds; swimming along reedy edges of lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
		09/11/2021	09:58	Mute Swan	7	lakes and ponds; flying nw across lake	NM
WA008	L. Sheelin	09/11/2021	09:30	Water Rail	2	lakes and ponds and reed and large sedge swamps; pig calls from within reedy lake margins	NM
BH041		22/11/2021	16:05	Black-headed Gull	58	improved agricultural grassland and hedgerows; swirling and flying over farmland in large group - landing occasionally. ~45mins continuously	NM
MA045	L. Iron	22/11/2021	16:02	Mallard	24	lakes and ponds; swimming on lake	NM
MH041	L. Sheelin	22/11/2021	08:40	Moorhen	3	lakes and ponds; calling within reedy boundaries	NM
	L. Iron	22/11/2021	16:00	Mute Swan	27	lakes and ponds; swimming on lake	NM
BH045	L. Sheelin	23/11/2021	09:32	Black-headed Gull	7	lakes and ponds; wheeling and circling over lake	NM
BH042		23/11/2021	10:11	Black-headed Gull	2	improved agricultural grassland; flying sw across farmland	NM
BH043	L. D'varagh	23/11/2021	15:41	Black-headed Gull	5	lakes and ponds; flying and swirling over lake	NM
BH044	L. Sheelin	23/11/2021	09:07	Black-headed Gull	6	lakes and ponds; flying across lake	NM
CA021	L. Kinale	23/11/2021	09:52	Cormorant	2	lakes and ponds; swimming and diving on lake	NM
CA022	Bracklagh Lough	23/11/2021	10:15	Cormorant	1	lakes and ponds; swimming and diving on lake	NM
CA023	L. Sheelin	23/11/2021	09:26	Cormorant	5	lakes and ponds; perched on tree	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
CA024	Derragh Lough	23/11/2021	11:18	Cormorant	2	lakes and ponds; flying low across lake	NM
CA025	L. Sheelin	23/11/2021	09:31	Cormorant	2	lakes and ponds; flying low across lake	NM
CA026		23/11/2021	10:36	Cormorant	1	depositing/lowland rivers and highly modified/non-native woodland; flying high along r. inny	NM
CA027		23/11/2021	10:51	Cormorant	1	bogs; flying across bog	NM
GA005	L. Bane	23/11/2021	14:21	Gadwall	6	lakes and ponds; swimming on lake	NM
GG064	L. Kinale	23/11/2021	09:47	Great Crested Grebe	3	lakes and ponds; swimming on lake	NM
GG065	L. Kinale	23/11/2021	10:03	Great Crested Grebe	2	lakes and ponds; swimming on lake	NM
GG066	L. D'varagh	23/11/2021	15:42	Great Crested Grebe	13	lakes and ponds; swimming on lake	NM
GG067	L. D'varagh	23/11/2021	15:40	Great Crested Grebe	2	lakes and ponds; swimming on lake	NM
GG068	L. Sheelin	23/11/2021	08:36	Great Crested Grebe	2	lakes and ponds; swimming on lake	NM
GG069	L. Sheelin	23/11/2021	08:45	Great Crested Grebe	1	lakes and ponds; swimming on lake	NM
GG071	L. Sheelin	23/11/2021	08:58	Great Crested Grebe	3	lakes and ponds; swimming on lake	NM
GG073	L. Sheelin	23/11/2021	09:24	Great Crested Grebe	3	lakes and ponds; swimming on lake	NM
GG070	L. Sheelin	23/11/2021	08:45	Great Crested Grebe	5	lakes and ponds; swimming and diving on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
GG072	L. Sheelin	23/11/2021	09:07	Great Crested Grebe	2	lakes and ponds; swimming and diving on lake	NM
H028		23/11/2021	11:05	Grey Heron	1	semi-natural grassland; wading in wet reedy grassland	NM
H029	BN2	23/11/2021	14:04	Grey Heron	1	cutover bog; flying low across wetland	NM
H030		23/11/2021	13:45	Grey Heron	1	cutover bog and scrub/transitional woodland; flying low across bog + perching in adjacent scrubby woodland	NM
LB017		23/11/2021	15:41	Lesser Black-backed Gull	1	lakes and ponds; flying over lake	NM
LG045	Derragh Lough	23/11/2021	11:10	Little Grebe	21	lakes and ponds; swimming and diving on lake + calling within reedy margins	NM
LG046		23/11/2021	15:45	Little Grebe	5	lakes and ponds; swimming and diving on lake	NM
LG047	L. D'varagh	23/11/2021	15:48	Little Grebe	6	lakes and ponds; swimming and diving on lake	NM
LG049	L. Sheelin	23/11/2021	09:27	Little Grebe	3	lakes and ponds; swimming and diving near to sheltered lake shore	NM
LG048	L. Sheelin	23/11/2021	09:03	Little Grebe	5	lakes and ponds; calling within reedy margins	NM
MA046	L. D'varagh	23/11/2021	15:39	Mallard	5	lakes and ponds; swimming on lake	NM
MA047	L. D'varagh	23/11/2021	15:50	Mallard	8	lakes and ponds; swimming on lake	NM
MA048	L. Sheelin	23/11/2021	09:27	Mallard	9	lakes and ponds; swimming on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
MA049	L. Bane	23/11/2021	14:20	Mallard	46	lakes and ponds; swimming and dabbling on lake	NM
MA050	L. Kinale	23/11/2021	09:48	Mallard	3	lakes and ponds; flying low across lake and fringes	NM
MA051	L. Sheelin	23/11/2021	08:45	Mallard	5	lakes and ponds; calling within reedy margins	NM
MA052	L. Sheelin	23/11/2021	09:08	Mallard	3	lakes and ponds; calling within reedy margins	NM
MH042	R. Inny	23/11/2021	13:06	Moorhen	1	depositing/lowland rivers; wading along river	NM
MH043	L. Kinale	23/11/2021	10:55	Moorhen	2	lakes and ponds; calling within reedy margins of lake	NM
MH044	L. Kinale	23/11/2021	09:50	Moorhen	2	lakes and ponds and reed and large sedge swamps; calling within reedy lake fringes	NM
MH045	L. D'varagh	23/11/2021	15:51	Moorhen	3	lakes and ponds; calling within lake fringes	NM
	L. D'varagh	23/11/2021	15:40	Mute Swan	12	lakes and ponds; swimming on lake + roosting on slipway	NM
	Derragh Lough	23/11/2021	11:10	Mute Swan	177	lakes and ponds; swimming on lake (+ juveniles)	NM
	L. Kinale	23/11/2021	09:50	Mute Swan	32	lakes and ponds; swimming on lake	NM
	L. Kinale	23/11/2021	09:50	Mute Swan	22	lakes and ponds; swimming on lake	NM
	L. Kinale	23/11/2021	09:55	Mute Swan	8	lakes and ponds; swimming on lake	NM
	Bracklagh Lough	23/11/2021	10:15	Mute Swan	16	lakes and ponds; swimming on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
	L. Kinale	23/11/2021	10:55	Mute Swan	15	lakes and ponds; swimming on lake	NM
		23/11/2021	15:22	Mute Swan	16	lakes and ponds; swimming on lake	NM
	L. D'varagh	23/11/2021	15:44	Mute Swan	27	lakes and ponds; swimming on lake	NM
	L. D'varagh	23/11/2021	15:50	Mute Swan	10	lakes and ponds; swimming on lake	NM
	L. D'varagh	23/11/2021	15:52	Mute Swan	58	lakes and ponds; swimming on lake	NM
	L. Sheelin	23/11/2021	08:35	Mute Swan	4	lakes and ponds; swimming on lake	NM
	L. Sheelin	23/11/2021	08:46	Mute Swan	12	lakes and ponds; swimming on lake	NM
	L. Sheelin	23/11/2021	08:47	Mute Swan	17	lakes and ponds; swimming on lake	NM
	L. Sheelin	23/11/2021	08:55	Mute Swan	5	lakes and ponds; swimming on lake	NM
	L. Sheelin	23/11/2021	08:58	Mute Swan	3	lakes and ponds; swimming on lake	NM
	L. Sheelin	23/11/2021	09:23	Mute Swan	6	lakes and ponds; swimming on lake	NM
	L. Sheelin	23/11/2021	09:14	Mute Swan	11	lakes and ponds; flying across lake	NM
WA009	L. Sheelin	23/11/2021	08:45	Water Rail	2	lakes and ponds and reed and large sedge swamps; pig calls from reedy margins	NM
BH046	BN2	10/12/2021	15:34	Black-headed Gull	7	cutover bog; swirling over bog wetland	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
CA028		10/12/2021	09:43	Cormorant	2	improved agricultural grassland; flying ne across farmland	NM
GG075	L. Sheelin	10/12/2021	09:04	Great Crested Grebe	3	lakes and ponds; swimming on lake	NM
GG076		10/12/2021	14:06	Great Crested Grebe	4	lakes and ponds; swimming on lake	NM
GG074	L. Sheelin	10/12/2021	08:35	Great Crested Grebe	2	lakes and ponds; swimming and diving on lake	NM
GN003	L. Sheelin	10/12/2021	08:42	Goldeneye	7	lakes and ponds; swimming and diving on lake	NM
H031	L. Bane	10/12/2021	16:04	Grey Heron	2	lakes and ponds and transition mire and quaking bog; perched on wet boggy margins of lake	NM
H032	R. Inny	10/12/2021	10:45	Grey Heron	1	highly modified/non-native woodland and depositing/lowland rivers; perched in tree along river	NM
H033	L. Kinale	10/12/2021	09:57	Grey Heron	1	lakes and ponds, semi-natural grassland and reed and large sedge swamps; calling from wet lake margins	NM
LB018	L. Sheelin	10/12/2021	08:37	Lesser Black-backed Gull	3	lakes and ponds; flying and swirling over lake	NM
LG050	L. Sheelin	10/12/2021	09:02	Little Grebe	6	lakes and ponds; swimming and diving close to lake shore	NM
LG051	Derragh Lough	10/12/2021	10:55	Little Grebe	12	lakes and ponds; calling within reedy margins	NM
MA053	L. Sheelin	10/12/2021	09:04	Mallard	12	lakes and ponds; swimming on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
MA054	Derragh Lough	10/12/2021	10:51	Mallard	16	lakes and ponds; swimming and dabbling along reedy margins of lake	NM
MA055	L. Sheelin	10/12/2021	08:36	Mallard	6	lakes and ponds; swimming along reedy shores	NM
MA056	BN2	10/12/2021	15:40	Mallard	7	cutover bog; foraging on rushy bare peat within bog wetland	NM
MA057	Bracklagh Lough	10/12/2021	09:26	Mallard	3	lakes and ponds; feeding near to reedy lake edges	NM
MH046	R. Inny	10/12/2021	12:07	Moorhen	3	depositing/lowland rivers; swimming on river	NM
MH047	L. Kinale	10/12/2021	09:54	Moorhen	7	lakes and ponds; swimming and calling along lake edges	NM
MH048	L. Sheelin	10/12/2021	08:41	Moorhen	5	lakes and ponds; calling within reedy margins of lake	NM
	L. Sheelin	10/12/2021	08:35	Mute Swan	12	lakes and ponds; swimming on lake	NM
	L. Sheelin	10/12/2021	08:40	Mute Swan	6	lakes and ponds; swimming on lake	NM
	L. Sheelin	10/12/2021	08:59	Mute Swan	15	lakes and ponds; swimming on lake	NM
	L. Kinale	10/12/2021	10:03	Mute Swan	9	lakes and ponds; swimming on lake	NM
		10/12/2021	14:06	Mute Swan	16	lakes and ponds; swimming on lake	NM
	Bracklagh Lough	10/12/2021	09:24	Mute Swan	12	lakes and ponds; swimming and feeding on lake	NM
	Derragh Lough	10/12/2021	10:50	Mute Swan	76	lakes and ponds; swimming and feeding on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
WA010	L. Kinale	10/12/2021	09:52	Water Rail	3	lakes and ponds and reed and large sedge swamps; pig calls from lake margins	NM
BH050	L. Sheelin	22/12/2021	13:45	Black-headed Gull	2	lakes and ponds; wheeling over lake	NM
BH047	L. D'varagh	22/12/2021	08:45	Black-headed Gull	5	lakes and ponds; swirling and swooping over lake	NM
BH048		22/12/2021	12:14	Black-headed Gull	6	improved agricultural grassland, hedgerows and lakes and ponds; flying s over farmland	NM
BH049		22/12/2021	13:35	Black-headed Gull	26	lakes and ponds; flying high and sw across lake	NM
CA029	Bracklagh Lough	22/12/2021	12:04	Cormorant	1	lakes and ponds; swimming on lake	NM
CA030	L. Sheelin	22/12/2021	13:40	Cormorant	1	lakes and ponds; flying low across lake	NM
GG077		22/12/2021	08:43	Great Crested Grebe	2	lakes and ponds; swimming on lake	NM
GG078	Deragh Lough	22/12/2021	11:03	Great Crested Grebe	2	lakes and ponds; swimming on lake	NM
GG080	L. Sheelin	22/12/2021	13:38	Great Crested Grebe	1	lakes and ponds; swimming on lake	NM
GG081	L. Sheelin	22/12/2021	13:41	Great Crested Grebe	23	lakes and ponds; swimming on lake	NM
GG082	L. Sheelin	22/12/2021	14:09	Great Crested Grebe	4	lakes and ponds; swimming on lake	NM
GG079	L. Kinale	22/12/2021	12:24	Great Crested Grebe	3	lakes and ponds; swimming and diving on lake	NM
H034	L. Sheelin	22/12/2021	13:35	Grey Heron	4	lakes and ponds; swimming on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
H035		22/12/2021	15:47	Grey Heron	1	lakes and ponds and transition mire and quaking bog; perched on saturated lake fringes	NM
H036	R. Inny	22/12/2021	10:36	Grey Heron	1	semi-natural grassland and depositing/lowland rivers; perched along river	NM
H037	L. Sheelin	22/12/2021	13:10	Grey Heron	1	lakes and ponds; flying low and calling across lake	NM
H038		22/12/2021	13:47	Grey Heron	1	bogs and scrub; flying and calling across bog	NM
H039	L. Sheelin	22/12/2021	13:54	Grey Heron	1	lakes and ponds; flying across reedy lake fringes	NM
H040		22/12/2021	16:07	Grey Heron	1	cutover bog and scrub; flying across bog	NM
H041	L. Kinale	22/12/2021	12:21	Grey Heron	2	reed and large sedge swamps and lakes and ponds; calling from lake edge	NM
LB019	L. Sheelin	22/12/2021	13:37	Lesser Black-backed Gull	2	lakes and ponds; swooping over lake	NM
LG053	L. D'varagh	22/12/2021	08:35	Little Grebe	3	lakes and ponds; swimming close to shore	NM
LG058	L. Sheelin	22/12/2021	13:57	Little Grebe	3	lakes and ponds; swimming and diving within reedy margins	NM
LG057	Deragh Lough	22/12/2021	11:00	Little Grebe	16	lakes and ponds; swimming and diving on lake	NM
LG055		22/12/2021	08:42	Little Grebe	3	lakes and ponds; swimming and calling within reedy margins	NM
LG054	L. D'varagh	22/12/2021	08:43	Little Grebe	7	lakes and ponds; swimming and calling within emergent reedy islets	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
LG052	L. D'varagh	22/12/2021	08:31	Little Grebe	3	lakes and ponds; calling within reedy margins of lake	NM
LG056	L. Kinale	22/12/2021	11:23	Little Grebe	5	lakes and ponds; calling within reedy margins	NM
MA058	L. D'varagh	22/12/2021	08:34	Mallard	3	lakes and ponds; swimming on lake	NM
MA059	L. Kinale	22/12/2021	12:20	Mallard	5	lakes and ponds; swimming on lake	NM
MA060	L. Bane	22/12/2021	15:46	Mallard	41	lakes and ponds; swimming on lake	NM
MA061	BN2	22/12/2021	15:34	Mallard	7	cutover bog; swimming and foraging on bog wetland	NM
MA062	L. Sheelin	22/12/2021	13:36	Mallard	5	lakes and ponds; swimming along edge of reedy fringes	NM
MA063	Bracklagh Lough	22/12/2021	12:16	Mallard	2	lakes and ponds; flying low across lake	NM
MA064		22/12/2021	09:21	Mallard	2	watercourses; flushed from wet drain	NM
MA065		22/12/2021	09:32	Mallard	2	lakes and ponds; calling within reedy margins	NM
MH049	L. D'varagh	22/12/2021	08:32	Moorhen	4	lakes and ponds and highly modified/non-native woodland; wading within flooded willow margins	NM
MH050		22/12/2021	09:31	Moorhen	3	scrub and reed and large sedge swamps; calling within wetland / wet willow scrub	NM
MH051	L. Kinale	22/12/2021	11:23	Moorhen	2	lakes and ponds; calling within reedy margins	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
MH052	L. Kinale	22/12/2021	12:14	Moorhen	2	lakes and ponds; calling within reedy margins	NM
MH053	L. Sheelin	22/12/2021	13:32	Moorhen	4	lakes and ponds; calling within reedy margins	NM
MH054	L. Sheelin	22/12/2021	13:55	Moorhen	5	lakes and ponds; calling within reedy margins	NM
	L. Sheelin	22/12/2021	13:05	Mute Swan	3	lakes and ponds; swimming within reedy corners of lake	NM
	L. D'varagh	22/12/2021	08:30	Mute Swan	46	lakes and ponds; swimming on lake	NM
	L. Kinale	22/12/2021	11:25	Mute Swan	5	lakes and ponds; swimming on lake	NM
	Deragh Lough	22/12/2021	11:00	Mute Swan	128	lakes and ponds; swimming on lake	NM
	Bracklagh Lough	22/12/2021	12:03	Mute Swan	13	lakes and ponds; swimming on lake	NM
	L. Kinale	22/12/2021	12:20	Mute Swan	16	lakes and ponds; swimming on lake	NM
	L. Kinale	22/12/2021	12:18	Mute Swan	35	lakes and ponds; swimming on lake	NM
	L. Kinale	22/12/2021	12:20	Mute Swan	7	lakes and ponds; swimming on lake	NM
	L. Sheelin	22/12/2021	13:35	Mute Swan	6	lakes and ponds; swimming on lake	NM
	L. Sheelin	22/12/2021	13:43	Mute Swan	7	lakes and ponds; swimming on lake	NM
	L. Sheelin	22/12/2021	13:47	Mute Swan	7	lakes and ponds; swimming on lake	NM
		22/12/2021	08:40	Mute Swan	7	lakes and ponds; swimming and foraging near lake edge	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
		22/12/2021	09:30	Mute Swan	29	lakes and ponds; swimming and feeding on lake	NM
	L. Sheelin	22/12/2021	13:47	Mute Swan	15	lakes and ponds; swimming and feeding along reedy lake fringes	NM
		22/12/2021	08:54	Mute Swan	5	lakes and ponds; roosting on lake edge	NM
	L. Bane	22/12/2021	15:44	Mute Swan	3	lakes and ponds; foraging within saturated edges of lake	NM
	R. Inny	22/12/2021	10:19	Mute Swan	3	depositing/lowland rivers; foraging along river edge (juveniles)	NM
WA011		22/12/2021	11:23	Water Rail	2	lakes and ponds and reed and large sedge swamps; pig calls from reeds	NM
BH051	L. Iron	23/12/2021	15:16	Black-headed Gull	12	lakes and ponds; swimming on lake + flying along edges	NM
H042		23/12/2021	16:18	Grey Heron	1	lakes and ponds; flying low and calling adjacenet to lake	NM
MH055	L. Iron	23/12/2021	15:32	Moorhen	16	lakes and ponds; swimming within weedy edges of lake	NM
		23/12/2021	16:29	Mute Swan	3	improved agricultural grassland and hedgerows; flying sw across farmland	NM
BH054	L. D'varagh	04/01/2022	13:34	Black-headed Gull	8	lakes and ponds; flying and swooping over lake	NM
BH053	L. D'varagh	04/01/2022	10:10	Black-headed Gull	2	lakes and ponds, improved agricultural grassland and scrub; flying along lake shore	NM
BH052	L. D'varagh	04/01/2022	09:08	Black-headed Gull	34	lakes and ponds; circling and soaring over se end of lake	NM
CA031	L. D'varagh	04/01/2022	09:16	Cormorant	1	lakes and ponds; swimming on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
CA032	L. D'varagh	04/01/2022	10:05	Cormorant	2	lakes and ponds; swimming on lake	NM
CA033	L. D'varagh	04/01/2022	13:41	Cormorant	2	lakes and ponds; flyinglow across lake	NM
CA034	L. D'varagh	04/01/2022	09:21	Cormorant	2	lakes and ponds; flying low across lake	NM
CA035	L. D'varagh	04/01/2022	10:10	Cormorant	1	lakes and ponds; flying low across lake	NM
GG083	L. D'varagh	04/01/2022	09:10	Great Crested Grebe	4	lakes and ponds; swimming on lake	NM
GG084	L. D'varagh	04/01/2022	13:30	Great Crested Grebe	2	lakes and ponds; swimming on lake	NM
LB020	L. D'varagh	04/01/2022	13:37	Lesser Black-backed Gull	2	lakes and ponds; flying over lake	NM
LG061	L. D'varagh	04/01/2022	10:00	Little Grebe	7	lakes and ponds; swimming on lake	NM
LG063	L. D'varagh	04/01/2022	13:25	Little Grebe	5	lakes and ponds; swimming on lake	NM
LG065	L. D'varagh	04/01/2022	13:37	Little Grebe	6	lakes and ponds; swimming on lake	NM
LG060	L. D'varagh	04/01/2022	09:10	Little Grebe	9	lakes and ponds; swimming and diving on lake	NM
LG062	L. D'varagh	04/01/2022	13:30	Little Grebe	7	lakes and ponds; swimming and diving near edge of lake	NM
LG064	L. D'varagh	04/01/2022	13:31	Little Grebe	6	lakes and ponds; swimming and calling within tangled margins	NM
LG066	L. D'varagh	04/01/2022	14:47	Little Grebe	9	lakes and ponds; swimming and calling within reedbed boundary	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
LG059	L. Iron	04/01/2022	15:40	Little Grebe	37	lakes and ponds; swimming and calling on lake and within reedy boundaries	NM
MA066	L. D'varagh	04/01/2022	11:23	Mallard	18	other artificial lakes and ponds; swimming on pond	NM
MA067	L. Iron	04/01/2022	15:40	Mallard	32	lakes and ponds; swimming and foraging on lake and within reedy fringes	NM
MH056	L. D'varagh	04/01/2022	09:10	Moorhen	3	lakes and ponds; wading within flooded margins	NM
MH057	L. D'varagh	04/01/2022	11:40	Moorhen	3	other artificial lakes and ponds; swimming on pond	NM
MH058	L. D'varagh	04/01/2022	13:25	Moorhen	2	lakes and ponds; calling within reedy margins	NM
MH059	L. D'varagh	04/01/2022	14:45	Moorhen	6	lakes and ponds and reed and large sedge swamps; calling within reedy margins	NM
MH060	L. D'varagh	04/01/2022	14:17	Moorhen	2	lakes and ponds; calling from lake edge	NM
	L. D'varagh	04/01/2022	10:48	Mute Swan	2	other artificial lakes and ponds; swimming on pond	NM
	L. Iron	04/01/2022	15:40	Mute Swan	43	lakes and ponds; swimming on lake	NM
	L. D'varagh	04/01/2022	13:35	Mute Swan	23	lakes and ponds; swimming on lake	NM
	L. D'varagh	04/01/2022	13:27	Mute Swan	2	lakes and ponds; swimming and foraging in tangled margins of lake	NM
	L. D'varagh	04/01/2022	14:45	Mute Swan	7	lakes and ponds; flying low across lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
GG085	L. D'varagh	05/01/2022	13:27	Great Crested Grebe	3	lakes and ponds; swimming on lake	NM
GN004	L. D'varagh	05/01/2022	13:30	Goldeneye	6	lakes and ponds; swimming on lake	NM
H043	BN2	05/01/2022	09:32	Grey Heron	2	cutover bog; flying low across bog wetland	NM
LG067	Derragh Lough	05/01/2022	10:35	Little Grebe	21	lakes and ponds; swimming and calling within reedy margins of lake	NM
LG068	L. D'varagh	05/01/2022	13:21	Little Grebe	16	lakes and ponds; swimming and calling within reedy edges	NM
	Derragh Lough	05/01/2022	10:34	Mute Swan	115	lakes and ponds; swimming on lake	NM
	L. D'varagh	05/01/2022	13:21	Mute Swan	50	lakes and ponds; swimming on lake	NM
BH057	L. Sheelin	17/01/2022	09:47	Black-headed Gull	4	lakes and ponds; swirling over lake	NM
BH061	L. D'varagh	17/01/2022	13:13	Black-headed Gull	16	lakes and ponds; swirling and swooping over lake	NM
BH063	L. Sheelin	17/01/2022	08:45	Black-headed Gull	16	lakes and ponds; swirling and swooping over lake	NM
BH058	Bracklagh Lough	17/01/2022	10:56	Black-headed Gull	6	lakes and ponds; swimming and swirling over lake	NM
BH056	L. Sheelin	17/01/2022	09:50	Black-headed Gull	19	lakes and ponds; flying and swooping over lake - spread out over s of lake	NM
BH055	L. Sheelin	17/01/2022	09:46	Black-headed Gull	6	lakes and ponds; flying and swooping over lake	NM
BH059		17/01/2022	15:54	Black-headed Gull	2	lakes and ponds, transition mire and quaking bog and semi-natural grassland; flying across lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
BH060	L. D'varagh	17/01/2022	13:00	Black-headed Gull	4	lakes and ponds; flying across lake	NM
BH062	L. Sheelin	17/01/2022	08:34	Black-headed Gull	3	lakes and ponds; flying across lake	NM
CA036	Derragh Lough	17/01/2022	11:20	Cormorant	1	lakes and ponds; swimming on lake	NM
CA037	L. Sheelin	17/01/2022	09:50	Cormorant	1	lakes and ponds; swimming and diving on lake	NM
CA038	L. Sheelin	17/01/2022	08:38	Cormorant	2	lakes and ponds; swimming and diving on lake	NM
CA039	L. Sheelin	17/01/2022	08:46	Cormorant	14	scrub and lakes and ponds; perched in tree along lake	NM
CA040	L. Sheelin	17/01/2022	08:47	Cormorant	24	lakes and ponds; flying low across lake - not as one group but as numerous pairs and solitary individuals	NM
CA041	L. Sheelin	17/01/2022	09:49	Cormorant	1	lakes and ponds; flying high across sw area of lake	NM
GA006	L. Kinale N	17/01/2022	10:37	Gadwall	8	lakes and ponds; swimming on lake	NM
GA007	L. Bane	17/01/2022	15:50	Gadwall	6	lakes and ponds; swimming on lake	NM
GD002	L. Sheelin	17/01/2022	08:47	Goosander	28	lakes and ponds; swimming on lake	NM
GD001	L. Kinale	17/01/2022	10:35	Goosander	6	lakes and ponds and reed and large sedge swamps; flying s across lake	NM
GE001	BN2	17/01/2022	16:10	Green Sandpiper	1	cutover bog; flying rapidly across bog wetland + foraging + piercing call	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
GG087	Derragh Lough	17/01/2022	11:21	Great Crested Grebe	2	lakes and ponds; swimming on lake	NM
GG088	L. D'varagh	17/01/2022	13:02	Great Crested Grebe	2	lakes and ponds; swimming on lake	NM
GG090	L. D'varagh	17/01/2022	13:04	Great Crested Grebe	2	lakes and ponds; swimming on lake	NM
GG091	L. Sheelin	17/01/2022	08:36	Great Crested Grebe	2	lakes and ponds; swimming on lake	NM
GG093	L. Sheelin	17/01/2022	08:48	Great Crested Grebe	3	lakes and ponds; swimming on lake	NM
GG086	L. Kinale	17/01/2022	10:38	Great Crested Grebe	2	lakes and ponds; swimming and diving on lake	NM
GG089	L. D'varagh	17/01/2022	13:10	Great Crested Grebe	3	lakes and ponds; swimming and diving on lake	NM
GG092	L. Sheelin	17/01/2022	08:45	Great Crested Grebe	4	lakes and ponds; swimming and diving on lake	NM
GN005	L. D'varagh	17/01/2022	13:05	Goldeneye	24	lakes and ponds; swimming on lake	NM
GN006	L. Sheelin	17/01/2022	08:43	Goldeneye	17	lakes and ponds; swimming on lake	NM
H044	L. Bane	17/01/2022	15:50	Grey Heron	1	transition mire and quaking bog; perched on fringes	NM
H045	L. Sheelin	17/01/2022	09:50	Grey Heron	1	lakes and ponds; flying lowvand calling across lake	NM
H046	L. D'varagh	17/01/2022	13:07	Grey Heron	1	scrub and reed and large sedge swamps; flying low across scrub and wetland	NM
H047	L. Kinale	17/01/2022	10:40	Grey Heron	1	lakes and ponds; flying low across lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
H048	BN2	17/01/2022	16:20	Grey Heron	1	cutover bog and scrub; flying and calling across bog wetland	NM
H049	L. D'varagh	17/01/2022	13:17	Grey Heron	2	lakes and ponds; flying across lake	NM
H050	BN2	17/01/2022	16:24	Grey Heron	1	cutover bog; flying across bog + harried by rn	NM
LB021	L. Sheelin	17/01/2022	09:48	Lesser Black-backed Gull	2	lakes and ponds; flying across lake	NM
LG069	L. Sheelin	17/01/2022	10:26	Little Grebe	6	lakes and ponds and scrub; swimming close to and within flooded scrubby shore	NM
LG075	L. Sheelin	17/01/2022	08:53	Little Grebe	13	lakes and ponds; swimming and diving in sheltered area of lake	NM
LG071	L. D'varagh	17/01/2022	12:59	Little Grebe	5	lakes and ponds; swimming and diving close to lake shore	NM
LG072	L. D'varagh	17/01/2022	13:12	Little Grebe	12	lakes and ponds; swimming and calling within reedy islets close to lake shore	NM
LG074	L. Sheelin	17/01/2022	08:30	Little Grebe	6	lakes and ponds; swimming and calling within reedy margins of lake	NM
LG073	L. D'varagh	17/01/2022	13:12	Little Grebe	7	lakes and ponds; swimming and calling on lake	NM
LG070	Derragh Lough	17/01/2022	11:20	Little Grebe	32	lakes and ponds; calling and swimming on lake and within reeds	NM
MA068	L. D'varagh	17/01/2022	13:10	Mallard	18	lakes and ponds; swimming on lake	NM
MA069	L. Sheelin	17/01/2022	08:46	Mallard	6	lakes and ponds; swimming on lake	NM
MA070	L. D'varagh	17/01/2022	13:52	Mallard	7	lakes and ponds; swimming and calling along reedy fringes	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
MA071	L. D'varagh	17/01/2022	13:04	Mallard	4	lakes and ponds; flying low across lake	NM
MA072	L. Sheelin	17/01/2022	08:52	Mallard	4	lakes and ponds; calling within reedy margins of lake	NM
MH061	R. Inny	17/01/2022	14:38	Moorhen	3	depositing/lowland rivers; wading along river banks	NM
MH062	L. Sheelin	17/01/2022	08:45	Moorhen	5	lakes and ponds; calling within reedy margins of lake	NM
MH063	L. D'varagh	17/01/2022	13:53	Moorhen	4	lakes and ponds; calling within reedy margins	NM
MH064	L. D'varagh	17/01/2022	13:08	Moorhen	6	lakes and ponds; calling within reedy margins	NM
MH065	L. D'varagh	17/01/2022	13:06	Moorhen	4	lakes and ponds and scrub; calling within flooded wooded margins of lake	NM
MH066	L. D'varagh	17/01/2022	13:14	Moorhen	6	lakes and ponds; calling and wading within reedy margins of lake	NM
MH067	Derragh Lough	17/01/2022	11:21	Moorhen	25	lakes and ponds and reed and large sedge swamps; calling and wading within reedy fringed	NM
	BN2	17/01/2022	16:09	Mute Swan	3	cutover bog; wading on bog wetland	NM
	L. Sheelin	17/01/2022	08:35	Mute Swan	7	lakes and ponds; swimminmg on lake	NM
	L. D'varagh	17/01/2022	13:23	Mute Swan	7	lakes and ponds; swimming within sw corner of lake	NM
	L. Sheelin	17/01/2022	09:56	Mute Swan	4	lakes and ponds; swimming on lake	NM
	L. Sheelin	17/01/2022	09:45	Mute Swan	16	lakes and ponds; swimming on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
	L. Sheelin	17/01/2022	10:22	Mute Swan	5	lakes and ponds; swimming on lake	NM
	L. Kinale N	17/01/2022	10:40	Mute Swan	220	lakes and ponds; swimming on lake	NM
	L. Kinale	17/01/2022	10:41	Mute Swan	6	lakes and ponds; swimming on lake	NM
	Bracklagh Lough	17/01/2022	10:56	Mute Swan	12	lakes and ponds; swimming on lake	NM
	Derragh Lough	17/01/2022	11:20	Mute Swan	76	lakes and ponds; swimming on lake	NM
	L. Kinale S	17/01/2022	11:46	Mute Swan	17	lakes and ponds; swimming on lake	NM
	L. D'varagh	17/01/2022	13:51	Mute Swan	16	lakes and ponds; swimming on lake	NM
	L. Bane	17/01/2022	15:50	Mute Swan	10	lakes and ponds; swimming on lake	NM
	L. D'varagh	17/01/2022	12:58	Mute Swan	6	lakes and ponds; swimming on lake	NM
	L. D'varagh	17/01/2022	13:15	Mute Swan	6	lakes and ponds; swimming on lake	NM
	L. D'varagh	17/01/2022	13:05	Mute Swan	23	lakes and ponds; swimming on lake	NM
	L. D'varagh	17/01/2022	13:18	Mute Swan	11	lakes and ponds; swimming on lake	NM
	L. Sheelin	17/01/2022	08:30	Mute Swan	6	lakes and ponds; swimming on lake	NM
	L. Sheelin	17/01/2022	08:43	Mute Swan	14	lakes and ponds; swimming on lake	NM
	L. Sheelin	17/01/2022	08:39	Mute Swan	5	lakes and ponds; swimming on lake	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
	L. Sheelin	17/01/2022	09:53	Mute Swan	17	lakes and ponds; swimming close to s shore	NM
	L. D'varagh	17/01/2022	13:06	Mute Swan	15	scrub and lakes and ponds; swimming and foraging along lake fringes and within edges of flooded woodland	NM
	L. Sheelin	17/01/2022	09:50	Mute Swan	18	lakes and ponds; swimming along n shore	NM
		17/01/2022	13:53	Mute Swan	2	improved agricultural grassland and semi-natural grassland; roosting on edge of flooding	NM
	R. Inny	17/01/2022	14:05	Mute Swan	61	improved agricultural grassland and depositing/lowland rivers; grazing on grassland along river (+5 swimming on river	NM
	R. Inny	17/01/2022	14:00	Mute Swan	14	improved agricultural grassland and depositing/lowland rivers; grazing on grassland adjacent to river (4 swimming on river)	NM
	BN2	17/01/2022	16:40	Mute Swan	2	cutover bog and scrub; flying sw across bog wetland and adjacent cutover bog	NM
		17/01/2022	11:16	Mute Swan	6	lakes and ponds and mixed broadleaved woodland; flying sw	NM
WA012	BN2	17/01/2022	16:46	Water Rail	3	cutover bog; pig calls within bog wetland	NM
WA013	L. Sheelin	17/01/2022	08:41	Water Rail	3	lakes and ponds; pig calls from within reedy margins	NM

