Derrybrien Wind Farm Project

Remedial Natura Impact Statement (rNIS)

Electricity Supply Board (ESB)

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1 Introduction

1.1 Purpose of the report

The Derrybrien Wind Farm Project ("the Project") in County Galway was acquired from a private developer by Gort Windfarms Ltd. (a wholly owned subsidiary of ESB) in 2003 with full development consents. The Project was constructed between 2003 and 2005, commissioned between September 2005 and March 2006 and commenced operations in March 2006. It is envisaged that the Project will operate until circa 2040.

Gort Windfarms Ltd has been directed pursuant to a notice issued by Galway County Council under S.177B of the Planning and Development Act, 2000 as amended, to make an application for Substitute Consent to An Bord Pleanála under Section 177E of the 2000 Act. The application shall be accompanied by a remedial Environmental Impact Assessment Report (rEIAR) or remedial Natural Impact Statement (rNIS), or both as the case may be, prepared in accordance with the requirements under Para. 177F and 177G of the Act.

Para. 177G of the 2000 Act sets out that the rNIS shall be prepared by experts with the competence to ensure its completeness and quality and contain:

- a statement of the significant effects, if any, on the relevant European site which have occurred or which are occurring or which can reasonably be expected to occur because the development was carried out;
- details of any appropriate remedial or mitigation measures undertaken or proposed to be undertaken by the applicant to remedy or mitigate any significant effects on the environment or on the European site;
- the period of time within which any such proposed remedial or mitigation measures shall be carried out by or on behalf of the applicant.

This report presents the rNIS, which has been prepared to accompany the substitute consent application for the Derrybrien Wind Farm Project. The report has been prepared in accordance with the requirements of Article 6(3) of the EU Habitats Directive (Directive 92/43/