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
BH067		18/01/2022	11:15	Black-headed Gull	28	improved agricultural grassland; swirling and swooping over grassland	NM
BH064	L. Iron	18/01/2022	16:23	Black-headed Gull	6	improved agricultural grassland, semi-natural grassland and scrub; soaring over swollen lake fringes	NM
BH065		18/01/2022	10:18	Black-headed Gull	4	improved agricultural grassland and lakes and ponds; roosting and foraging beside flooded hollow of field	NM
BH066		18/01/2022	10:23	Black-headed Gull	1	improved agricultural grassland and hedgerows; flying across farmland	NM
CA042	L. D'varagh	18/01/2022	13:45	Cormorant	2	lakes and ponds; flying across lake	NM
LG076	L. Iron	18/01/2022	16:00	Little Grebe	17	lakes and ponds; swimming on lake	NM
MA073		18/01/2022	10:31	Mallard	2	turloughs, lakes and ponds and improved agricultural grassland; wading within wetland	NM
MA074	L. Iron	18/01/2022	16:00	Mallard	67	lakes and ponds; swimming on lake	NM
		18/01/2022	10:30	Mute Swan	1	turloughs, lakes and ponds and improved agricultural grassland; wading within wetland	NM
	L. Iron	18/01/2022	16:00	Mute Swan	34	lakes and ponds; swimming on lake and within swollen edges	NM
BH068	Lough Sheelin west	14/02/2022	11:45	Black-headed Gull	65	lakes and ponds; foraging	KB

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
BH069	Bracklagh Lough	14/02/2022	12:20	Black-headed Gull	9	lakes and ponds; foraging	KB
BH070	Robinstown pond	14/02/2022	14:32	Black-headed Gull	7	lakes and ponds; foraging	KB
CA043	Lough Sheelin west	14/02/2022	11:45	Cormorant	3	lakes and ponds; foraging	KB
GG094	Lough Sheelin west	14/02/2022	11:45	Great Crested Grebe	17	lakes and ponds; foraging	KB
GG095	Bracklagh Lough	14/02/2022	12:20	Great Crested Grebe	2	lakes and ponds; foraging	KB
GG096	Derragh Lough	14/02/2022	13:26	Great Crested Grebe	2	lakes and ponds; foraging	KB
H051	Lough Sheelin west	14/02/2022	11:45	Grey Heron	1	lakes and ponds; foraging	KB
HG001	Lough Sheelin west	14/02/2022	11:45	Herring Gull	1	lakes and ponds; foraging	KB
LG077	Lough Sheelin west	14/02/2022	11:45	Little Grebe	5	lakes and ponds; foraging	KB
LG078	Derragh Lough	14/02/2022	13:26	Little Grebe	4	lakes and ponds; foraging	KB
MA075	Derragh Lough	14/02/2022	13:26	Mallard	1	lakes and ponds; roosting	KB
MA076	Bracklagh Lough	14/02/2022	12:20	Mallard	2	lakes and ponds; foraging	KB

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
MA077	Derragh Lough	14/02/2022	13:26	Mallard	2	lakes and ponds; foraging	KB
MH068	Lough Sheelin west	14/02/2022	11:45	Moorhen	2	lakes and ponds; foraging	KB
MH069	Bracklagh Lough	14/02/2022	12:20	Moorhen	3	lakes and ponds; foraging	KB
MH070	Lough Kinale south	14/02/2022	13:40	Moorhen	2	lakes and ponds; foraging	KB
	Lough Kinale	14/02/2022	12:50	Mute Swan	12	lakes and ponds; roosting	KB
	Derragh Lough	14/02/2022	13:26	Mute Swan	7	lakes and ponds; roosting	KB
	Lough Sheelin east	14/02/2022	10:40	Mute Swan	2	lakes and ponds; foraging	KB
	Lough Sheelin centre	14/02/2022	11:00	Mute Swan	1		KB
	Lough Sheelin west	14/02/2022	11:45	Mute Swan	43	lakes and ponds; foraging	KB
	Bracklagh Lough	14/02/2022	12:20	Mute Swan	9	lakes and ponds; foraging	KB
	Lough Kinale	14/02/2022	12:50	Mute Swan	89	lakes and ponds; foraging	KB
	Derragh Lough	14/02/2022	13:26	Mute Swan	37	lakes and ponds; foraging	KB
	River Inny	14/02/2022	13:35	Mute Swan	2	watercourses; foraging	KB

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
	Lough Kinale south	14/02/2022	13:40	Mute Swan	5	lakes and ponds; foraging	KB
SU001	Robinstown pond	14/02/2022	14:32	Shelduck	2	lakes and ponds; foraging	KB
CA044	Lough Derravaragh north	15/02/2022	13:13	Cormorant	2	lakes and ponds; foraging	KB
GG097	Lough Derravaragh south	15/02/2022	12:20	Great Crested Grebe	6	lakes and ponds; foraging	KB
GG098	Lough Derravaragh north	15/02/2022	13:13	Great Crested Grebe	2	lakes and ponds; foraging	KB
GN007	Lough Derravaragh south	15/02/2022	12:20	Goldeneye	11	lakes and ponds; foraging	KB
GN008	Lough Derravaragh north	15/02/2022	13:13	Goldeneye	6	lakes and ponds; foraging	KB
LG079	Lough Derravaragh south	15/02/2022	12:20	Little Grebe	4	lakes and ponds; foraging	KB
LG080	Lough Derravaragh north	15/02/2022	13:13	Little Grebe	11	lakes and ponds; foraging	KB
MH071	Lough Derravaragh north	15/02/2022	13:13	Moorhen	1	lakes and ponds; foraging	KB

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
	Lough Derravaragh south	15/02/2022	12:20	Mute Swan	4	lakes and ponds; roosting	KB
	Lough Derravaragh north	15/02/2022	13:13	Mute Swan	1		KB
	Lough Iron	15/02/2022	09:40	Mute Swan	12	lakes and ponds; foraging	KB
	lake off Lough Derravaragh	15/02/2022	11:47	Mute Swan	8	watercourses and lakes and ponds; foraging	KB
	Lough Derravaragh south	15/02/2022	12:20	Mute Swan	24	lakes and ponds; foraging	KB
	River Inny and lake off Lough Derravaragh	15/02/2022	12:50	Mute Swan	4	lakes and ponds; foraging	KB
	Clonave, river Inny	15/02/2022	12:56	Mute Swan	19	improved agricultural grassland and watercourses; foraging	KB
	River Inny	15/02/2022	12:58	Mute Swan	4	improved agricultural grassland and watercourses; foraging	KB
	Derrycrave	15/02/2022	15:30	Mute Swan	2	lakes and ponds and cutover bog; foraging	KB
BH071	Bracklagh Lough	26/02/2022	09:00	Black-headed Gull	108	lakes and ponds; foraging	KB

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
BH072	Lough Sheelin west	26/02/2022	09:20	Black-headed Gull	9	lakes and ponds; foraging	KB
BH073	Lough Kinale	26/02/2022	10:26	Black-headed Gull	56	lakes and ponds; foraging	KB
CA045	Lough Sheelin west	26/02/2022	09:20	Cormorant	2	lakes and ponds; foraging	KB
CA046	Lough Sheelin east	26/02/2022	10:14	Cormorant	1	lakes and ponds; foraging	KB
GG099	Bracklagh Lough	26/02/2022	09:00	Great Crested Grebe	2	lakes and ponds; foraging	KB
GG100	Lough Sheelin west	26/02/2022	09:20	Great Crested Grebe	22	lakes and ponds; foraging	KB
GG101	Lough Sheelin centre	26/02/2022	09:53	Great Crested Grebe	5	lakes and ponds; foraging	KB
GG102	Lough Kinale	26/02/2022	10:26	Great Crested Grebe	9	lakes and ponds; foraging	KB
GG103	Derragh Lough	26/02/2022	11:04	Great Crested Grebe	6	lakes and ponds; foraging	KB
GG104	Lough Kinale south	26/02/2022	11:28	Great Crested Grebe	1	lakes and ponds; foraging	KB
H052	Lough Sheelin west	26/02/2022	09:20	Grey Heron	2	lakes and ponds; foraging	KB
H053	Lough Kinale	26/02/2022	10:26	Grey Heron	4	lakes and ponds; foraging	KB

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
H054	Derragh Lough	26/02/2022	11:04	Grey Heron	3	lakes and ponds; foraging	KB
LG081	Lough Sheelin west	26/02/2022	09:20	Little Grebe	8	lakes and ponds; foraging	KB
LG082	Derragh Lough	26/02/2022	11:04	Little Grebe	4	lakes and ponds; foraging	KB
MA078	Derragh Lough	26/02/2022	11:04	Mallard	5	lakes and ponds; foraging	KB
MA079	Derrycrave	26/02/2022	13:28	Mallard	5	lakes and ponds and cutover bog; foraging	KB
MH072	Derragh Lough	26/02/2022	11:04	Moorhen	1	lakes and ponds; foraging	KB
MH073	Lough Kinale south	26/02/2022	11:28	Moorhen	1	lakes and ponds; foraging	KB
	Bracklagh Lough	26/02/2022	09:00	Mute Swan	4	lakes and ponds; foraging	KB
	Lough Sheelin west	26/02/2022	09:20	Mute Swan	19	lakes and ponds; foraging	KB
	Lough Sheelin centre	26/02/2022	09:53	Mute Swan	5	lakes and ponds; foraging	KB
	Lough Kinale	26/02/2022	10:26	Mute Swan	218	lakes and ponds; foraging	KB
	Derragh Lough	26/02/2022	11:04	Mute Swan	35	lakes and ponds; foraging	KB
	Inny River	26/02/2022	11:22	Mute Swan	2	watercourses; foraging	KB

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
	Lough Kinale south	26/02/2022	11:28	Mute Swan	8	lakes and ponds; foraging	KB
	Flooded cutaway bog on site	26/02/2022	12:58	Mute Swan	2	cutover bog; foraging	KB
	Derrycrave	26/02/2022	13:28	Mute Swan	2	lakes and ponds and cutover bog; foraging	KB
SU002	Robinstown pond	26/02/2022	13:42	Shelduck	2	lakes and ponds; foraging	KB
BH074	Lough Derravaragh south	28/02/2022	11:45	Black-headed Gull	28	lakes and ponds; foraging	KB
BH075	lake off Lough Derravaragh	28/02/2022	12:28	Black-headed Gull	8	lakes and ponds; foraging	KB
BH076	River Inny and lake off Lough Derravaragh	28/02/2022	13:05	Black-headed Gull	3	lakes and ponds and watercourses; foraging	KB
GG105	Lough Derravaragh south	28/02/2022	11:45	Great Crested Grebe	10	lakes and ponds; foraging	KB
GG106	lake off Lough Derravaragh	28/02/2022	12:28	Great Crested Grebe	4	lakes and ponds; foraging	KB

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
GG107	River Inny and lake off Lough Derravaragh	28/02/2022	13:05	Great Crested Grebe	3	lakes and ponds and watercourses; foraging	KB
LG083	Lough Derravaragh south	28/02/2022	11:45	Little Grebe	6	lakes and ponds; foraging	KB
LG084	Lough Derravaragh north	28/02/2022	13:31	Little Grebe	3	lakes and ponds; foraging	KB
MH074	lake off Lough Derravaragh	28/02/2022	12:28	Moorhen	2	lakes and ponds; foraging	KB
MH075	River Inny and lake off Lough Derravaragh	28/02/2022	13:05	Moorhen	2	lakes and ponds and watercourses; foraging	KB
MH076	River Inny	28/02/2022	14:00	Moorhen	2	watercourses; foraging	KB
	Lough Derravaragh south	28/02/2022	11:45	Mute Swan	11	lakes and ponds; foraging	KB
	lake off Lough Derravaragh	28/02/2022	12:28	Mute Swan	5	lakes and ponds; foraging	KB

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
	River Inny and lake off Lough Derravaragh	28/02/2022	13:05	Mute Swan	2	lakes and ponds and watercourses; foraging	KB
	Clonava island	28/02/2022	13:13	Mute Swan	36	improved agricultural grassland and watercourses; foraging	KB
	Clonava island	28/02/2022	13:21	Mute Swan	14	improved agricultural grassland and watercourses; foraging	KB
	Lough Derravaragh north	28/02/2022	13:31	Mute Swan	4	lakes and ponds; foraging	KB
	Lough Iron - piercefield fields	28/02/2022	15:20	Mute Swan	3	improved agricultural grassland; foraging	KB
BH077	Brackagh Lough	07/03/2022	09:00	Black-headed Gull	12	lakes and ponds; foraging	KB
BH078	Lough Kinale	07/03/2022	10:20	Black-headed Gull	8	lakes and ponds; foraging	KB
CA047	Lough Sheelin west	07/03/2022	09:16	Cormorant	8	lakes and ponds; roosting	KB
GG108	Brackagh Lough	07/03/2022	09:00	Great Crested Grebe	2	lakes and ponds; foraging	KB
GG109	Lough Sheelin west	07/03/2022	09:16	Great Crested Grebe	5	lakes and ponds; foraging	KB
GG110	Lough Kinale	07/03/2022	10:20	Great Crested Grebe	2	lakes and ponds; foraging	KB

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
GG111	Derragh Lough	07/03/2022	10:51	Great Crested Grebe	3	lakes and ponds; foraging	KB
LG085	Brackagh Lough	07/03/2022	09:00	Little Grebe	6	lakes and ponds; foraging	KB
LG086	Lough Sheelin west	07/03/2022	09:16	Little Grebe	4	lakes and ponds; foraging	KB
LG087	Derragh Lough	07/03/2022	10:51	Little Grebe	4	lakes and ponds; foraging	KB
LG088	Lough Kinale south	07/03/2022	11:08	Little Grebe	1	lakes and ponds; foraging	KB
LG089	Robinstown pond	07/03/2022	12:39	Little Grebe	2	lakes and ponds; foraging	KB
MH077	Brackagh Lough	07/03/2022	09:00	Moorhen	4	lakes and ponds; foraging	KB
MH078	Lough Sheelin west	07/03/2022	09:16	Moorhen	2	lakes and ponds; foraging	KB
MH079	Derragh Lough	07/03/2022	10:51	Moorhen	2	lakes and ponds; foraging	KB
MH080	Robinstown flooded fields	07/03/2022	12:50	Moorhen	2	wet grassland; foraging	KB
	Brackagh Lough	07/03/2022	09:00	Mute Swan	2	lakes and ponds; roosting	KB
	Lough Sheelin west	07/03/2022	09:16	Mute Swan	5	lakes and ponds; roosting	KB

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
	Brackagh Lough	07/03/2022	09:00	Mute Swan	16	lakes and ponds; foraging	KB
	Lough Sheelin west	07/03/2022	09:16	Mute Swan	23	lakes and ponds; foraging	KB
	Lough Sheelin centre	07/03/2022	19:42	Mute Swan	4	lakes and ponds; foraging	KB
	Lough Sheelin east	07/03/2022	10:05	Mute Swan	2	lakes and ponds; foraging	KB
	Lough Kinale	07/03/2022	10:20	Mute Swan	42	lakes and ponds; foraging	KB
	Derragh Lough	07/03/2022	10:51	Mute Swan	31	lakes and ponds; foraging	KB
	Lough Kinale south	07/03/2022	11:08	Mute Swan	4	lakes and ponds; foraging	KB
	Robinstown pond	07/03/2022	12:39	Mute Swan	1	lakes and ponds; foraging	KB
	Robinstown flooded fields	07/03/2022	12:50	Mute Swan	2	wet grassland; foraging	KB
BH079	Lough Derravaragh south	08/03/2022	12:01	Black-headed Gull	33	lakes and ponds; foraging	KB
BH080	Lake off Lough Derravaragh	08/03/2022	12:37	Black-headed Gull	143	improved agricultural grassland; foraging	KB

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
BH081	Lake off Lough Derravaragh	08/03/2022	12:37	Black-headed Gull	61	lakes and ponds; foraging	KB
CM006	Lough Derravaragh south	08/03/2022	12:01	Common Gull	1	lakes and ponds; foraging	KB
GG112	Lough Derravaragh south	08/03/2022	12:01	Great Crested Grebe	13	lakes and ponds; foraging	KB
GG113	Lake off Lough Derravaragh	08/03/2022	12:37	Great Crested Grebe	2	lakes and ponds; foraging	KB
GG114	River Inny and lake off Loughh Derravaragh	08/03/2022	13:10	Great Crested Grebe	4	lakes and ponds and watercourses; foraging	KB
GG115	Lough Derravaragh north	08/03/2022	13:32	Great Crested Grebe	2	lakes and ponds; foraging	KB
LG090	Lough Derravaragh south	08/03/2022	12:01	Little Grebe	4	lakes and ponds; foraging	KB
LG091	River Inny and lake off Loughh Derravaragh	08/03/2022	13:10	Little Grebe	2	lakes and ponds and watercourses; foraging	KB

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
MA080	Lake off Lough Derravaragh	08/03/2022	12:37	Mallard	7	lakes and ponds; foraging	KB
MA081	Lough Derravaragh north	08/03/2022	13:32	Mallard	20	lakes and ponds; foraging	KB
MA082	Lough Bane	08/03/2022	15:30	Mallard	2	lakes and ponds; foraging	KB
MA083	Derrycrave - BnaM lake/pond	08/03/2022	16:00	Mallard	1	lakes and ponds; foraging	KB
	Lough Derravaragh south	08/03/2022	12:01	Mute Swan	8	lakes and ponds; foraging	KB
	Lake off Lough Derravaragh	08/03/2022	12:37	Mute Swan	2	improved agricultural grassland; foraging	KB
	Lake off Lough Derravaragh	08/03/2022	12:37	Mute Swan	4	lakes and ponds; foraging	KB
	River Inny and lake off Loughh Derravaragh	08/03/2022	13:10	Mute Swan	2	lakes and ponds and watercourses; foraging	KB
	Clonava	08/03/2022	13:22	Mute Swan	38	improved agricultural grassland and watercourses; foraging	KB

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
	River Inny	08/03/2022	13:24	Mute Swan	17	watercourses; foraging	KB
	Lough Derravaragh north	08/03/2022	13:32	Mute Swan	5	lakes and ponds; foraging	KB
	Flooded bog on site	08/03/2022	15:24	Mute Swan	1	cutover bog; foraging	KB
	Derrycrave - BnaM lake/pond	08/03/2022	16:00	Mute Swan	2	lakes and ponds; foraging	KB
BH082	Brackagh Lough	31/03/2022	08:00	Black-headed Gull	3	lakes and ponds; foraging	KB
BH083	Lough Sheelin west	31/03/2022	08:20	Black-headed Gull	32	lakes and ponds; foraging	KB
BH084	Derragh Lough	31/03/2022	09:32	Black-headed Gull	2	lakes and ponds; foraging	KB
BH086	Lough Derravaragh south	31/03/2022	15:27	Black-headed Gull	16	lakes and ponds; foraging	KB
BH085	River Inny	31/03/2022	10:24	Black-headed Gull	3	watercourses and cutover bog; flying over	KB
GG116	Lough Sheelin west	31/03/2022	08:20	Great Crested Grebe	15	lakes and ponds; foraging	KB
GG117	Lough Kinale	31/03/2022	09:07	Great Crested Grebe	2	lakes and ponds; foraging	KB
GG118	Derragh Lough	31/03/2022	09:32	Great Crested Grebe	2	lakes and ponds; foraging	KB

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
GG119	Lough Kinale south	31/03/2022	09:50	Great Crested Grebe	1	lakes and ponds; foraging	KB
GG120	Lough Derravaragh north	31/03/2022	13:41	Great Crested Grebe	2	lakes and ponds; foraging	KB
GG121	Lake off Lough Derravaragh	31/03/2022	15:00	Great Crested Grebe	2	lakes and ponds; foraging	KB
GG122	Lough Derravaragh south	31/03/2022	15:27	Great Crested Grebe	13	lakes and ponds; foraging	KB
GN009	Lough Derravaragh north	31/03/2022	13:41	Goldeneye	5	lakes and ponds; foraging	KB
H055	Lough Sheelin west	31/03/2022	08:20	Grey Heron	1	lakes and ponds; foraging	KB
H056	Derragh Lough	31/03/2022	09:32	Grey Heron	1	lakes and ponds; foraging	KB
LG092	Derragh Lough	31/03/2022	09:32	Little Grebe	2	lakes and ponds; foraging	KB
LG093	Lough Kinale south	31/03/2022	09:50	Little Grebe	1	lakes and ponds; foraging	KB
LG094	Lough Derravaragh north	31/03/2022	13:41	Little Grebe	3	lakes and ponds; foraging	KB

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
LG095	Lough Derravaragh south	31/03/2022	15:27	Little Grebe	1	lakes and ponds; foraging	KB
MA084	Brackagh Lough	31/03/2022	08:00	Mallard	2	lakes and ponds; foraging	KB
MA085	Lough Kinale	31/03/2022	09:07	Mallard	2	lakes and ponds; foraging	KB
MA086	Derragh Lough	31/03/2022	09:32	Mallard	3	lakes and ponds; foraging	KB
MA087	Flooded bog on site	31/03/2022	11:20	Mallard	1	cutover bog; foraging	KB
MA088	Lough Bane	31/03/2022	11:25	Mallard	1	lakes and ponds; foraging	KB
MA089	Lough Derravaragh north	31/03/2022	13:41	Mallard	10	lakes and ponds; foraging	KB
MA090	Lake off Lough Derravaragh	31/03/2022	15:00	Mallard	4	lakes and ponds; foraging	KB
MA091	Lough Derravaragh south	31/03/2022	15:27	Mallard	6	lakes and ponds; foraging	KB
MH081	Lough Sheelin east	31/03/2022	08:45	Moorhen	1	lakes and ponds; foraging	KB
MH082	River Inny	31/03/2022	09:40	Moorhen	1	watercourses; foraging	KB
MH083	Robinstown flooded fields	31/03/2022	13:16	Moorhen	4	lakes and ponds; foraging	KB

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
MH084	Lough Derravaragh north	31/03/2022	13:41	Moorhen	2	lakes and ponds; foraging	KB
	Brackagh Lough	31/03/2022	08:00	Mute Swan	2	lakes and ponds; foraging	KB
	Lough Sheelin west	31/03/2022	08:20	Mute Swan	11	lakes and ponds; foraging	KB
	Lough Sheelin centre	31/03/2022	08:32	Mute Swan	21	lakes and ponds; foraging	KB
	Lough Sheelin east	31/03/2022	08:45	Mute Swan	2	lakes and ponds; foraging	KB
	Lough Kinale	31/03/2022	09:07	Mute Swan	214	lakes and ponds; foraging	KB
	Derragh Lough	31/03/2022	09:32	Mute Swan	34	lakes and ponds; foraging	KB
	Lough Kinale south	31/03/2022	09:50	Mute Swan	7	lakes and ponds; foraging	KB
	Flooded bog on site	31/03/2022	11:20	Mute Swan	1	cutover bog; foraging	KB
	Lough Bane	31/03/2022	11:25	Mute Swan	1	lakes and ponds; foraging	KB
	Lough Derravaragh north	31/03/2022	13:41	Mute Swan	11	lakes and ponds; foraging	KB
	River Inny	31/03/2022	14:02	Mute Swan	7	improved agricultural grassland and watercourses; foraging	KB

Wildfowl Distribution Surveys							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
	River Inny and lake off Loughh Derravaragh	31/03/2022	14:12	Mute Swan	5	lakes and ponds; foraging	KB
	Lake off Lough Derravaragh	31/03/2022	15:00	Mute Swan	3	lakes and ponds; foraging	KB
	Lough Derravaragh south	31/03/2022	15:27	Mute Swan	32	lakes and ponds; foraging	KB
SU003	Robinstown pond	31/03/2022	13:10	Shelduck	2	lakes and ponds; foraging	KB

Table 1-67 Incidental Non-target Species Observations

Incidental Records							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
	Breeding Walkover Survey, onsite	07/04/2021	08:21	Hare	1	mixed broadleaved/conifer woodland; feeding	PM
	Breeding Walkover Survey, 500m survey radius	07/04/2021	09:21	Hare	1	cutover bog; walking	PM
	Breeding Raptor Survey, rvp6	29/04/2021	13:21	Mallard	1	wet grassland; travelling	PM
	Breeding Raptor Survey, rvp6	29/04/2021	14:35	Mallard	2	mixed broadleaved/conifer woodland; travelling	PM
	Breeding Raptor Survey, rvp1	30/04/2021	13:06	Black-Headed Gull	1	cutover bog; travelling	PM
	Breeding Raptor Survey, rvp1	30/04/2021	13:41	Grey Heron	1	cutover bog; travelling	PM
	Breeding Raptor Survey, rvp2	30/04/2021	08:16	Mallard	1	improved agricultural grassland and short rotation coppice; travelling; landed	PM
	Breeding Raptor Survey, rvp1	30/04/2021	12:45	Mallard	2	cutover bog; travelling	PM
	Breeding Raptor Survey, rvp1	30/04/2021	13:29	Ringed Plover	2	cutover bog; landed and began territorial behaviour, either m&f displaying or 2m posturing	PM

Incidental Records							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
	Breeding Raptor Survey, rvp1	06/05/2021	17:20	Black-Headed Gull	1	improved agricultural grassland; travelling	PM
	Breeding Raptor Survey, rvp1	06/05/2021	17:23	Black-Headed Gull	3	cutover bog; travelling; landed	PM
	Breeding Raptor Survey, rvp1	06/05/2021	16:39	Grey Heron	1	cutover bog; flew and landed on bog	PM
	Breeding Raptor Survey, rvp1	06/05/2021	18:47	Grey Heron	1	depositing/lowland rivers and mixed broadleaved/conifer woodland; travelling	PM
	Breeding Raptor Survey, rvp1	06/05/2021	16:39	Mallard	3	cutover bog; one flew and landed beside pair	PM
	Breeding Raptor Survey, rvp1	06/05/2021	16:50	Mallard	3	cutover bog; flew in to join other ma	PM
	Breeding Raptor Survey, rvp1	06/05/2021	18:03	Moorhen	1	cutover bog; feeding	PM
	Breeding Raptor Survey, rvp1	06/05/2021	17:20	Mute Swan	1	cutover bog; travelling	PM
	Breeding Raptor Survey, rvp1	06/05/2021	17:01	Ringed Plover	1	cutover bog; flying; landedand began feeding	PM
	Breeding Walkover Survey, on site	14/05/2021	08:27	Hare	1	cutover bog; running	PM

Incidental Records							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
	Breeding Walkover Survey, on site	14/05/2021	05:53	Red Fox	1	improved agricultural grassland; carrying prey (chicken)	PM
	Breeding Walkover Survey, on site	14/05/2021	07:23	Red Squirrel	1	conifer plantation; ran across track	PM
	Breeding Woodcock Survey, on site	18/05/2021	21:12	Grey Heron	1	mixed broadleaved/conifer woodland and improved agricultural grassland; travelling	PM
	Breeding Woodcock Survey, on site	18/05/2021	21:48	Grey Heron	1	mixed broadleaved/conifer woodland; travelling	PM
	Vantage Point Survey, vp4	21/05/2021	06:37	Hare	1	cutover bog; travelling	PM
	Breeding Raptor Survey, rvp2a	24/05/2021	19:21	Black-Headed Gull	1	improved agricultural grassland and mixed broadleaved/conifer woodland; travelling	PM
	Breeding Raptor Survey, rvp2a	24/05/2021	18:02	Grey Heron	1	improved agricultural grassland and mixed broadleaved/conifer woodland; travelling	PM
	Breeding Raptor Survey, rvp1	03/06/2021	18:10	Black-Headed Gull	3	cutover bog; roosting	PM
	Breeding Raptor Survey, rvp1	03/06/2021	18:29	Grey Heron	1	cutover bog; circling before landing	PM
	Breeding Raptor Survey, rvp1	03/06/2021	18:30	Irish Hare	1	cutover bog; travelling	PM

Incidental Records							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
	Breeding Raptor Survey, rvp1	03/06/2021	18:09	Mallard	5	cutover bog; roosting	PM
	Breeding Raptor Survey, rvp1	03/06/2021	20:18	Mallard	20	conifer plantation and cutover bog; coming into roost, all males	PM
	Breeding Raptor Survey, rvp1	03/06/2021	20:24	Mallard	43	cutover bog; flying to other lake	PM
	Breeding Raptor Survey, rvp1	03/06/2021	18:29	Ringed Plover	1	cutover bog; preening	PM
	Breeding Raptor Survey, rvp6	04/06/2021	19:26	Grey Heron	1	depositing/lowland rivers; travelling	PM
	Breeding Raptor Survey, rvp6	04/06/2021	18:47	Mallard	1	cutover bog; travelling, male	PM
	Breeding Woodcock Survey, t3 coole	04/06/2021	21:45	Mink	1	conifer plantation; travelling	TRea
	Breeding Raptor Survey, rvp2	28/06/2021	21:10	Black-Headed Gull	2	mixed broadleaved/conifer woodland; travelling	PM
	Breeding Raptor Survey, rvp2	28/06/2021	19:10	Black-Headed Gull	1	mixed broadleaved/conifer woodland; travelling	PM
	Breeding Raptor Survey, rvp2	28/06/2021	19:56	Black-Headed Gull	1	mixed broadleaved/conifer woodland and improved agricultural grassland; travelling, juvenile	PM
	Breeding Raptor Survey, rvp2	28/06/2021	19:23	Great Spotted Woodpecker	1	conifer plantation; on tree	PM

Incidental Records							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
	Breeding Raptor Survey, rvp2	28/06/2021	19:52	Lesser Black-Backed Gull	1	mixed broadleaved/conifer woodland and improved agricultural grassland; travelling	PM
	Breeding Raptor Survey, rvp2	28/06/2021	20:24	Lesser Black-Backed Gull	1	mixed broadleaved/conifer woodland; travelling	PM
	Breeding Raptor Survey, coole brvp5	13/07/2021	14:20	Pine Martin	1	bogs and highly modified/non-native woodland; travelling	TRea
	Breeding Raptor Survey, rvp1 coole	19/07/2021	10:29	Meadow Pipit	2	bogs; display	TRea
	Breeding Walkover Survey, 500m survey radius	23/07/2021	08:01	Irish Hare	1	cutover bog; travelling	PM
	Vantage Point Survey, coole vp6	19/08/2021	15:44	Meadow Pipit	6	cutover bog; flying, calling, present through duration of survey	TRea
GL001	Wildfowl Distribution Survey, r. inny	12/10/2021	15:04	Grey Wagtail	1	depositing/lowland rivers; flying along river	NM
GL002	Wildfowl Distribution Survey,	23/11/2021	13:12	Grey Wagtail	2	depositing/lowland rivers and hedgerows; flitting under bridge	NM
RE001	Vantage Point Survey, clonrobert	25/01/2022	14:07	Redwing	1	improved agricultural grassland and treelines; flying	ZE

Incidental Records							
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
MA001	Vantage Point Survey, coole vp6	08/03/2022	13:13	Mallard	2	cutover bog; flying, 2 ma seen flying in route to site	NS

APPENDIX 3

CONFIDENTIAL DATA

This data has been removed from the public files for confidentiality reasons in the interest of the protected species

APPENDIX 4

FIGURES

Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Vantage Point Location

N

Drawing Title: Vantage Point Locations

Project Title: Coole Wind Farm

Drawn By	Checked By
I.Hynes	P. Cregg
Project No.	Drawing No.
200445g	Fig. 1
Scale	Date
1:25000	05/07/2022

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Website: ww.mkoireland.ie

Map Legend

- Wind Farm Site
- Vantage Point Locations

N

Drawing Title
Viewshed analysis (20m swept Height)

Project Title
Coole Wind Farm

Drawn By	Checked By
IH	PC
Project No.	Drawing No.
200445g	Fig. 1.A
Scale	Date
1:48707	27.10.2022

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Map Legend

- Wind Farm Site
- Vantage Point Locations

N

Drawing Title
Viewshed analysis (25m swept Height)

Project Title
Coole Wind Farm

Drawn By	Checked By
IH	PC
Project No.	Drawing No.
200445g	Fig. 1.B
Scale	Date
1:48707	27.10.2022

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Map Legend

- Wind Farm Site
- Vantage Point Locations

N

Drawing Title
Viewshed analysis (26m Swept Height)

Project Title
Coole Wind Farm

Drawn By	Checked By
IH	PC
Project No.	Drawing No.
200445g	Fig. 1.C
Scale	Date
1:48707	27.10.2022

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Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Vantage Point Location
- Flightline

N

Drawing Title
Golden Plover Observations.
Vantage Point Surveys

Project Title
Coole Wind Farm

Drawn By	Checked By
P. Manley	P. Cregg
Project No.	Drawing No.
200445g	Fig. 1.1
Scale	Date
1:45000	05/07/2022

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Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Vantage Point Location
- Flightline

N

Drawing Title
White-fronted Goose Obs.
Vantage Point Surveys

Project Title
Coole Wind Farm

Drawn By	Checked By
I.Hynes	P. Cregg
Project No.	Drawing No.
200445g	Fig. 1.2
Scale	Date
1:25000	05/07/2022

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Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Vantage Point Location
- Flightline

N

Drawing Title
Hen Harrier Observations
Vantage Point Surveys

Project Title
Coole Wind Farm

Drawn By	Checked By
I.Hynes	P. Cregg
Project No.	Drawing No.
200445g	Fig. 1.3
Scale	Date
1:25000	05/07/2022

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Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Vantage Point Location
- Flightline
- Non-flight observations

N

Drawing Title
Kingfisher Observations
Vantage Point Surveys

Project Title
Coole Wind Farm

Drawn By	Checked By
I.Hynes	P. Cregg
Project No.	Drawing No.
200445g	Fig. 1.4
Scale	Date
1:25000	05/07/2022

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Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Vantage Point Location
- Flightline

N

Drawing Title: Merlin Observations Vantage Point Surveys

Project Title: Coole Wind Farm

Drawn By	Checked By
I.Hynes	P. Cregg
Project No. 200445g	Drawing No. Fig. 1.5
Scale 1:25000	Date 05/07/2022

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Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Vantage Point Location
- Flightline

N

Drawing Title
Peregrine Observations
Vantage Point Surveys

Project Title
Coole Wind Farm

Drawn By	Checked By
I.Hynes	P. Cregg
Project No.	Drawing No.
200445g	Fig. 1.6
Scale	Date
1:25000	05/07/2022

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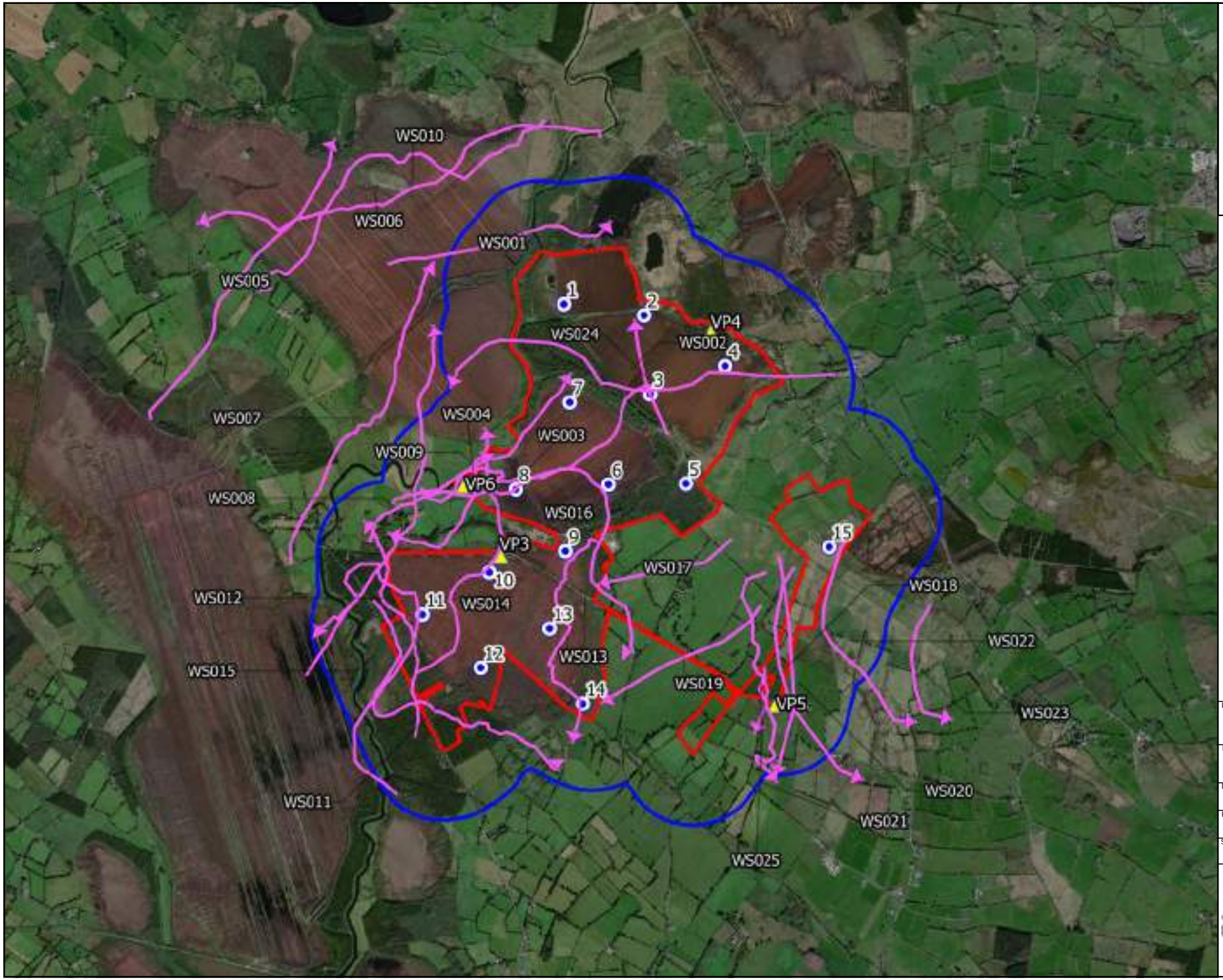

Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Vantage Point Location
- Flightline

N

Drawing Title
Whooper Swan Observations
Vantage Point Surveys

Project Title
Coole Wind Farm

Drawn By	Checked By
I.Hynes	P. Cregg
Project No.	Drawing No.
200445g	Fig. 1.7
Scale	Date
1:35000	05/07/2022

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Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Vantage Point Location
- Flightline

N

Drawing Title
Coot Observations
Vantage Point Surveys

Project Title
Coole Wind Farm

Drawn By	Checked By
I.Hynes	P. Cregg
Project No.	Drawing No.
200445g	Fig. 1.8
Scale	Date
1:25000	05/07/2022

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Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Vantage Point Location
- Flightline

N

Drawing Title
Curlew Observations
Vantage Point Surveys

Project Title
Coole Wind Farm

Drawn By	Checked By
I.Hynes	P. Cregg
Project No.	Drawing No.
200445g	Fig. 1.9
Scale	Date
1:25000	05/07/2022

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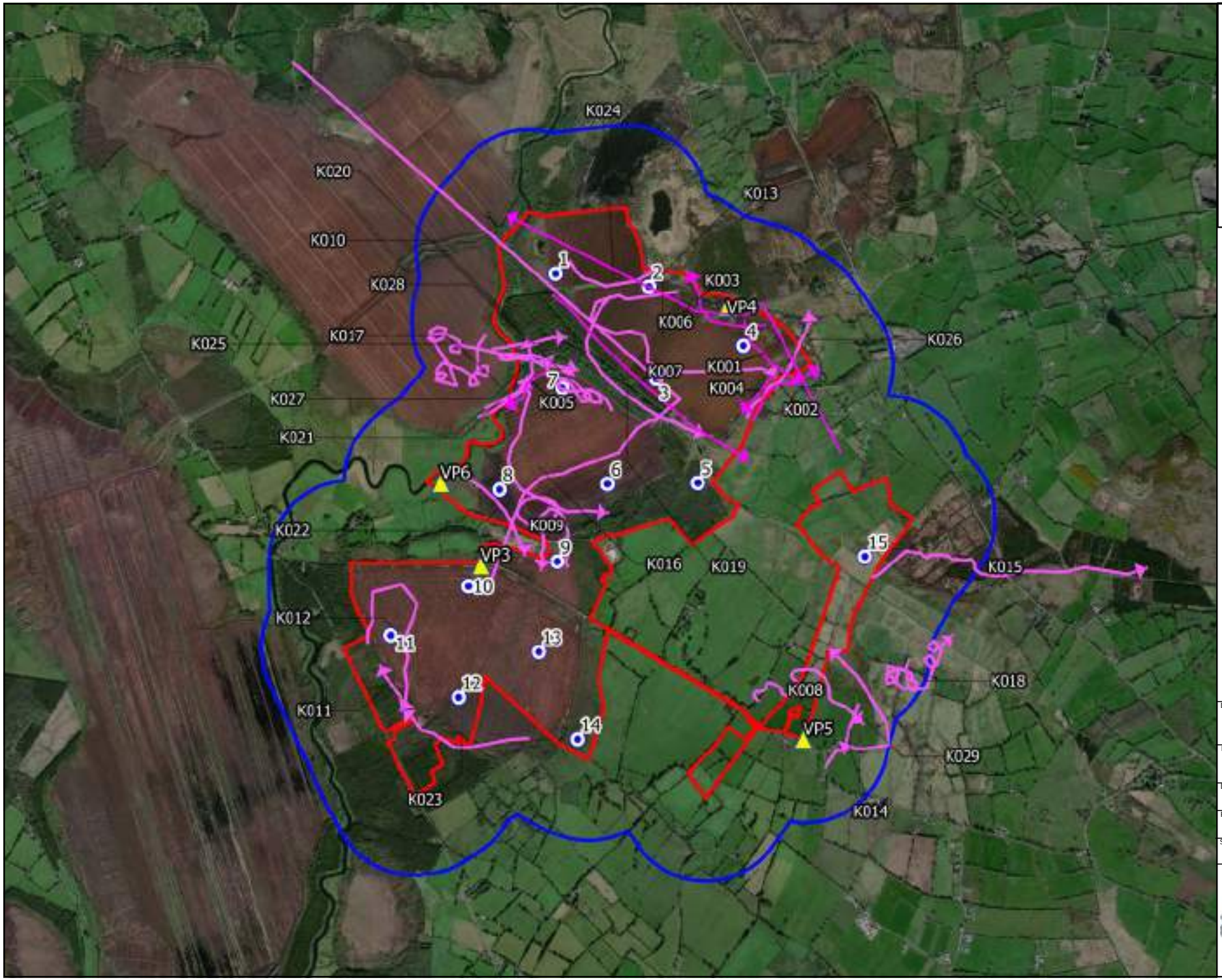

Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Vantage Point Location
- Flightline

Drawing Title
Kestrel Observations
Vantage Point Surveys

Project Title
Coole Wind Farm

Drawn By	Checked By
I. Hynes	P. Cregg
Project No.	Drawing No.
200445g	Fig. 1.10
Scale	Date
1:30000	05/07/2022

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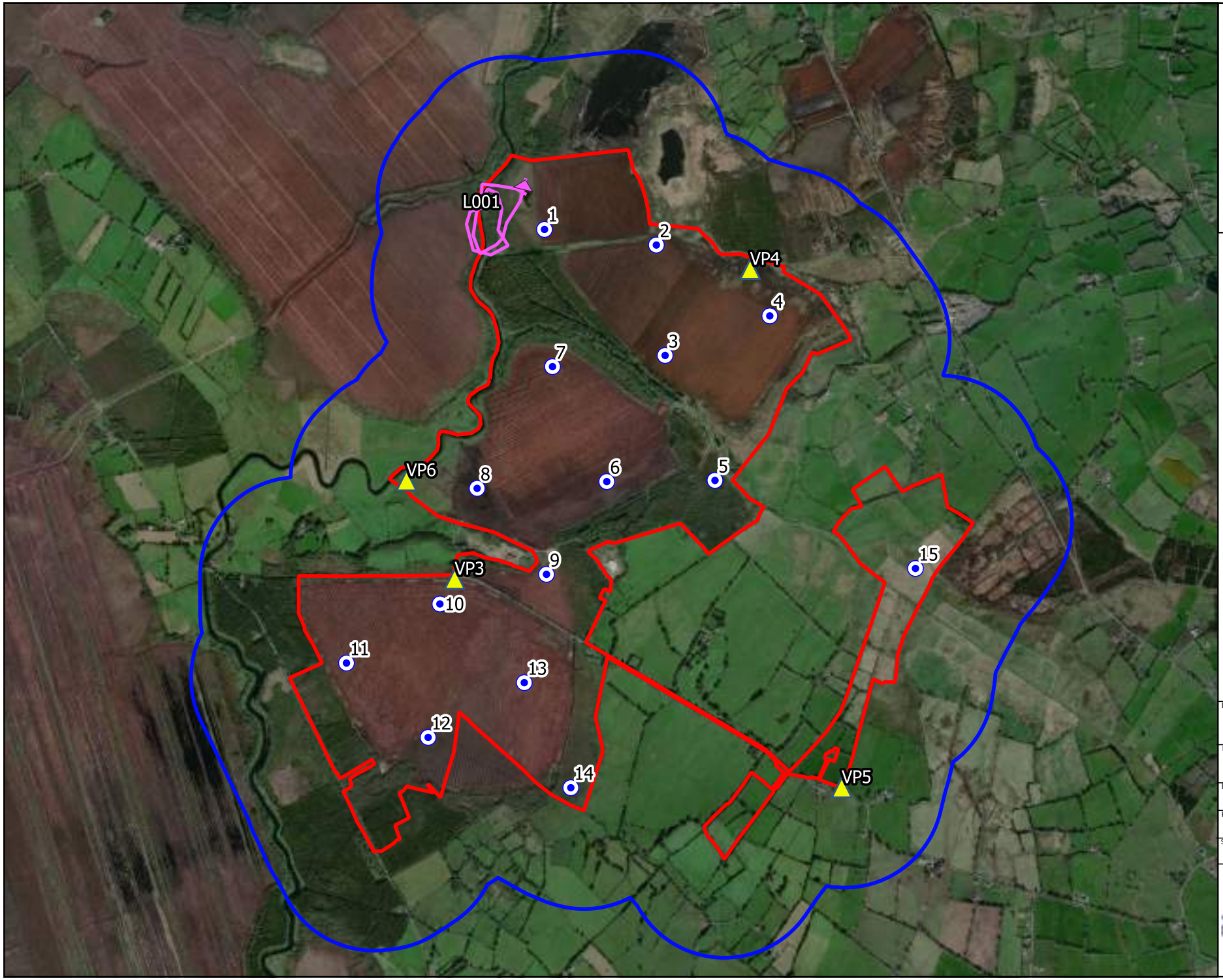

Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Vantage Point Location
- Flightline

N

Drawing Title
Lapwing Observations
Vantage Point Surveys

Project Title
Coole Wind Farm

Drawn By	Checked By
I. Hynes	P. Cregg
Project No.	Drawing No.
200445g	Fig. 1.11
Scale	Date
1:25000	05/07/2022

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Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Vantage Point Location
- Flightline
- Non-flight observations

N

Drawing Title	Snipe Observations Vantage Point Surveys
Project Title	Coole Wind Farm
Drawn By: I. hynes	Checked By: P. Cregg
Project No.: 200445g	Drawing No.: Fig. 1.12
Scale: 1:25000	Date: 05/07/2022

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Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Vantage Point Location
- Flightline

N

Drawing Title
Woodcock Observations
Vantage Point Surveys

Project Title
Coole Wind Farm

Drawn By	Checked By
I. Hynes	P. Cregg
Project No.	Drawing No.
200445g	Fig. 1.13
Scale	Date
1:25000	05/07/2022

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Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Vantage Point Location
- Flightline

N

Drawing Title
Buzzard Observations
Vantage Point Surveys

Project Title
Coole Wind Farm

Drawn By	Checked By
I.Hynes	P. Cregg
Project No.	Drawing No.
200445g	Fig. 1.14
Scale	Date
1:45000	05/07/2022

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Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Vantage Point Location
- Possible Breeding Territories

N

Drawing Title: Buzzard Breeding Territories Vantage Point Surveys

Project Title: Coole Wind Farm

Drawn By	Checked By
I.Hynes	P.Cregg
Project No.	Drawing No.
200445g	Fig. 1.14.1
Scale	Date
1:45000	05/07/2022

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Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Vantage Point Location
- Flightline

N

Drawing Title
Sparrowhawk Observations
Vantage Point Surveys

Project Title
Coole Wind Farm

Drawn By	Checked By
I.Hynes	P. Cregg
Project No.	Drawing No.
200445g	Fig. 1.15
Scale	Date
1:25000	05/07/2022

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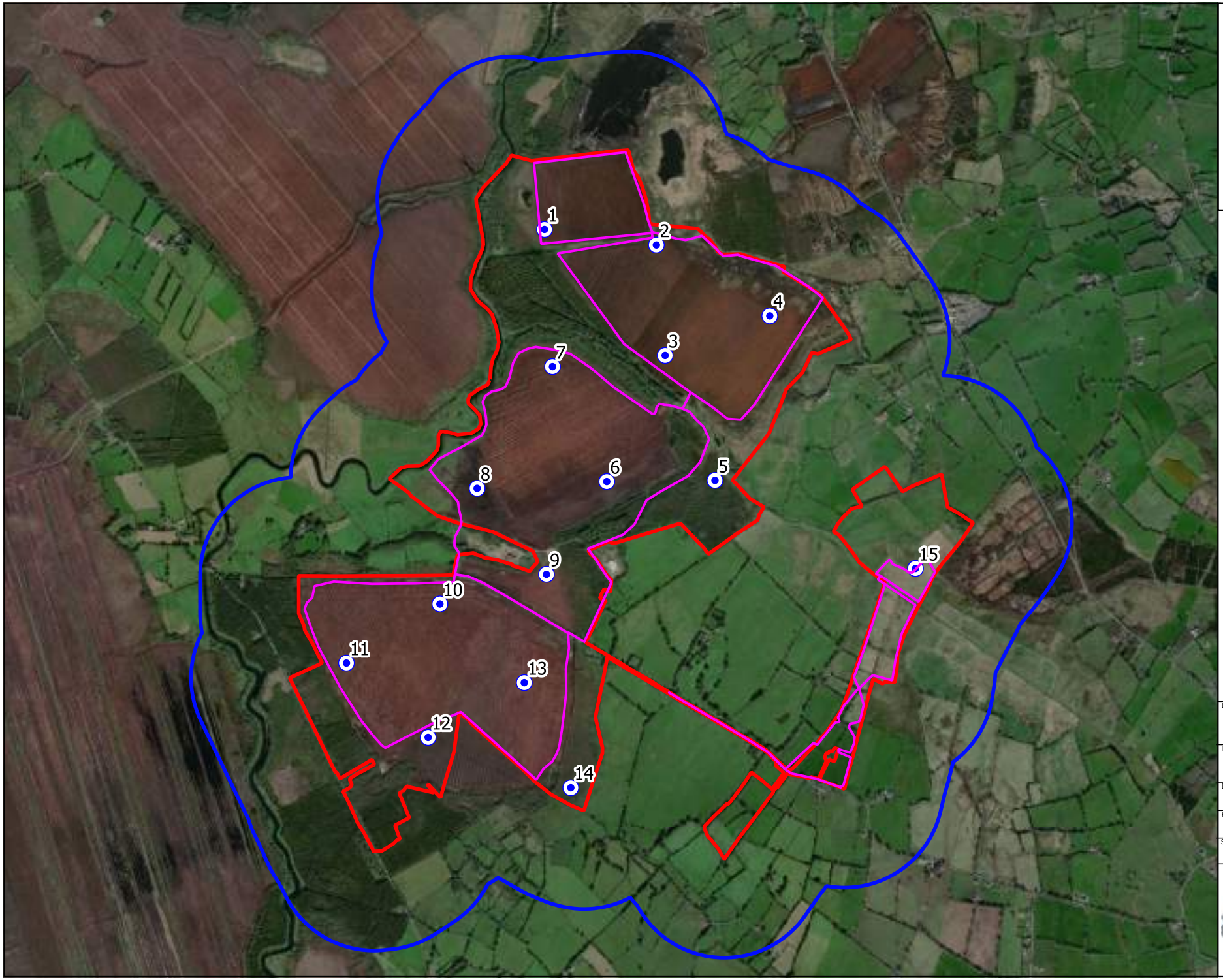

Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Walkover Transects

N

Drawing Title: Breeding Walkover Transects

Project Title: Coole Wind Farm

Drawn By	Checked By
I.Hynes	P. Cregg
Project No.	Drawing No.
200445g	Fig. 2
Scale	Date
1:25000	05/07/2022

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Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Flightline

N

Drawing Title
Golden Plover Observations
Breeding Walkover Surveys

Project Title
Coole Wind Farm

Drawn By	Checked By
I.Hynes	P. Cregg
Project No.	Drawing No.
200445g	Fig. 2.1
Scale	Date
1:25000	05/07/2022

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Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Flightline

N

Drawing Title
Snipe Observations
Breeding Walkover Surveys

Project Title
Coole Wind Farm

Drawn By	Checked By
I.Hynes	P. Cregg
Project No.	Drawing No.
200445g	Fig. 2.3
Scale	Date
1:45000	05/07/2022

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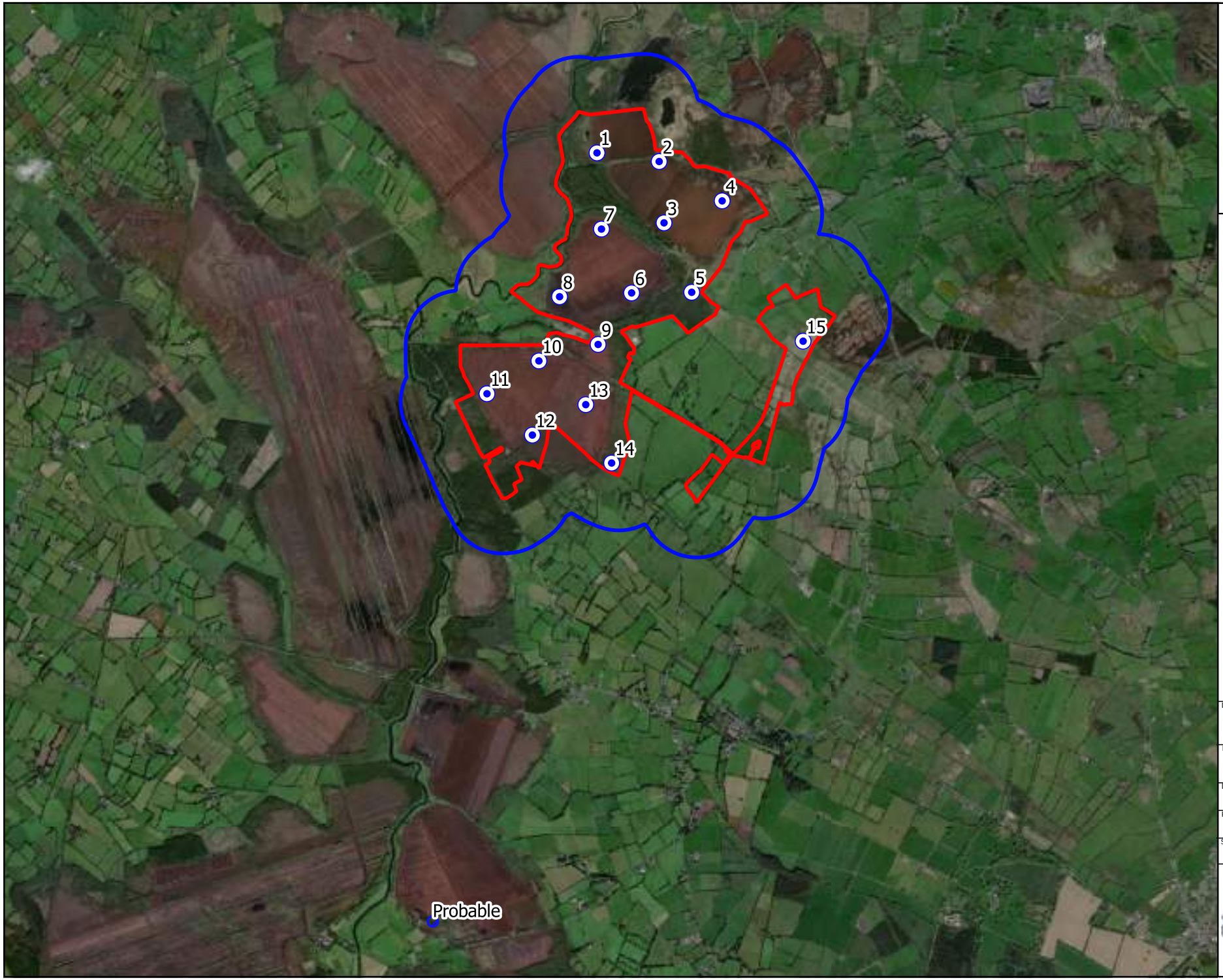

Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Probable Territory

N

Drawing Title: Snipe Breeding Territories

Project Title: Coole Wind Farm

Drawn By	Checked By
P. Manley	P. Cregg
Project No.	Drawing No.
200445g	Fig. 6.2
Scale	Date
1:45000	05/07/2022

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Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Flightline

N

Drawing Title
Buzzard Observations
Breeding Walkover Surveys

Project Title
Coole Wind Farm

Drawn By	Checked By
I.Hynes	P. Cregg
Project No.	Drawing No.
200445g	Fig. 2.4
Scale	Date
1:45000	05/07/2022

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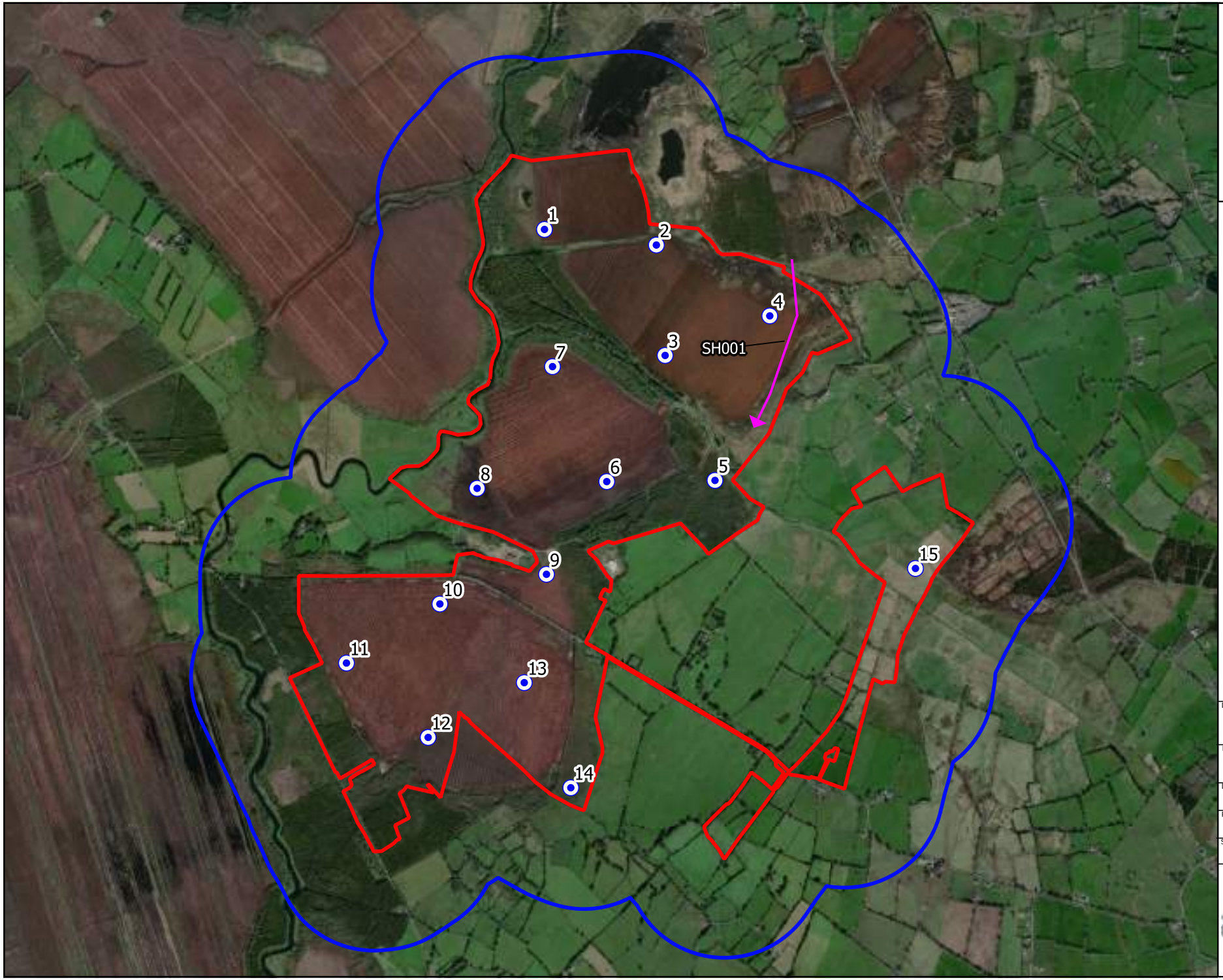

Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Flightline

N

Drawing Title
Sparrowhawk Observations
Breeding Walkover Surveys

Project Title
Coole Wind Farm

Drawn By	Checked By
I.Hynes	P. Cregg
Project No.	Drawing No.
200445g	Fig. 2.5
Scale	Date
1:25000	05/07/2022

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Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Confirmed Territory

N

Drawing Title
Sparrowhawk Breeding Territory

Project Title
Coole Wind Farm

Drawn By	Checked By
I.Hynes	P. Cregg
Project No.	Drawing No.
200445g	Fig. 2.5.1
Scale	Date
1:25000	05/07/2022

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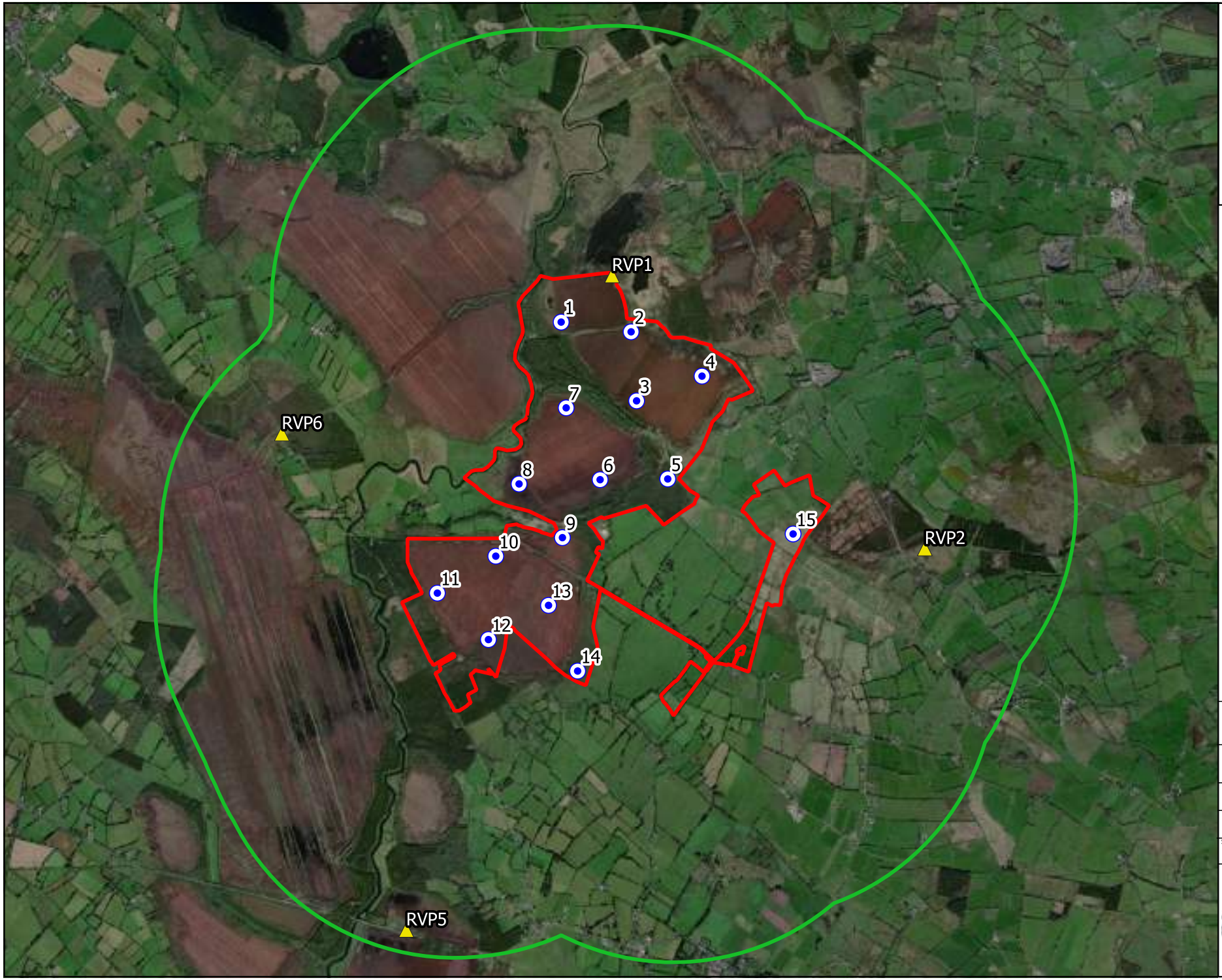

Map Legend

- Wind Farm Site
- 2km Survey Radius
- Turbine Layout
- Breeding Raptor Vantage Point Locations

N

Drawing Title	Breeding Raptor Vantage Point Locations
Project Title	Coole Wind Farm
Drawn By: I.Hynes	Checked By: P. Cregg
Project No.: 200445g	Drawing No.: Fig. 3
Scale: 1:40000	Date: 05/07/2022

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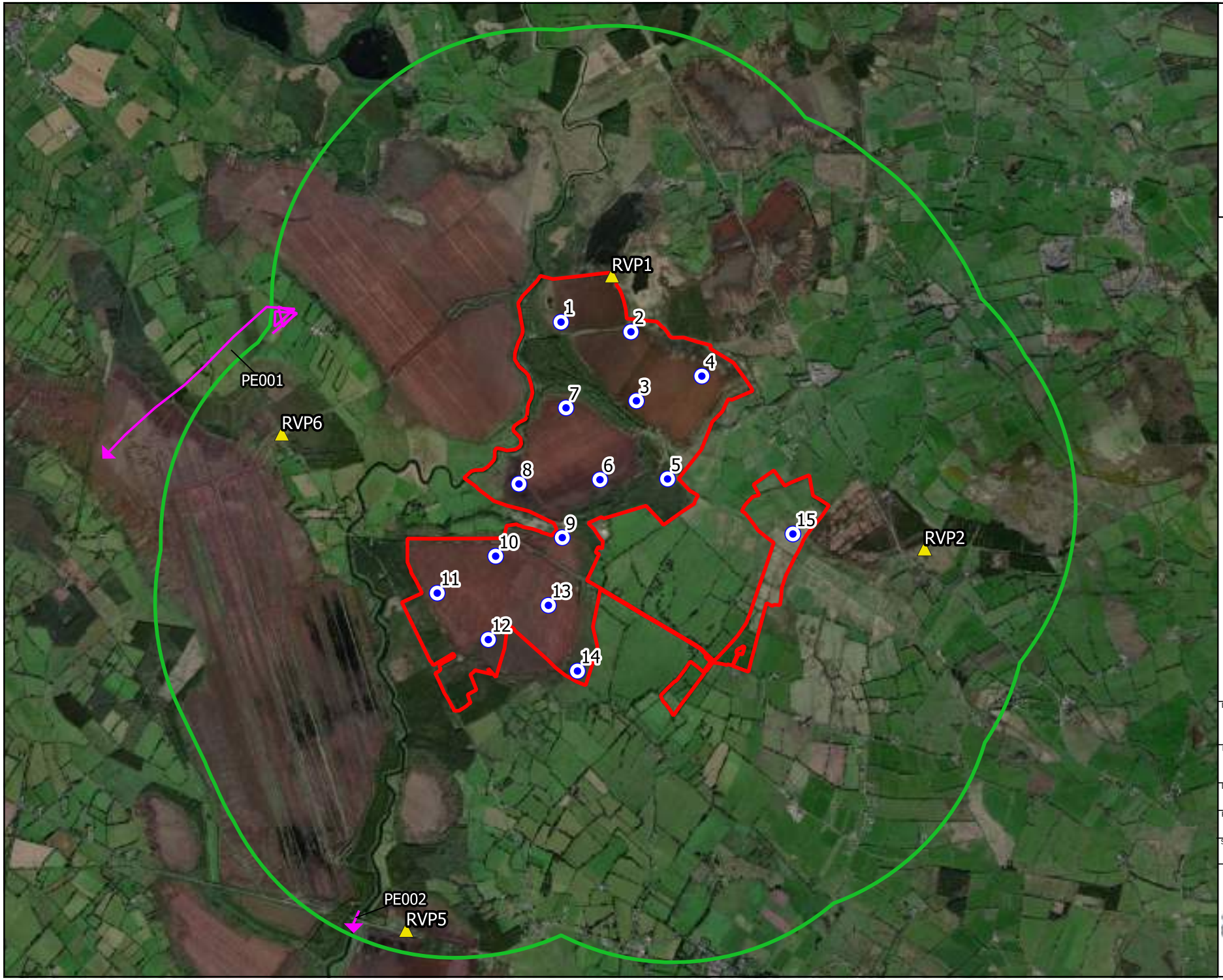

Map Legend

- Wind Farm Site
- 2km Survey Radius
- Turbine Layout
- Breeding Raptor Vantage Point Locations
- Flightline

N

Drawing Title	Peregrine Observations Breeding Raptor Surveys
Project Title	Coole Wind Farm
Drawn By: I.Hynes	Checked By: P. Cregg
Project No.: 200445g	Drawing No.: Fig. 3.1
Scale: 1:40000	Date: 05/07/2022

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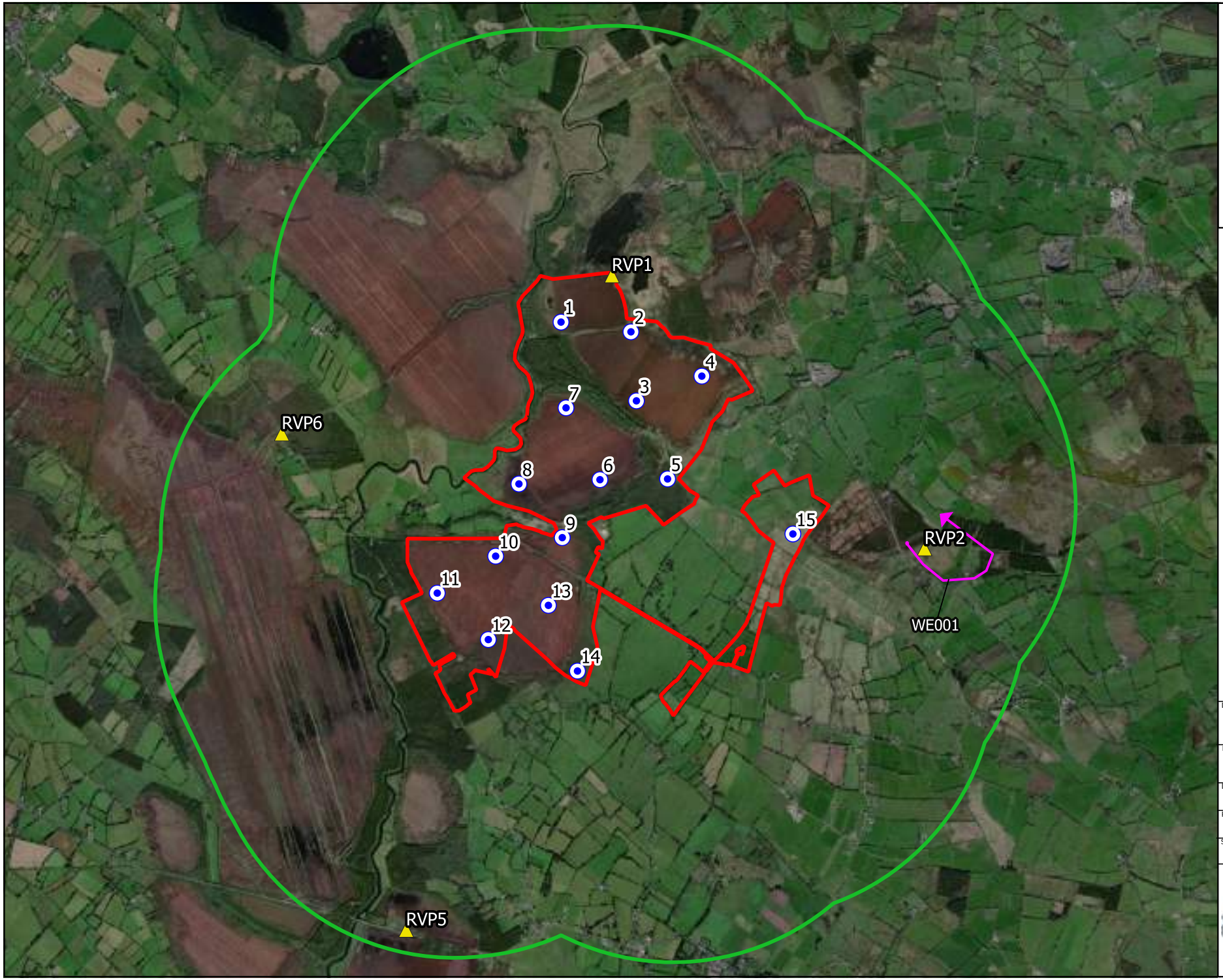

Map Legend

- Wind Farm Site
- 2km Survey Radius
- Turbine Layout
- Breeding Raptor Vantage Point Locations
- Flightline

N

Drawing Title: White-tailed Eagle Obs. Breeding Raptor Surveys

Project Title: Coole Wind Farm

Drawn By	Checked By
I.Hynes	P. Cregg
Project No. 200445g	Drawing No. Fig. 3.2
Scale 1:40000	Date 05/07/2022

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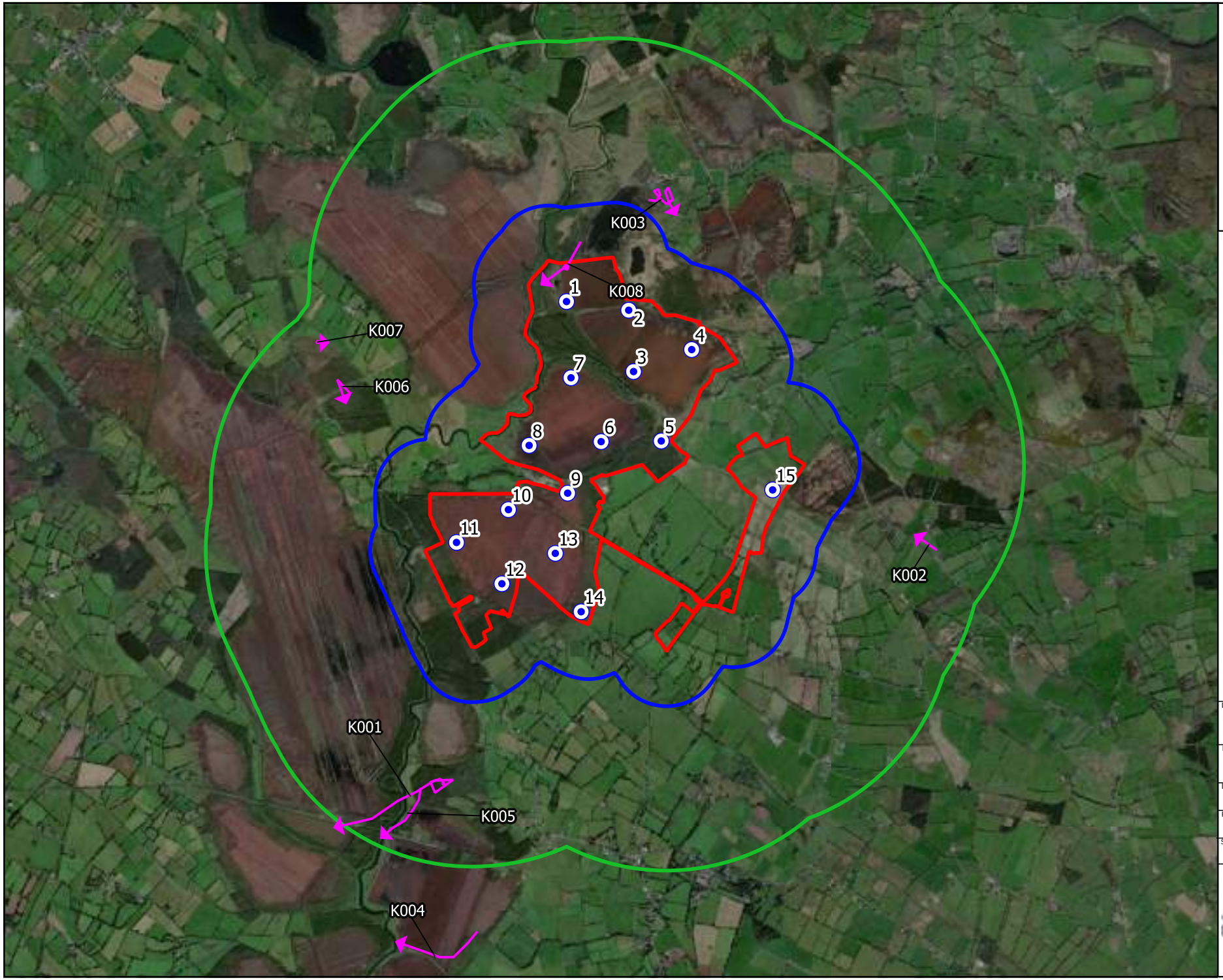

Map Legend

- Wind Farm Site
- 2km Survey Radius
- Turbine Layout
- Breeding Raptor Vantage Point Locations
- Flightline

N

Drawing Title
Kestrel Observations
Breeding Raptor Surveys

Project Title
Coole Wind Farm

Drawn By	Checked By
I.Hynes	P. Cregg
Project No.	Drawing No.
200445g	Fig. 3.3
Scale	Date
1:45000	05/07/2022

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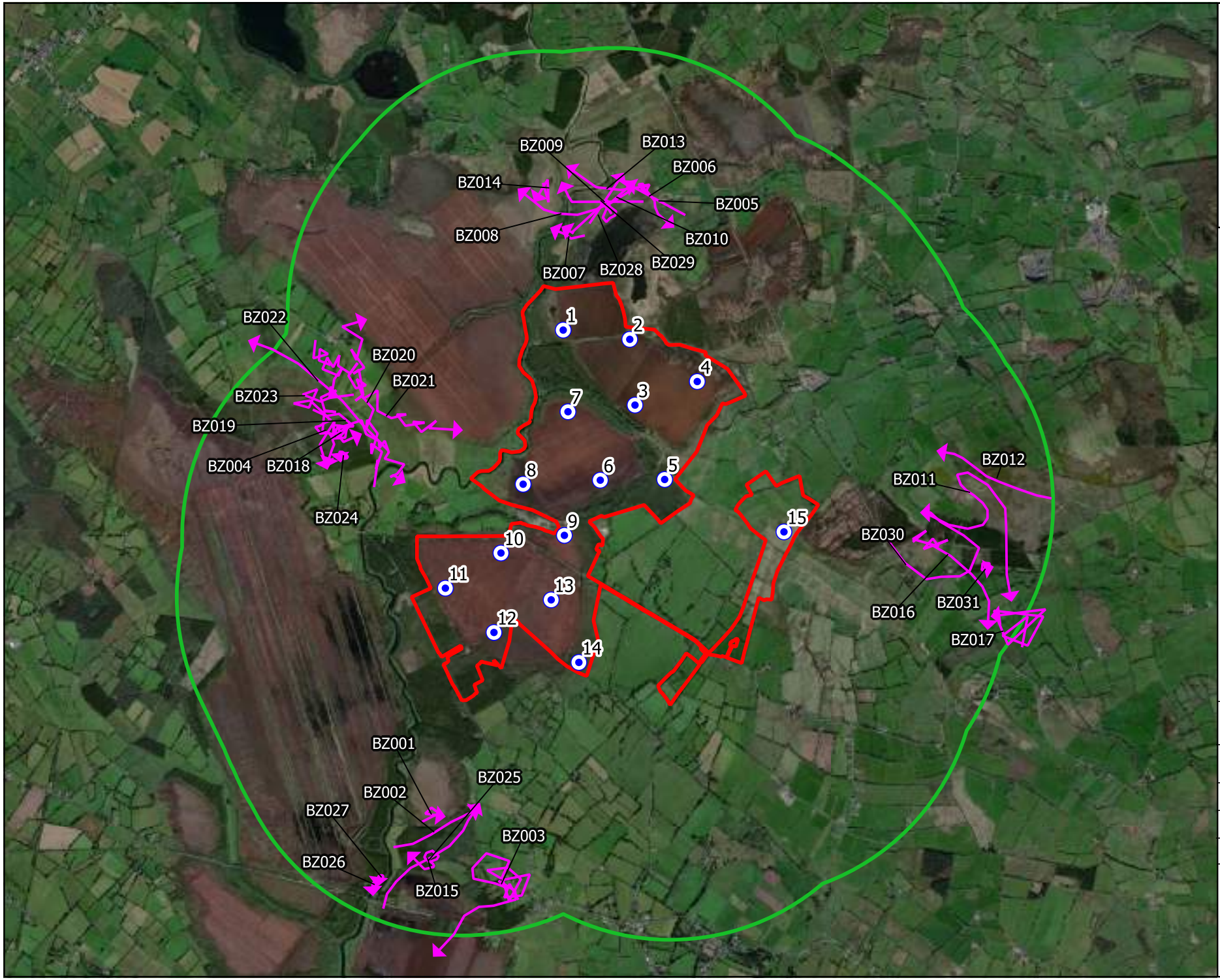

Map Legend

- Wind Farm Site
- 2km Survey Radius
- Turbine Layout
- Breeding Raptor Vantage Point Locations
- Flightline

N

Drawing Title	Buzzard Observations Breeding Raptor Surveys
Project Title	Coole Wind Farm
Drawn By: I.Hynes	Checked By: P. Cregg
Project No.: 200445g	Drawing No.: Fig. 3.4
Scale: 1:42000	Date: 05/07/2022

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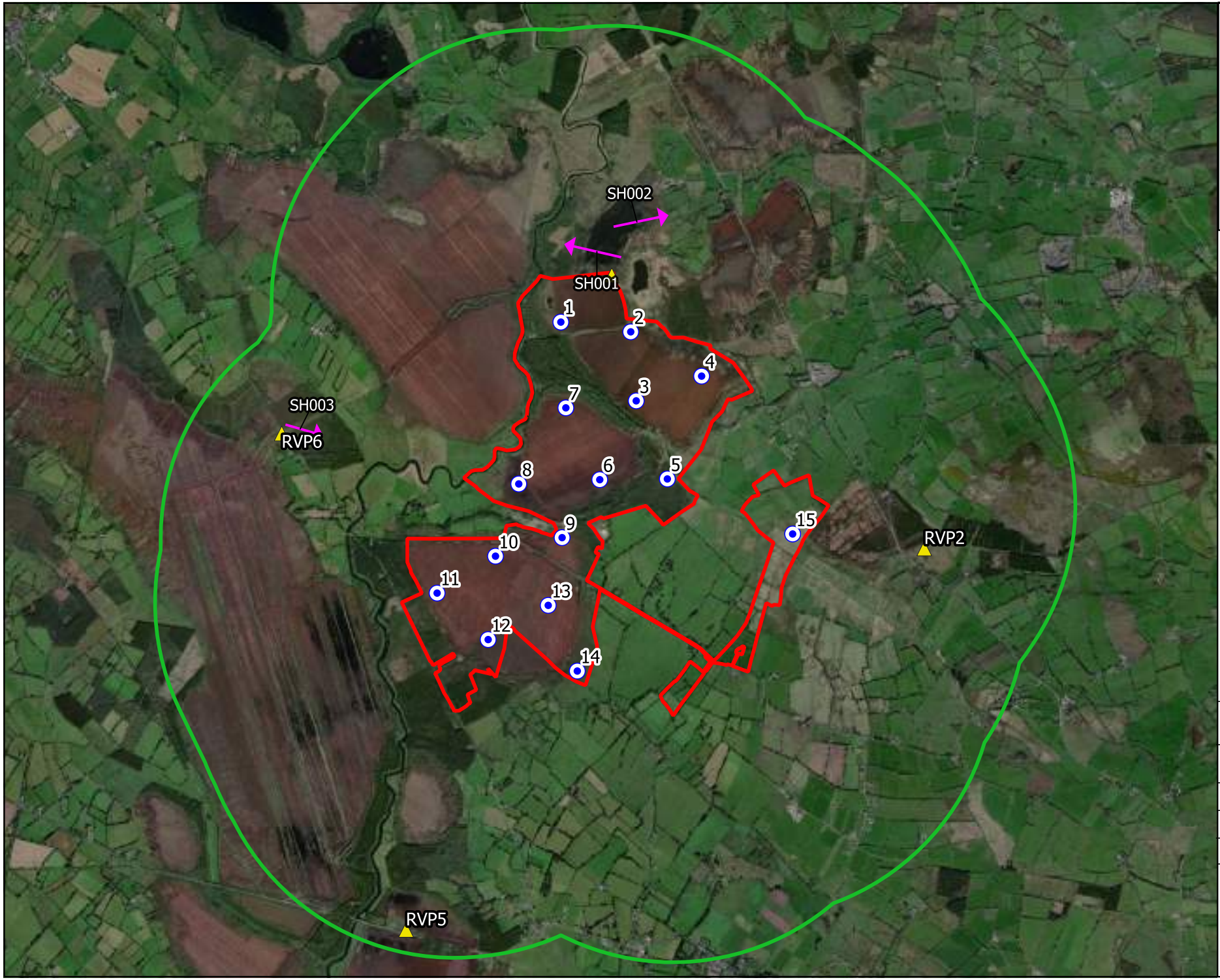

Map Legend

- Wind Farm Site
- 2km Survey Radius
- Turbine Layout
- Breeding Raptor Vantage Point Locations
- Flightline

N

Drawing Title	Sparrowhawk Observations Breeding Raptor Surveys
Project Title	Coole Wind Farm
Drawn By: I.Hynes	Checked By: P. Cregg
Project No.: 200445g	Drawing No.: Fig. 3.5
Scale: 1:40000	Date: 05/07/2022

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Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Woodcock Transects

N

Drawing Title
Breeding Woodcock Transects

Project Title
Coole Wind Farm

Drawn By	Checked By
I.Hynes	P. Cregg
Project No.	Drawing No.
200445g	Fig. 4
Scale	Date
1:25000	05/07/2022

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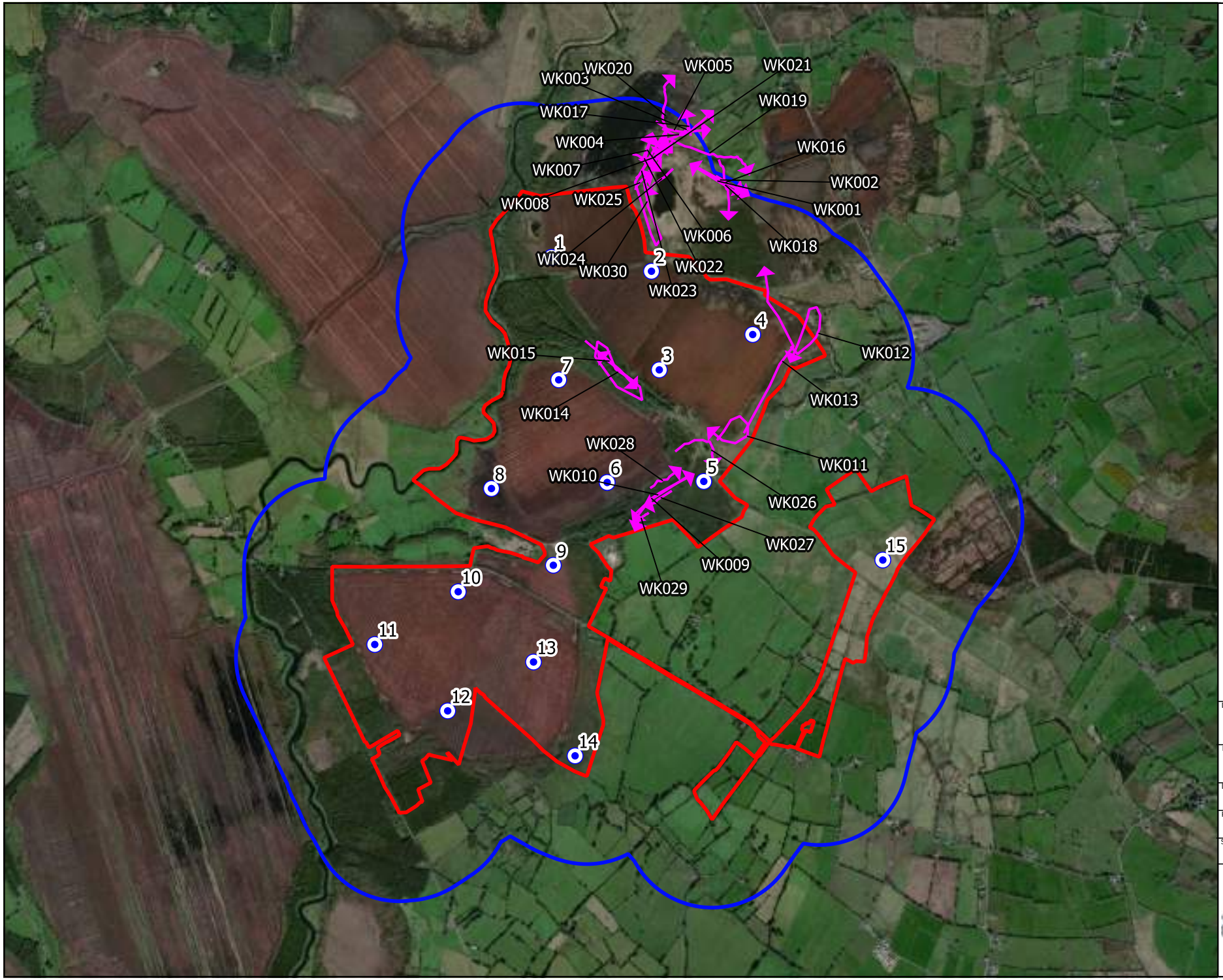

Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Flightline

N

Drawing Title
Woodcock Observations
Breeding Woodcock Surveys

Project Title
Coole Wind Farm

Drawn By	Checked By
I.Hynes	P. Cregg
Project No.	Drawing No.
200445g	Fig. 4.1
Scale	Date
1:28000	05/07/2022

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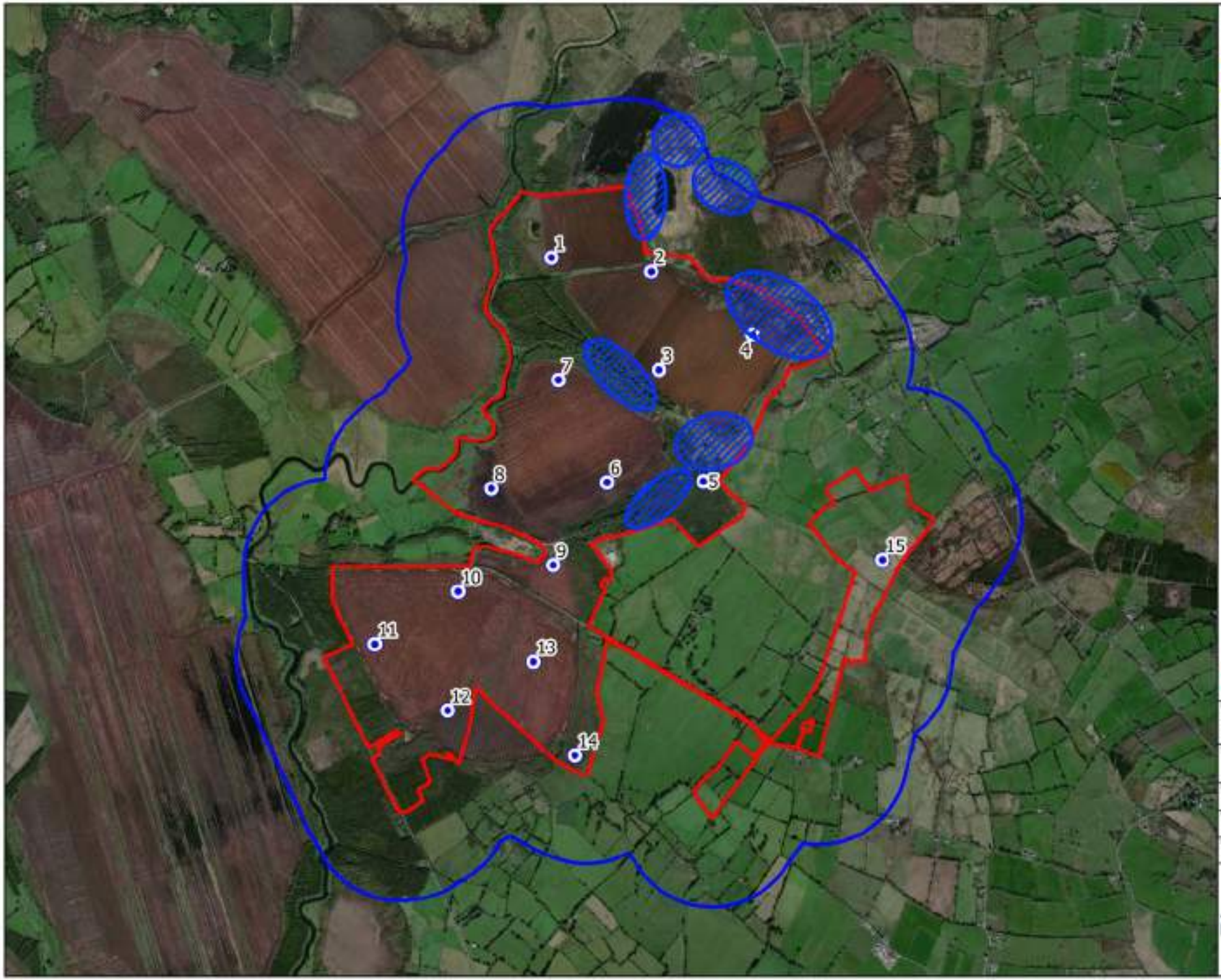

Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Possible Breeding Territory

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Drawing Title: Woodcock Territories
Breeding Woodcock Surveys

Project Title: Coole Wind Farm

Drawn By	Checked By
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Project No.	Drawing No.
200445g	Fig. 4.11
Scale	Date
1:28000	05/07/2022

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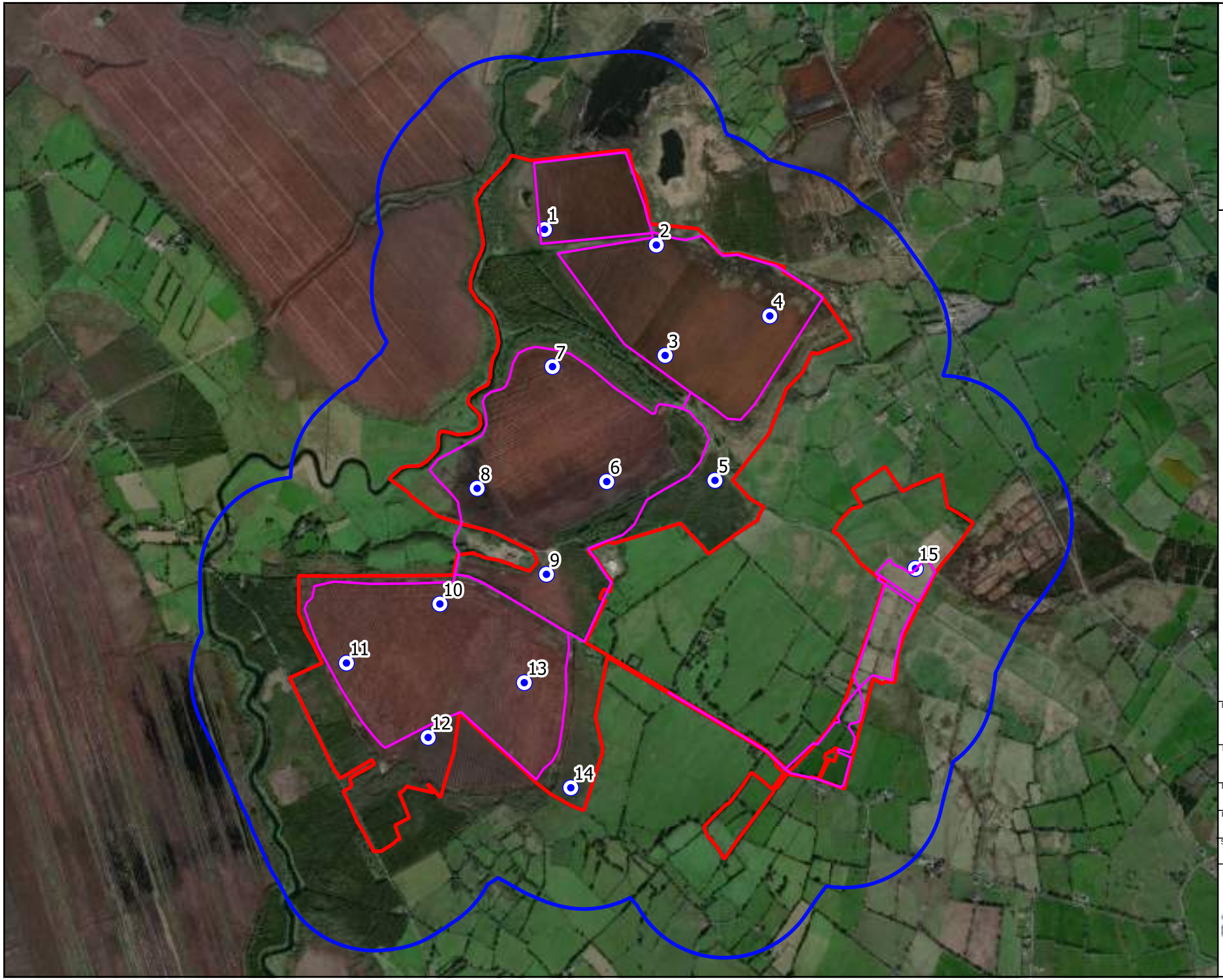

Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Walkover Transects

N

Drawing Title
Winter Walkover Transects

Project Title
Coole Wind Farm

Drawn By	Checked By
I.Hynes	P. Cregg
Project No.	Drawing No.
200445g	Fig. 5
Scale	Date
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Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Flightline

N

Drawing Title
Golden Plover Observations
Winter Walkover Surveys

Project Title
Coole Wind Farm

Drawn By	Checked By
I.Hynes	P. Cregg
Project No.	Drawing No.
200445g	Fig. 5.1
Scale	Date
1:25000	05/07/2022

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Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Flightline

N

Drawing Title
Greenland white-fronted goose Obs. Winter Walkover Surveys

Project Title
Coole Wind Farm

Drawn By	Checked By
I.Hynes	P. Cregg
Project No.	Drawing No.
200445g	Fig. 5.2
Scale	Date
1:25000	05/07/2022

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Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Flightline

N

Drawing Title
Kingfisher Observations Winter Walkover Surveys

Project Title
Coole Wind Farm

Drawn By	Checked By
I.Hynes	P. Cregg
Project No.	Drawing No.
200445g	Fig. 5.3
Scale	Date
1:25000	05/07/2022

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Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Flightline

N

Drawing Title
Teal Observations Winter Walkover Surveys

Project Title
Coole Wind Farm

Drawn By	Checked By
I.Hynes	P. Cregg
Project No.	Drawing No.
200445g	Fig. 5.4
Scale	Date
1:25000	05/07/2022

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Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Flightline

N

Drawing Title	Wigeon Observations Winter Walkover Surveys
Project Title	Coole Wind Farm
Drawn By: I.Hynes	Checked By: P. Cregg
Project No.: 200445g	Drawing No.: Fig. 5.5
Scale: 1:25000	Date: 05/07/2022

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Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Flightline

N

Drawing Title	Kestrel Observations Winter Walkover Surveys
Project Title	Coole Wind Farm
Drawn By: I.Hynes	Checked By: P. Cregg
Project No.: 200445g	Drawing No.: Fig. 5.6
Scale: 1:25000	Date: 05/07/2022

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Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Flightline

N

Drawing Title
Lapwing Observations Winter Walkover Surveys

Project Title
Coole Wind Farm

Drawn By	Checked By
I.Hynes	P. Cregg
Project No.	Drawing No.
200445g	Fig. 5.7
Scale	Date
1:25000	05/07/2022

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Website: ww.mkoireland.ie

Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Flightline

N

Drawing Title	Snipe Observations Winter Walkover Surveys
Project Title	Coole Wind Farm
Drawn By: I.Hynes	Checked By: P. Cregg
Project No.: 200445g	Drawing No.: Fig. 5.8
Scale: 1:25000	Date: 05/07/2022

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Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Flightline

N

Drawing Title
Buzzard Observations Winter Walkover Surveys

Project Title
Coole Wind Farm

Drawn By	Checked By
I.Hynes	P. Cregg
Project No.	Drawing No.
200445g	Fig. 5.9
Scale	Date
1:25000	05/07/2022

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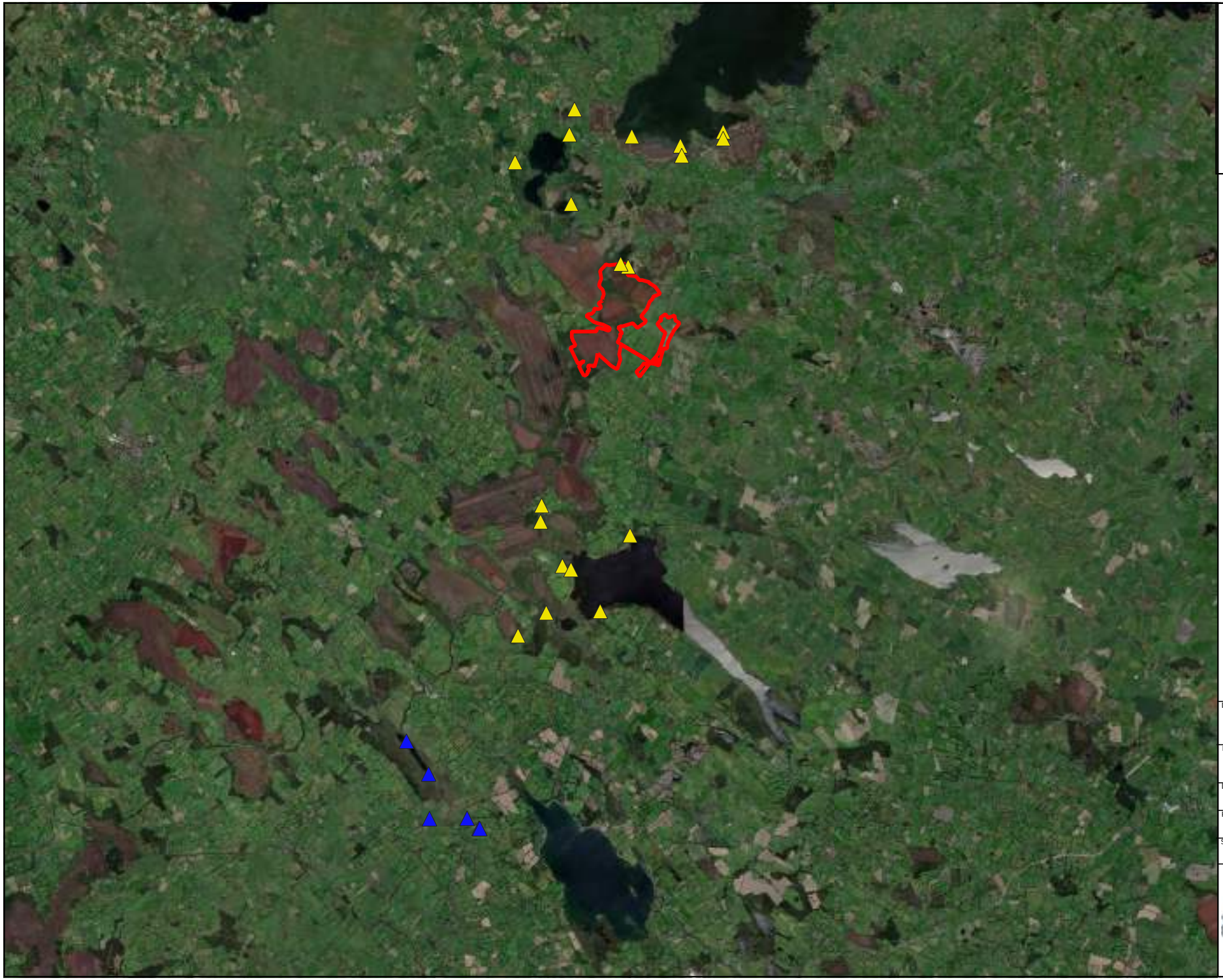

Map Legend

- Wind Farm Site
- Wildfowl Distribution Survey Locations
- Lough Iron Wildfowl Distribut Survey Locations

N

Drawing Title
Wildfowl Distribution Survey Locations

Project Title
Coole Wind Farm

Drawn By	Checked By
I.Hynes	P. Cregg
Project No.	Drawing No.
200445g	Fig. 6
Scale	Date
1:156501	05/07/2022

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Map Legend

Wind Farm Site

Observations

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Common Tern Observations
Wildfowl Distribution Survey

Coole Wind Farm

IHynes	P.Cregg
200445g	Fig. 6.1
1:126501	05/07/2022

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Map Legend

- Wind Farm Site
- Observations

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Drawing Title
Golden Plover Observations
Wildfowl Distribution Survey

Project Title
Coole Wind Farm

Drawn By	Checked By
I.Hynes	P.Cregg
Project No.	Drawing No.
200445g	Fig. 6.2
Scale	Date
1:126501	05/07/2022

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Map Legend

Wind Farm Site

Observations

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Drawing Title
Greenland white-fronted goose Obs. Wildfowl Distribution Survey

Project Title
Coole Wind Farm

Drawn By	Checked By
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Project No.	Drawing No.
200445g	Fig. 6.3
Scale	Date
1:126501	05/07/2022

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Website:

Map Legend

- Wind Farm Site
- Observations

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Drawing Title
Kingfisher Observations
Wildfowl Distribution Survey

Project Title
Coole Wind Farm

Drawn By	Checked By
I.Hynes	P.Cregg
Project No.	Drawing No.
200445g	Fig. 6.4
Scale	Date
1:126501	05/07/2022

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Map Legend

Wind Farm Site

Observations

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Little Egret Observations
Wildfowl Distribution Survey

Coole Wind Farm

Drawn By	Checked By
I.Hynes	P.Cregg
Project No.	Drawing No.
200445g	Fig. 6.5
Scale	Date
1:146501	05/07/2022

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Planning and Environmental Consultants

Map Legend

- Wind Farm Site
- Observations

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Drawing Title
Ruff Observations Wildfowl Distribution Survey

Project Title
Coole Wind Farm

Drawn By	Checked By
I.Hynes	P.Cregg
Project No.	Drawing No.
200445g	Fig. 6.6
Scale	Date
1:146501	05/07/2022

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Map Legend

- Wind Farm Site
- Observations

N

Whooper Swan Observations
Wildfowl Distribution Survey

Coole Wind Farm

Drawn By	Checked By
I.Hynes	P Cregg
Project No.	Drawing No.
200445g	Fig 6.6
Scale	Date
1:146501	05/07/2022

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Map Legend

- Wind Farm Site
- Observations

N

Drawing Title	Coot Observations Wildfowl Distribution Survey
Project Title	Coole Wind Farm
Drawn By	I.Hynes
Checked By	P. Cregg
Project No.	200445g
Drawing No.	Fig. 6.8
Scale	1:146501
Date	05/07/2022

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Map Legend

- Wind Farm Site
- Observations

N

Drawing Title: Pochard Observations Wildfowl Distribution Survey

Project Title: Coole Wind Farm

Drawn By	Checked By
I.Hynes	P Cregg
Project No.	Drawing No.
2004458	Fig. 6.9
Scale	Date
1:146501	05/07/2022

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Map Legend

- Wind Farm Site
- Observations

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Drawing Title: Shoveler Observations Wildfowl Distribution Survey

Project Title: Coole Wind Farm

Drawn By	Checked By
I.Hynes	P Cregg
Project No.	Drawing No.
2004458	Fig. 6.10
Scale	Date
1:146501	05/07/2022

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Map Legend

- Wind Farm Site
- Observations

N

Drawing Title	Teal Observations Wildfowl Distribution Survey
Project Title	Coole Wind Farm
Drawn By: I.Hynes	Checked By: P Cregg
Project No: 2004458	Drawing No: Fig 6.11
Scale: 1:56501	Date: 05/07/2022

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Map Legend

- Wind Farm Site
- Observations

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Tufted Duck Observations
Wildfowl Distribution Survey

Coole Wind Farm

Drawn By	Checked By
I.Hynes	P Cregg
Project No.	Drawing No.
2004458	Fig. 6.12
Scale	Date
1:206501	05/07/2022

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Map Legend

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- Observations

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Wigeon Observations Wildfowl Distribution Survey

Project Title: Coole Wind Farm

Drawn By	Checked By
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Project No.	Drawing No.
2004458	Fig. 6.13
Scale	Date
1:156501	05/07/2022

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Map Legend

- Wind Farm Site
- Observations

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Curlew Observations Wildfowl Distribution Survey

Project Title: Coole Wind Farm

Drawn By	Checked By
J.Hynes	P Cregg
Project No.	Drawing No.
2004458	Fig. 6.14
Scale	Date
1:156501	05/07/2022

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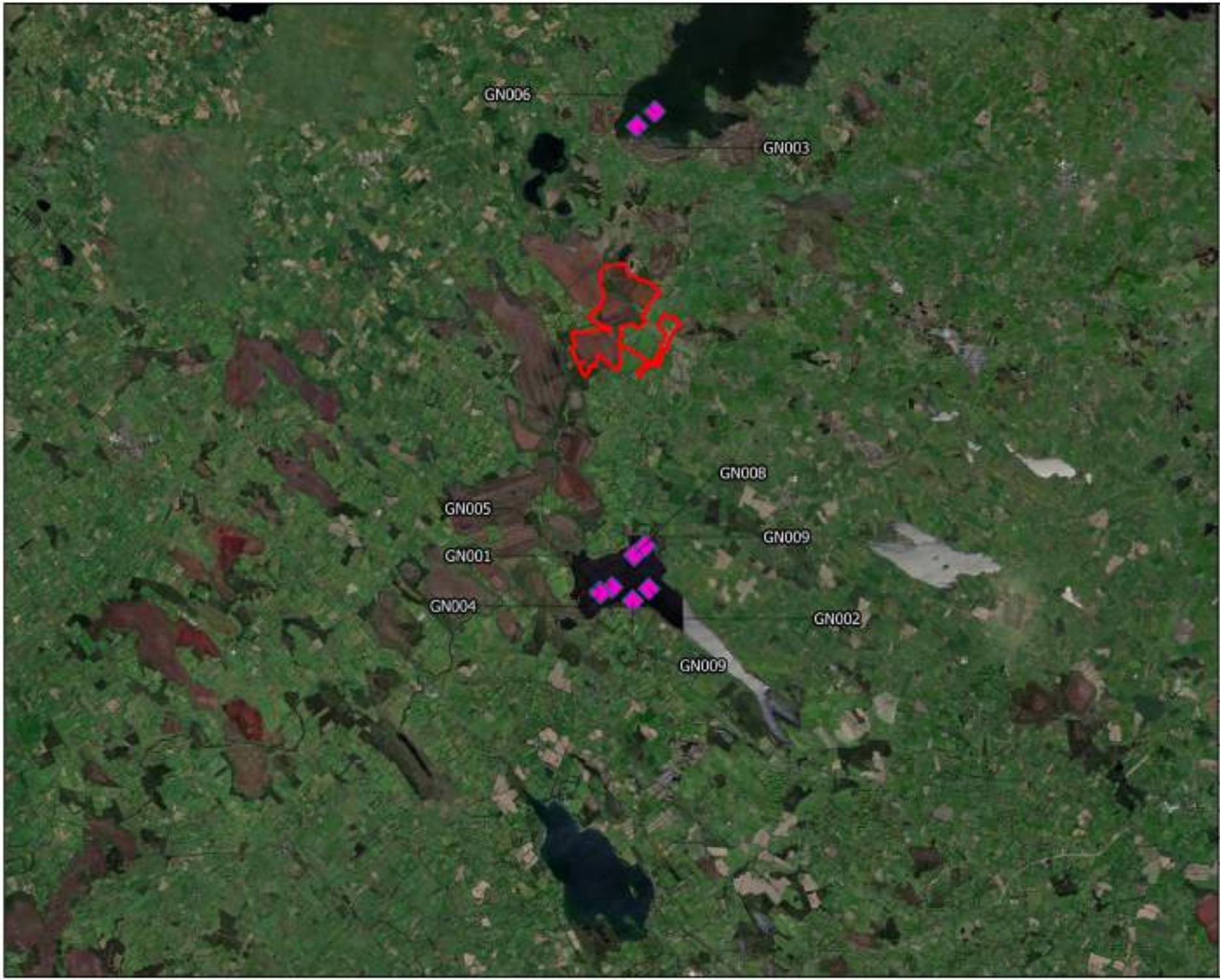

Map Legend

- Wind Farm Site
- Observations

Goldeneye Observations
Wildfowl Distribution Survey

Coole Wind Farm

Drawn By	Checked By
I.Hynes	P Cregg
Project No.	Drawing No.
2004458	Fig. 6.15
Scale	Date
1:156501	05/07/2022

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Map Legend

- Wind Farm Site
- Observations

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N

Drawing Title: Lapwing Observations Wildfowl Distribution Survey

Project Title: Coole Wind Farm

Drawn By	Checked By
J.Hynes	P Cregg
Project No.	Drawing No.
2004458	Fig. 6.16
Scale	Date
1:156501	05/07/2022

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Map Legend

- Wind Farm Site
- Observations

N

Snipe Observations Wildfowl Distribution Survey

Coole Wind Farm

Drawn By	Checked By
J.Hynes	P Cregg
Project No.	Drawing No.
2004458	Fig. 6.17
Scale	Date
1:156501	05/07/2022

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Map Legend

- Wind Farm Site
- Turbine Layout
- Flightline

Kingfisher Incidental Observations

Coole Wind Farm

Drawn By	Checked By
I.Hynes	P Cregg
Project No.	Drawing No.
2004458	Fig 7.1
Scale	Date
1:75000	05/07/2022

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Map Legend

- Wind Farm Site
- Turbine Layout
- Flightline

N

Drawing Title: Peregrine Incidental Observations

Project Title: Coole Wind Farm

Drawn By	Checked By
I.Hynes	P Cregg
Project No.	Drawing No.
2004458	Fig. 7.2
Scale	Date
1:30000	05/07/2022

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Map Legend

- Wind Farm Site
- Turbine Layout
- Flightline

N

Drawing Title	White-tailed eagle Incidental Observations
Project Title	Coole Wind Farm
Drawn By: I.Hynes	Checked By: P Cregg
Project No: 2004458	Drawing No: Fig. 7.3
Scale: 1:95000	Date: 05/07/2022

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Map Legend

- Wind Farm Site
- Turbine Layout
- Flightline

N

Drawing Title: Kestrel Incidental Observations

Project Title: Coole Wind Farm

Drawn By	Checked By
I.Hynes	P Cregg
Project No.	Drawing No.
2004458	Fig. 7.4
Scale	Date
1:125250	05/07/2022

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Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Flightline

N

Snipe
Incidental Observations

Coole Wind Farm

Drawn By	Checked By
I. Hynes	P Cregg
Project No.	Drawing No.
200445g	Fig. 7.6
Scale	Date
1:25000	08/07/2022

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Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Possible Breeding Territory

N

Snipe Breeding Territories
Incidental Observations

Project Title: Coole Wind Farm

Drawn By	Checked By
I. Hynes	P Cregg
Project No.	Drawing No.
2004458	Fig. 7.6.1
Scale	Date
1:25000	08/07/2022

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Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Flightline

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N

Buzzard Incidental Observations

Coole Wind Farm

Drawn By	Checked By
I. Hynes	P Cregg
Project No.	Drawing No.
2004458	Fig. 7.7
Scale	Date
1:173666	08/07/2022

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Map Legend

- Wind Farm Site
- 500m Survey Radius
- Turbine Layout
- Flightline

N

Drawing Title: Sparrowhawk Incidental Observations

Project Title: Coole Wind Farm

Drawn By	Checked By
I. Hynes	P Cregg
Project No.	Drawing No.
200445g	Fig. 7.8
Scale	Date
1:78417	08/07/2022

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APPENDIX 5

COLLISION RISK ASSESSMENT

Appendix 5 – Collision Risk Assessment

Coole Wind Farm

Table of Contents

TABLE OF TABLES

1. INTRODUCTION

This document outlines the methodology used to assess the collision risk for birds at the proposed Coole wind farm, Co. Westmeath. The collision risk assessment is based on vantage point surveys undertaken at the wind farm site from October 2015 up to, and including, September 2017; from April 2018 up to, and including, March 2020; and from March 2021 up to, and including, March 2022. This represents two 24-month survey periods and a 13-month survey period, consisting of five breeding seasons and five non-breeding seasons, which is in full compliance with Scottish Natural Heritage guidance (SNH, 2017). Surveys were undertaken from four fixed Vantage Point (VP) Locations: VP3/VP4 between October 2015 to September 2017, VP3/VP5 between April 2018 to March 2020, VP4/VP6 between March 2021 to March 2022 and VP3/VP5 between October 2021 and March 2022.

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 farm development on key ornithological receptors (KORs) in the EIAR.

To ensure the full range of possible turbine dimensions was assessed (20-175m) three separate collision risk analyses were undertaken. Details of the three turbine dimension scenarios are outlined in further detail in Section 2.3 below.

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 farm development. 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 15 No. turbines will be between 97.5m and 100.5 at hub height, with 3 blades with a diameter of between 149m and 155m, giving a maximum rotor height of 175m and a minimum rotor height of 20m. The model makes a number of assumptions on the turbine design and on biometrics of birds:

1. Birds are assumed to be of a simple cruciform shape.
2. Turbine blades are assumed to have length, depth and pitch angle, but no thickness.
3. Birds fly through turbines in straight lines.
4. 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 the 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 the wind farm which represents the width of the commuting corridor. A "risk window" is identified: a 2-dimensional line the width of the 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 the wind farm while assuming that all flights within the vantage point viewshed are randomly occurring, ie. any observed flight could just as easily occur within the 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 windfarm area.
- 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.

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 Coole wind farm, for all species recorded in flight in the wind farm study area, flights were randomly distributed. Therefore, a **Random Flight Model** conducted for these species.

2.2 Modelling Process

The steps used in the Band Model to derive the collision mortality rate for each species observed at the 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. Note that this is the unrealistic/worst-case scenario for collision mortality, as it assumes that birds flying towards the turbines make no attempt to avoid them.
- To account for birds attempting to avoid a 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 the wind farm, based on observed bird activity during the vantage point survey period.

2.3 Turbine specifications

As previously outlined to ensure the full range of possible turbine dimensions was assessed (20-175m) three separate collision risk analyses were undertaken. Details of the three turbine dimension scenarios were as follows:

- Maximum rotor diameter and minimum hub height: 20-175m
- Median rotor diameter and median hub height: 25-175m
- Minimum rotor diameter and maximum hub height: 26-175m

Birds in flight within the viewshed at heights between 15-200m above ground level have been included in the collision risk model, as relevant. The candidate turbine specifications are available in Table 1.

Table 1 Turbine specifications at Coole wind farm

Wind Farm Component	Scenario Modelled
Candidate turbine model	Nordex 149[1]
Number of turbines	15
Blades per turbine rotor	3
Rotor diameter (m)	155
Rotor radius (m)	77.5
Hub height (m)	97.5
Swept height (m)	20-175
Pitch of blade (degrees)	6
Maximum chord (m) (i.e. depth of blade)	4.5
Rotational period (s)	6.417
*Turbine operational time	85%

***This operational period of 85% is referenced from a report by the British Wind Energy Association (BWEA) (2007) which identifies the standard operational period of the wind turbines in the UK to be roughly 85%.**

The above candidate turbine parameters were used for the 15 No. turbines with a blade diameter of 155m, giving a maximum rotor height of 175 and a minimum rotor height of 20m are assessed in the analysis.

To ensure that the full range of possible turbine dimensions are assessed, two alternative turbine dimensions were considered. Collision risk models was run to assess the minimum rotor diameter of the range of turbine dimensions (i.e. rotor diameter of 149m) and the median turbine dimensions (i.e. rotor diameter of 150m) considered in this application. The second model assesses the swept path between 26-175m and the third model accesses the swept path between 25-175m. Appendix 1 shows the collision risk assessment based on alternative dimension turbines. These three collision risk assessments allow for the full range of possible turbine dimensions to be assessed (20-175m, 25-175m and 26-175m).

Please note:

Taking a precautionary approach, the highest predicted collision risk (from the three analyses, i.e. at 20-175m, 25-175m and 26-175m) for each species was considered to be the collision risk in the impact assessment.

2.4 Key Ornithological Receptors

[1] *A candidate turbine is used to calculate the maximum chord and the rotational period for the modelling scenario. The best fit turbine model is used, in this case, a 149m Nordex turbine was the closed to the proposed turbine specifications.*

The key ornithological receptors (KORs) recorded within PCH during surveys at Coole were:

- Greenland White-fronted Goose
- Golden Plover
- Hen Harrier
- Merlin
- Peregrine
- Whooper Swan
- Kestrel
- Lapwing
- Snipe
- Woodcock
- Buzzard
- Sparrowhawk

A CRM was conducted for each of these species. It is acknowledged that the predicted number of transits, and hence predicted rate of collision, for snipe may be largely underestimated, as flight activity for this species is largely crepuscular in nature (during twilight) while the VP survey sample predominantly consists of hours during daylight period when visibility is not an issue. It is assumed that waterbirds (including snipe) are active for 25% of the night along with daylight hours (as per SNH guidance) and this is accounted for in the model.

2.5 Calculation Parameters (20-175m)

The calculation parameters for the vantage point are outlined in Table 2. Bird biometrics are presented in Table 3. Table 4 presents the model input values: bird seconds in flight at PCH (random model) or the number of birds crossing the risk window (regular models) observed from the vantage point 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 Coole wind farm survey effort and viewshed coverage

Vantage Point	Visible Area at 20m	Risk Area	Turbines visible	Total Survey Effort (hrs)
VP3	562.4	257.354	6	332.5
VP4	230.057	163.302	4	230.5
VP5	458.258	134.672	2	181
VP6	442.394	175.627	4	72

Table 3 Bird biometrics

Species	Body Length(m)	Wingspan(m)	Flight Speed(m/s)
Greenland White-fronted Goose	0.72	1.48	16.1
Golden Plover	0.28	0.72	17.9
Merlin	0.28	0.56	12.6
Peregrine Falcon	0.42	1.02	20.7
Whooper Swan	1.52	2.3	17.3
Kestrel	0.34	0.76	10.1
Lapwing	0.3	0.84	11.9
Snipe	0.26	0.46	17.1
Woodcock	0.34	0.58	17.1
Buzzard	0.54	1.2	13.3
Sparrowhawk	0.33	0.62	10

Table 4 Model input values

Species	Model	Period	Input Value (Total)
Greenland White-fronted Goose	random	Winter	3,800
Golden Plover	random	Winter	471,229
Merlin	random	All	80
Peregrine	random	All	1,315
Whooper Swan	random	Winter	17,204
Kestrel	random	All	13,505
Lapwing	random	Winter	3,625
Snipe	random	All	1,751
Woodcock	random	Breeding	40
Buzzard	random	All	34,448
Buzzard	random	Breeding	22,219
Sparrowhawk	random	All	1,493

The avoidance rates applied to the collision risk were: 99.8% for Greenland white-fronted goose, 99.6% for golden plover[2]; 99.5% for whooper swan, 95% for kestrel and 98% for the remaining species.

[2] *Please see Appendix 2 for the rationale for the avoidance rate of golden plover.*

3. RESULTS (20-175M)

The predicted number of transits per year and the 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 Results of CRM

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		
Greenland White-fronted Goose	Winter	random	340.5304	5.92%	N/A	5.92%	20.15	99.8%	0.040	1.21 birds	24.81 years
Golden Plover	Winter	random	59,385.08	4.45%	N/A	4.45%	2645.53	99.6%	10.582	317.46 birds	0.09 years
Merlin	All	random	11.8707	4.61%	4.53%	4.57%	0.54	98.0%	0.011	0.33 birds	92.13 years
Peregrine Falcon	All	random	209.7564	4.81%	4.52%	4.67%	9.79	98.0%	0.196	5.87 birds	5.11 years
Whooper Swan	Winter	random	1,987.359	7.98%	N/A	7.98%	158.53	99.5%	0.793	23.78 birds	1.26 years
Kestrel	All	random	975.2979	5.17%	5.07%	5.12%	49.93	95.0%	2.497	74.90 birds	0.40 years
Lapwing	Winter	random	390.1192	4.86%	N/A	4.86%	18.95	98.0%	0.379	11.37 birds	2.64 years
Snipe	All	random	208.2588	4.29%	N/A	4.29%	8.93	98.0%	0.179	5.36 birds	5.60 years
Woodcock	Breeding	random	10.43266	4.53%	N/A	4.53%	0.47	98.0%	0.009	0.28 birds	105.90 years
Buzzard	All	random	3,371.563	5.63%	5.42%	5.52%	186.28	98.0%	3.726	111.77 birds	0.27 years
Buzzard	Breeding	random	2163.464	5.63%	5.42%	5.52%	119.53	98.0%	2.391	71.72 birds	0.42 years
Sparrowhawk	All	random	90.56372	5.09%	5.03%	5.06%	4.59	98.0%	0.092	2.75 birds	10.90 years

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https://www.timeanddate.com/sun/

CRA APPENDIX 1

COLLISION RISK ASSESSMENT – ALTERNATIVE TURBINE DIMENSIONS

3.1 Alternative Turbine 1 Inputs (26-175m)

Table 6 Alternative turbine 1 specifications at Coole wind farm

Wind Farm Component	Scenario Modelled
Assumed turbine model	Nordex 149
Number of turbines	15
Blades per turbine rotor	3
Rotor diameter (m)	149
Rotor radius (m)	74.5
Hub height (m)	100.5
Swept height (m)	26-175
Pitch of blade (degrees)	6
Maximum chord (m) (i.e. depth of blade)	4.5
Rotational period (s)	6.417
*Turbine operational time	85%

***This operational period of 85% is referenced from a report by the British Wind Energy Association (BWEA) (2007) which identifies the standard operational period of the wind turbines in the UK to be roughly 85%.**

Table 7 Coole wind farm survey effort and viewshed coverage

Vantage Point	Visible Area at 26m	Risk Area	Turbines visible	Total Survey Effort
VP3	629.362	258.187	6	332.5
VP4	304.978	210.577	5	230.5
VP5	506.478	157.376	3	181
VP6	512.943	239.32	5	72

Table 8 Model input values

Species	Model	Period	Input Value (Total)
Greenland White-fronted Goose	random	Winter	3,800
Golden Plover	random	Winter	426,479
Merlin	random	All	80
Peregrine	random	All	888
Whooper Swan	random	Winter	8,495
Kestrel	random	All	7,380
Lapwing	random	Winter	800
Snipe	random	All	1,424
Woodcock	random	Breeding	0
Buzzard	random	All	23,478
Buzzard	random	Breeding	15,521
Sparrowhawk	random	All	1,171

3.2 Alternative Turbine 2 Inputs (25-175m)

Table 9 Alternative turbine 2 specifications at Coole wind farm

Wind Farm Component	Scenario Modelled
Assumed turbine model	Nordex 149
Number of turbines	15
Blades per turbine rotor	3
Rotor diameter (m)	150
Rotor radius (m)	75
Hub height (m)	100
Swept height (m)	25-175
Pitch of blade (degrees)	6
Maximum chord (m) (i.e. depth of blade)	4.5
Rotational period (s)	6.417
*Turbine operational time	85%

***This operational period of 85% is referenced from a report by the British Wind Energy Association (BWEA) (2007) which identifies the standard operational period of the wind turbines in the UK to be roughly 85%.**

Table 10 Coole wind farm survey effort and viewshed coverage

Vantage Point	Visible Area at 25m	Risk Area	Turbines visible	Total Survey Effort
VP3	627.494	256.887	6	332.5
VP4	292.392	201.662	5	230.5
VP5	497.208	154.51	3	181
VP6	505.53	232.92	5	72

Table 11 Model input values

Species	Model	Period	Input Value (Total)
Greenland White-fronted Goose	random	Winter	3,800
Golden Plover	random	Winter	426,479
Merlin	random	All	80
Peregrine	random	All	888
Whooper Swan	random	Winter	8,495
Kestrel	random	All	7,380
Lapwing	random	Winter	800
Snipe	random	All	1,424
Woodcock	random	Breeding	0
Buzzard	random	All	23,478
Buzzard	random	Breeding	15,521
Sparrowhawk	random	All	1,171

4. ALTERNATIVE TURBINE DIMENSIONS RESULTS

The predicted number of transits per year and the collision risk for the alternative turbine dimensions are presented in Tables 12 and 13 below, 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 12 Results of CRM for Alternative Turbine 1 (26-175m)

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		
Greenland White-fronted Goose	Winter	random	288.1648	6.09%	N/A	6.09%	17.54	99.8%	0.035	1.05 birds	28.51 years
Golden Plover	Winter	random	43507.54	4.62%	N/A	4.62%	2008.25	99.6%	8.033	240.99 birds	0.12 years
Merlin	All	random	8.607914	4.76%	4.68%	4.72%	0.41	98.0%	0.008	0.24 birds	123.08 years
Peregrine Falcon	All	random	104.7015	4.98%	4.66%	4.82%	5.05	98.0%	0.101	3.03 birds	9.90 years
Whooper Swan	Winter	random	802.4748	8.15%	N/A	8.15%	65.39	99.5%	0.327	9.81 birds	3.06 years
Kestrel	All	random	444.1574	5.32%	5.22%	5.27%	23.40	95.0%	1.170	35.10 birds	0.85 years
Lapwing	Winter	random	85.05496	5.01%	N/A	5.01%	4.26	98.0%	0.085	2.56 birds	11.72 years
Snipe	All	random	147.3097	4.43%	N/A	4.43%	6.53	98.0%	0.131	3.92 birds	7.65 years
Buzzard	All	random	1882.868	5.79%	5.58%	5.68%	107.01	98.0%	2.140	64.20 birds	0.47 years
Buzzard	Breeding	random	1286.294	5.79%	5.58%	5.68%	73.10	98.0%	1.462	43.86 birds	0.68 years
Sparrowhawk	All	random	53.84197	5.24%	5.18%	5.21%	2.80	98.0%	0.056	1.68 birds	17.83 years

Table 13 Results of CRM for Alternative Turbine 2 (25-175m)

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		
Greenland White-fronted Goose	Winter	random	292.3815	6.09%	N/A	6.09%	17.79	99.8%	0.036	1.07 birds	28.10 years
Golden Plover	Winter	random	44742.13	4.62%	N/A	4.62%	2065.24	99.6%	8.261	247.83 birds	0.12 years
Merlin	All	random	9.0387	4.76%	4.68%	4.72%	0.43	98.0%	0.009	0.26 birds	117.22 years
Peregrine Falcon	All	random	108.004	4.98%	4.66%	4.82%	5.21	98.0%	0.104	3.13 birds	9.60 years
Whooper Swan	Winter	random	822.1859	8.15%	N/A	8.15%	66.99	99.5%	0.335	10.05 birds	2.99 years
Kestrel	All	random	458.9188	5.32%	5.22%	5.27%	24.18	95.0%	1.209	36.26 birds	0.83 years
Lapwing	Winter	random	89.31155	5.01%	N/A	5.01%	4.48	98.0%	0.090	2.69 birds	11.16 years
Snipe	All	random	292.3815	6.09%	N/A	6.09%	17.79	99.8%	0.036	1.07 birds	28.10 years
Buzzard	All	random	1947.209	5.79%	5.58%	5.68%	110.66	98.0%	2.213	66.40 birds	0.45 years
Buzzard	Breeding	random	1309.816	5.79%	5.58%	5.68%	74.44	98.0%	1.489	44.66 birds	0.67 years
Sparrowhawk	All	random	54.82305	5.24%	5.18%	5.21%	2.86	98.0%	0.057	1.71 birds	17.51 years

Table 14 Comparison of collision risk for turbine dimensions and the alternative turbine dimensions

Species	Collision Risk – 155m rotor diameter		Collision Risk – 149m rotor diameter		Collision Risk – 150m rotor diameter	
	Collisions per year	Collisions over the lifetime of the wind farm	Collisions per year	Collisions over the lifetime of the wind farm	Collisions per year	Collisions over the lifetime of the wind farm
Greenland White-fronted Goose	0.040	1.21 birds	0.035	1.05 birds	0.036	1.07 birds
Golden Plover	10.582	317.46 birds	8.033	240.99 birds	8.261	247.83 birds
Merlin	0.011	0.33 birds	0.008	0.24 birds	0.009	0.26 birds
Peregrine Falcon	0.196	5.87 birds	0.101	3.03 birds	0.104	3.13 birds
Whooper Swan	0.793	23.78 birds	0.327	9.81 birds	0.335	10.05 birds
Kestrel	2.497	74.90 birds	1.170	35.10 birds	1.209	36.26 birds
Lapwing (Winter)	0.379	11.37 birds	0.085	2.56 birds	0.090	2.69 birds
Snipe	0.179	5.36 birds	0.131	3.92 birds	0.036	1.07 birds
Woodcock	0.009	0.28 birds	0	0 birds	0	0 birds
Buzzard	3.726	111.77 birds	2.140	64.20 birds	2.213	66.40 birds
Buzzard (Breeding)	2.391	71.72 birds	1.462	43.86 birds	1.489	44.66 birds
Sparrowhawk	0.092	2.75 birds	0.056	1.68 birds	0.057	1.71 birds

CRA APPENDIX 2

GOLDEN PLOVER AVOIDANCE RATE CALCULATION

COOLE WIND FARM: GOLDEN PLOVER AVOIDANCE RATES

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CONTENTS

SUMMARY

This report assesses the evidence for developing a species-specific avoidance rate for wintering Golden Plover populations, and makes recommendations for specifying this rate.

Collision risk modelling for onshore wind farms in Ireland generally follows the latest Scottish Natural Heritage / Natural Scotland avoidance rate guidance. This guidance includes two types of avoidance rates: species-specific avoidance rates; and a default avoidance rate that should be applied to all other species. Based on the latest version of the guidance, the default avoidance rate of 98% applies to wintering Golden Plover populations. However, review of the development of the SNH avoidance rate guidance shows that the default avoidance rate of 98% is not based on any published empirical evidence, the trend is for avoidance rates to increase as more data becomes available, and the guidance does not always reflect the latest evidence on species-specific avoidance rates. Therefore, the lack of a species-specific avoidance rate for Golden Plover in the SNH avoidance rate guidance does not necessarily mean that there is not any robust data available that could be used to develop a species-specific avoidance rate for Golden Plover.

There are reports for four UK wind farms that provide data that can be used to estimate avoidance rates, or which provide their own estimates of avoidance rates, for wintering Golden Plover populations. For three of these wind farms, the collision monitoring methodologies are robust and generally comply with best practice guidance, so the collision fatality estimates can be regarded as reliable. The avoidance rates calculated for the wintering Golden Plover populations at these wind farms range from 99.87-99.98%. For the fourth wind farm, the available information on the collision monitoring methodology was limited, but there may have been some issues with the methodology and results. The avoidance rate for the wintering Golden Plover population given in the relevant reports for this wind farm was 99.6%.

The highest avoidance rate currently recommended by Scottish Natural Heritage / Natural Scotland is 99.8% for geese. The narrow range of the avoidance rate values for wintering Golden Plover populations at the three wind farms with reliable collision fatality estimates would suggest that 99.8% is a suitable avoidance rate for wintering Golden Plover populations. The 99.6% avoidance rate at the other wind farm is lower than this value, although there may be some issues with this avoidance rate. Therefore, I recommend that collision risk modelling for wintering Golden Plover populations use two avoidance rate values: 99.6% and 99.8%. In practice, this will mean two predicted collision rates, with the one calculated with the 99.6% avoidance rate being twice the value of the other calculated with the 99.8% avoidance rate. These predicted collisions will be five times, and ten times, respectively, lower than predicted collisions calculated with the default 98% avoidance rate.

1. INTRODUCTION

This report was commissioned by MKO.

The objective of the report was to assess the evidence for developing a species-specific avoidance rate for wintering Golden Plover populations, and, if appropriate, make recommendations for specifying this rate.

Collision risk modelling for onshore wind farms in Ireland generally follows the latest Scottish Natural Heritage / Natural Scotland avoidance rate guidance (referred to hereafter as the SNH avoidance rate guidance). The latest version of this guidance (SNH, 2018) does not include a species-specific avoidance rate for wintering Golden Plover populations. Therefore, following the SNH avoidance rate guidance would mean that the default 98% avoidance rate should be applied to wintering Golden Plover populations. However, there is apparently robust data available from post-construction monitoring that indicates that a much higher avoidance rate should be applied to wintering Golden Plover populations.

In this report, I first review the development of the SNH avoidance rate guidance and consider whether the history of its development affects the interpretation of the fact that it does not include a species-specific avoidance rate for wintering Golden Plover populations. I then review the methods and results of four post-construction monitoring studies, and use the data from these studies to derive empirical avoidance rates for the wintering Golden Plover population in each study. I then assess the overall weight of evidence for applying a species-specific avoidance rate to wintering Golden Plover populations and make recommendations for avoidance rate values that should be used in collision risk modelling for such populations.

2. THE SNH AVOIDANCE RATE GUIDANCE

2.1. TYPES OF AVOIDANCE RATES

The SNH avoidance rate guidance includes two types of avoidance rates: specific avoidance rates for individual species, or groups of closely-related species (e.g., swans or geese); and a default avoidance rate that should be applied to all other species.

2.2. THE EVOLUTION OF THE SNH AVOIDANCE RATES

The latest version of the SNH avoidance rate guidance (SNH, 2018) includes a default 98% avoidance rate for species not listed in their guidance. However, this default avoidance rate does not appear to have any empirical basis.

In 2000, the first guidance from Scottish Natural Heritage on avoidance rates recommended a precautionary avoidance rate of 95%, which was "based solely on expert opinion and has little or no empirical basis, as no sound, relevant data were available at the time" (SNH, 2010). In 2010, Scottish Natural Heritage updated their guidance on avoidance rates to included species-specific avoidance rates where relevant data was available (SNH, 2010). They also updated the default avoidance rate for other species to 98% because "in the majority of cases where avoidance rates have been derived from empirical data, the avoidance rates are higher than 95%" (SNH, 2010). Further revisions of the SNH avoidance rate guidance were published in 2016 and 2018 (SNH, 2016; 2018). Comparison of the first species-specific avoidance rates published by Scottish Natural Heritage with the latest species-specific avoidance rates (Table 2.1) shows that as the knowledge base has developed there has been an increase in the recommended avoidance rates. Most species-specific avoidance rates are 99% or higher. The only species with species-specific avoidance rates of less than 99% are White-tailed Eagle and Kestrel.

Table 2.1. Species-specific avoidance rates defined in SNH guidance

Species	SNH Guidance	
	2010	2018
Divers	98%	99.5%
Swans	98%	99.5%
Geese	99%	99.8%
Red Kite	98%	99%
Hen Harrier	99%	99%
Golden Eagle	99%	99%
White-tailed Eagle	95%	95%
Kestrel	95%	95%
Skuas	98%	99.5%

Sources: SNH (2010, 2018). Divers: the 2010 guidance gives a species-specific avoidance rate for Red-throated Diver and a default avoidance rate for Black-throated Diver. Swans: the 2010 guidance gives a species-specific avoidance rate for Whooper Swan, and does not provide avoidance rates for other swan species, while the 2018 guidance gives a species-specific avoidance rate for all swan species. Geese: the 2010 guidance gives separate (but identical) species-specific avoidance rates for Greylag, Pink-footed, Greenland White-fronted and Barnacle Geese, while the 2018 guidance gives a single species-specific avoidance rate for all geese species. Skuas: the 2010 guidance gives a single default avoidance rate for all skua species, while the 2018 guidance gives separate (but identical) species-specific avoidance rates for Great Skua and Arctic Skua.

2.3. EXAMPLES OF SPECIES-SPECIFIC AVOIDANCE RATES IN THE SNH AVOIDANCE RATE GUIDANCE

The 95% avoidance rate for White-tailed Eagle is described as being based on: "sufficient evidence from flight behaviour and collision monitoring studies in Norway for vulnerability to collisions; see May *at al.* (2011)" (SNH, 2018). However, this appears to include a citation error as May *at al.* (2011) provides an estimate for a year-round avoidance rate of 98%, with a confidence interval of 95-99%, based on satellite telemetry data. Presumably, the intended citation was May *at al.* (2010), which included an estimated avoidance rate of 95.8%, based on VP survey data,

corrected for the observed wind speed distribution at the study site. This latter reference also included avoidance rates of 97.8% and 97.9% for fixed rotation speeds, and an avoidance rate of 92.5% when the collision risk was modelled using uncertainty levels. The SNH avoidance rate guidance on avoidance rates does not discuss these differing estimates of White-tailed Eagle avoidance rates, and the recommended 95% avoidance rate has remained unchanged since 2010 without any caveats added to reflect the various avoidance rates indicated by the May *at al.* (2010 and 2011) studies.

The 95% avoidance rate for Kestrel is described as being based on: *"*sufficient evidence from flight behaviour (including hovering) and collision monitoring studies for vulnerability to collisions*"* (SNH, 2018). The cited source (Whitfield and Madders, 2006) is, in fact, a review of avoidance rates for Red Kite. The information on Kestrel is derived from an analysis which finds a significant correlation between the *"*numbers of individuals seen*"* against numbers of carcasses found for 16 raptor species at a single wind farm in Spain. Kestrel is a large outlier above the regression line, and this appears to be the only empirical evidence that has been used by SNH to support the 95% avoidance rate for Kestrel. However, even taken at face value, all this analysis does is indicate that Kestrel has a lower avoidance rate than other raptor species, but it does not provide any quantitative data that can be used to estimate the avoidance rate. More seriously, this analysis does not account for behavioural and ecological differences between species that may affect the relationship between recorded bird activity and collisions. It is also subject to the perennial problem with analyses of collision rates: the small absolute numbers of collisions which means that random sampling error may have significant effects.

These two examples show that the species-specific avoidance rates in the SNH avoidance rate guidance do not necessarily reflect all the available evidence (White-tailed Eagle) and can be based on rather sketchy evidence (Kestrel).

2.4. UPDATING THE SNH AVOIDANCE RATE GUIDANCE

The SNH avoidance rate guidance states that *"*it is updated when robust new information becomes available*"* (SNH, 2018). However, while this may be an aspiration, it may not necessarily happen quickly. For example, the SNH avoidance rate guidance currently does not give species-specific avoidance rates for gulls, so the default avoidance rate of 98% applies to all gull species. This guidance refers specifically to onshore wind farms, while separate guidance has been developed for offshore wind farms (JNCC *at al.*, 2014). The latter guidance recommends an avoidance rate of 99.5% for large gulls, based on a review by Cook *at al.* (2014). The discrepancy between the recommended avoidance rates for large gulls between offshore and onshore wind farms, was not addressed until a review by Furness (2019), which was commissioned by SNH. This review recommended that the 99.5% avoidance rate for large gulls at offshore wind farms should also be adopted for onshore wind farms. The review also recommended an avoidance rate of 99.2% for small gulls, which was also based on the data in Cook *at al.* (2014). However, as of June 2022, Scottish Natural Heritage / NatureScot have not updated their guidance on avoidance rates for onshore wind farms to reflect the robust evidence that has been available about species-specific avoidance rates for gulls since at least 2014.

2.5. CONCLUSIONS

The above analysis of the development of the SNH avoidance rate guidance and its treatment of avoidance rates for White-tailed Eagle, Kestrel and gulls, shows that the default avoidance rate of 98% is not based on any published empirical evidence, the trend is for avoidance rates to increase as more data becomes available, and the guidance does not always reflect the latest evidence on species-specific avoidance rates. Therefore, the lack of a species-specific avoidance rate for Golden Plover in the SNH avoidance rate guidance does not necessarily mean that there is not any robust data available that could be used to develop a species-specific avoidance rate for Golden Plover.

3. REVIEW OF GOLDEN PLOVER AVOIDANCE RATES

3.1. SOURCES

I found post-construction monitoring reports for three UK wind farms that provide robust data on Golden Plover collision fatality rates, and, for which, there was appropriate data available that could be used to estimate avoidance rates. These reports were for the Blood Hill Wind Farm (Percival *at al.*, 2008), the Goole Fields I Wind Farm (Percival *at al.*, 2018a) and the Goole Fields II Wind Farm (Percival *at al.*, 2018b, 2019). In addition, information on Golden Plover collision fatality rates and avoidance rates is included in the Habitats Regulations Assessment reports for another UK wind farm site (Haverigg II and III[1]; Percival, 2020a, 2020b), although the reports do not contain sufficient detail to allow full review of the collision monitoring methods and results. Unless otherwise stated, all information and data used in this report for each wind farm was taken from the relevant references cited above.

The characteristics of these wind farms are summarised in Table 3.1.

Table 3.1. Characteristics of the wind farms.

Wind farm	Location	Commissioned	Number of turbines	Hub height (m)	Turbine dimeter (m)
Blood Hill Wind Farm	Norfolk	1992	10	30	27
Goole Fields I	Yorkshire	2014	16	80	92
Goole Fields II	Yorkshire	2016	17	80	92
Haverigg II	Cumbria	1998	4	62.5	42
Haverigg III	Cumbria	2005	4	76	52

Sources: Percival (2020a, 2020 b); Percival *at al.* (2008, 2018a, 2018b, 2019).

3.2. COLLISION MONITORING

3.2.1. Methods

The post-construction monitoring for the Blood Hill and Goole Fields I and II wind farms were carried out by the same consultancy and used the similar methodology for collision monitoring. These included weekly searches for carcasses, and searcher efficiency trials and carcass removal trials (Table 3.2). The weekly carcass searches included detailed searches of radii of 100 m (Blood Hill and Goole Fields I), or 130 m (Goole Fields II) around each turbine, with an additional 250 m scanned for large carcasses (Goole Fields I and Goole Fields II). The carcasses found were left in situ to provide data on searcher efficiency and removal rates. In addition, dedicated searcher efficiency, and carcass removal, trials were carried out at all three wind farms. These involved putting out a number of carcasses. A separate observer then tried to locate these carcasses the same day, while the carcasses were also monitored by trail cameras to investigate removal rates.

Table 3.2. Collision monitoring methods.

Wind farm	Seasons	Search frequency	Search radius	Searcher efficiency / carcass removal trials
Blood Hill	2006/07-2007/08	weekly	100 m	67 carcasses
Goole Fields I	2015/16-2018/19	weekly	100 m detailed search 250 m large carcass search	18 carcasses
Goole Fields II	2017/18-2018/19	weekly	130 m detailed search 250 m large carcass search	48 carcasses

Sources: Percival *at al.* (2008, 2018a, 2018b, 2019).

[1] Haverigg I and II are separate, but adjacent, wind farms. However, the reports combine the data for the two wind farms to calculate a single avoidance rate.

The post-construction monitoring for the Haverigg II and III wind farms was carried out between September 2018 and February 2019, with approximately monthly visits. Detailed information about the methodology of this monitoring was not available to me for this review. However, it included searcher efficiency and carcass removal trials.

3.2.2. Results

No Golden Plover fatalities were recorded at the Blood Hill Wind Farm, single fatalities were recorded at the Goole Fields I and Goole Fields II Wind Farms, and one probable Golden Plover fatality and another probable wader fatality were recorded at the Haverigg II and III Wind Farms (Table 3.3). At Blood Hill, searcher efficiency was very high, and the report notes that conditions were good for searching with winter cereals or bare ploughed ground under the turbines. At Goole Fields I and Goole Fields II, crop growth prevented full coverage of the search area on each visit, with overall coverage levels of 60-88% across the five winters covered at these two wind farms. Searcher efficiency was lower than at Blood Hill but still relatively high.

Table 3.3. Collision monitoring results.

Wind farm	Seasons	Golden Plover / wader fatalities recorded	Coverage	Searcher efficiency	% of carcasses missed due to scavengers
Blood Hill	2006/07	0	100%	> 99%	38%
	2007/08	0	100%		
Goole Fields I	2015/16	1	60%	82%	14%
	2016/17	0	81%		
	2018/19	0	79%		
Goole Fields II	2017/18	1	81%	91%	17%
	2018/19	0	88%		
Haverigg II and III	2018/19	2	no data	93%	33%

All data taken from the relevant reports cited in Section 3.1. The fatalities at Goole Fields I and Goole Fields II were confirmed Golden Plover fatalities. The fatalities at Haverigg II and III were one probable Golden Plover and one probable wader.

3.3. DERIVATION OF AVOIDANCE RATES

3.3.1. Avoidance rate calculations

Table 3.4 shows the predicted number of collisions using the SNH default 98% avoidance rate, the estimated number of collision fatalities, and the empirical avoidance rates for each site. The estimated number of collision fatalities are the actual number of collision fatalities recorded adjusted for coverage, searcher efficiency and carcass removal. Note that the data for Haverigg II and III is a combined estimate for Golden Plover and Curlew. At Blood Hill, Goole Fields I and Goole Fields II, the estimated numbers of collision fatalities were 30-90 times lower than the predicted collisions. The difference was lower at Haverigg II and III, but the estimated numbers of collision fatalities number of collision fatalities was still around six times lower than the predicted collisions. The empirical avoidance rates vary from 99.6% to 99.98%.

For the Blood Hill Wind Farm, there does not appear to be any pre-construction collision risk estimates available. Instead, collision risk estimates were obtained from post-construction vantage point surveys. The reports for the Haverigg II and III Wind Farms were for lifetime extension applications, so the collision risk estimates were also obtained from post-construction vantage point surveys. As noted in the reports, comparison of these estimates with the collision monitoring results may underestimate the avoidance rate, as birds avoiding the wind farm (macro-avoidance) will not be included in the collision risk predictions. However, the monitoring data does not indicate any significant displacement impacts to Golden Plover, so macro-avoidance may not be a significant factor for this species. For the Goole Fields I and Goole Fields II Wind Farms, the post-construction monitoring reports include the pre-construction collision risk predictions from the Environmental Statements for the projects.

No Golden Plover fatalities were recorded in the post-construction monitoring at Blood Hill. However, it would be incorrect to assume a 100% avoidance rate as, where collision rates are low, zero fatalities will be expected in some years ("false negatives"; SNH, 2009). The study by Fijn et al. (2012), which was used by Whitfield and Urquhart (2015) to derive an avoidance rate for Whooper Swan, also did not record any fatalities. To derive an avoidance rate, they assumed that one swan had been killed, and Whitfield and Urquhart (2015) followed that assumption. Therefore, to obtain an avoidance rate estimate for Blood Hill, I used a nominal value of 0.7 Golden Plover fatalities at Blood Hill (equal to one Golden Plover carcass found over two years, corrected for the expected percentage of carcasses missed due to scavenger removal).

Table 3.4. Comparison of collision risk predictions with collision monitoring results.

Wind farm	Predicted collisions (98% avoidance rate) per year	Golden Plover / wader fatalities per year	Avoidance rate
Blood Hill	62	0.7	99.98%
Goole Fields I	56	0.6	99.98%
Goole Fields II	53	1.7	99.94%
Haverigg II and III	28	5.0	99.6%

The data in this table for Haverigg II and III are combined calculations for Golden Plover and Curlew.

The predicted collisions were obtained from the data reported in the post-construction monitoring reports (see Section 3.1). In those reports, the predicted collisions were calculated from post-construction vantage point survey data for Blood Hill and Haverigg II and III, and from pre-construction vantage point survey data for Goole Fields I and Goole Fields II. For Blood Hill, the post-construction monitoring report includes the predicted collisions with an avoidance rate of 0% and the predicted collisions with a 98% avoidance rate were calculated from this figure. For Goole Fields I and Goole Fields II, the post-construction monitoring reports include the predicted collisions with a 99% avoidance rate, and the predicted collisions with a 98% avoidance rate were calculated from these figures.

The Golden Plover / wader fatalities (excluding Blood Hill) were obtained from the data reported in the post-construction monitoring reports (see Section 3.1). In those reports, the Golden Plover / wader fatalities are estimated figures that were calculated from the recorded collisions, adjusted for coverage, searcher efficiency and carcass removal. For Blood Hill, as no Golden Plover fatalities were recorded, a nominal value of 0.7 Golden Plover fatalities is used here to calculate the avoidance rate (see text). For Haverigg II and III, the recorded collisions used for the calculations comprised one probable Golden Plover and one probable wader.

The avoidance rates for Blood Hill, Goole Fields I and Goole Fields II were calculated from the predicted collisions and Golden Plover fatality data provided in the relevant post-construction monitoring reports (see Section 3.1). The avoidance rate for Haverigg II and III is the avoidance rate figure provided in the relevant reports (see Section 3.1).

3.3.2. Correction factors

There are some complicating factors that need to be taken into account in assessing the reliability of the avoidance rate estimates in Table 3.4.

The maps of Golden Plover flightlines in the Blood Hill post-construction monitoring report show a concentration of flightlines in the western section of the 500 m buffer used for the collision risk model, with relatively few flightlines actually crossing the central part of the buffer where the turbines are located. This pattern suggests that the assuming random distribution of flight activity within the 500 m buffer will overestimate the actual collision risk.

For the Goole Fields I and Goole Fields II Wind Farms, the use of pre-construction vantage point survey data for the collision risk predictions means that the accuracy of the avoidance rate estimates is dependent on the pre-construction Golden Plover flight activity being representative of the post-construction Golden Plover flight activity (allowing for any macro-avoidance effects). At Goole Fields II, the mean Golden Plover bird-days/km^2 were around 2.1 times higher in the pre-construction surveys, compared to the post-construction surveys (Figure 15 in Percival *at al.*, 2019), while the mean Golden Plover count within the 600 m buffer zone was around 2.2 times higher during the pre-construction surveys, compared to the post-construction surveys (Table 22 in Percival *at al.*, 2019). These differences seem unlikely to be due to macro-avoidance effects as any displacement impacts to wintering Golden Plover would be likely to be contained within the 600 m buffer zone (and the mean Golden Plover bird-days/km^2 included counts outside the 600 m buffer zone).

The collision risk predictions used for the avoidance rate calculation for the Haverigg II and III Wind Farms used post-construction vantage point survey data. However, this was from a different winter (2014/15) than the winter used for the collision monitoring (2018/19). Therefore, the accuracy of

the avoidance rate estimates is dependent on the Golden Plover flight activity patterns being similar in the two winters.

To allow for the above issues, I have used correction factors of 2.0 for the Blood Hill non-avoidance rate estimate, and 2.15 for the Goole Fields II non-avoidance rate estimate. The correction factor of 2.0 for the Blood Hill non-avoidance rate estimate is based on a visual estimate of differences in flightline densities in the western section of the buffer, compared to the central and eastern sections. The correction factor of 2.15 for the Goole Fields II non-avoidance rate estimate is the mean of the pre-construction / post-construction ratio of Golden Plover bird-days/km^2 and the pre-construction / post-construction ratio of Golden Plover counts within the 600 m buffer zone.

Applying correction factors of 2.0 to the Blood Hill non-avoidance rate estimate, and 2.15 to the Goole Fields II non-avoidance rate estimate, gives corrected avoidance rate estimates of 99.87-99.98%, while sufficient information is not available to assess whether a correction factor should be applied to the 99.6% avoidance rate for Haverigg II and III (Table 3.5).

Table 3.5. Corrected avoidance rate estimates.

Wind farm	Avoidance rate		Correction factor	Reason
	original	corrected		
Blood Hill	99.98%	99.96%	2.0	Uneven distribution of flight activity relative to turbine locations
Goole Fields I	99.98%	99.98%	1.0	-
Goole Fields II	99.94%	99.87%	2.15	Reduction in Golden Plover numbers
Haverigg II and III	99.6%	-	-	No data available to assess whether correction factor is needed (see text)

Note that the correction factor is applied to the non-avoidance rate. See text for further details of the reasons for the avoidance rate correction factors.

4. CONCLUSIONS

The collision monitoring methodologies used in the Blood Hill, Goole Fields I and Goole Fields II post-construction monitoring studies are robust and generally comply with best practice guidance (SNH, 2009). Therefore, I consider that the Golden Plover collision fatality estimates for the Goole Fields I and Goole Fields II Wind Farms from these studies are reliable. The reported zero collision fatality estimate for the Blood Hill Wind Farm does not include any correction for "false negatives" (cf., SNH, 2009), but I have allowed for this by using a nominal estimate in my calculations of avoidance rates.

The avoidance rates derived from these studies are very high, and even when I corrected two of them by doubling the non-avoidance rate to reflect uneven distribution of flight activity (Blood Hill) and apparent reductions in Golden Plover numbers (Goole Fields II), they remain around, or higher than, 99.9%. However, a degree of caution is necessary in applying these figures. Due to the low collision rate, very few collision fatalities are found. This means that random variation in the number of collision fatalities found can cause significant changes in the avoidance rate estimate. For example, if a second fatality had been found at Goole Fields II, then the corrected avoidance rate estimate would decrease from 99.87%-99.74%. While this change may seem small, it would cause a doubling in the predicted collision risk.

Detailed information about the collision monitoring methodology used for the Haverigg II and III Wind Farms post-construction monitoring study was not available to me for this review. However, I note that there was a lower frequency of monitoring (approximately monthly) compared to the other studies (weekly). This will have made the collision fatality estimate less reliable. The avoidance rate calculation for this wind farm used combined data for Golden Plover and Curlew, while the two collision fatalities were a probable Golden Plover and a probable wader. Also, the avoidance rate calculations used flight activity and collision fatality data from different winters, and, unlike with Goole Fields I and Goole Fields II it was not possible for me to assess whether differences in Golden Plover flight activity patterns between the winters could have affected the calculations[2]. Therefore, it is possible that the significantly lower avoidance rate calculated for this wind farm, compared to the avoidance rates for Blood Hill, Goole Fields I and Goole Fields II, reflects methodological issues.

These avoidance rates are only derived from four studies, with two of these studies carried out at adjoining wind farms. However, these still represent a much stronger evidence base for a species-specific avoidance rate than the evidence used for Kestrel in the SNH avoidance rate guidance (see Section 2.3). Also, other species-specific avoidance rates in the SNH avoidance rate guidance are based on data from limited numbers of sites: e.g., both the White-tailed Eagle avoidance rate (see Section 2.3) and the Whooper Swan avoidance rate (Whitfield and Urquhart, 2015) are based on data from single sites. Therefore, the evidence base for a species-specific avoidance rate is relatively strong for Golden Plover compared to some of the species for which the SNH avoidance rate guidance does include species-specific avoidance rates. The lack of a species-specific avoidance rate for Golden Plover in the SNH avoidance rate guidance may reflect the fact that the conservation concern about Golden Plover and wind farms in Scotland is focussed on breeding populations. Data from wintering populations (such as in the studies reviewed here) may not be applicable to breeding populations due to the differences in their behaviour and ecology.

The highest avoidance rate currently recommended by SNH (2018) is 99.8% for geese. The narrow range of the corrected avoidance rates for Blood Hill, Goole Fields I and Goole Fields II (99.87-99.98%) would suggest that 99.8% is a suitable avoidance rate for wintering Golden Plover populations. The 99.6% avoidance rate at Haverigg II and III is lower than this value, although

[2] Note that, while my assessment of this issue for the Goole Fields II Wind Farm resulted in an increase in the corrected avoidance rate, compared to the original value, it is equally plausible that differences in flight activity between winters could cause a decrease in the corrected avoidance rate, compared to the original value.

there may be some issues with this avoidance rate. Therefore, I recommend that collision risk modelling for wintering Golden Plover populations use two avoidance rate values: 99.6% and 99.8%. In practice, this will mean two predicted collision rates, with the one calculated with the 99.6% avoidance rate being twice the value of the other calculated with the 99.8% avoidance rate. These predicted collisions will be five times, and ten times, respectively, lower than predicted collisions calculated with the default 98% avoidance rate.

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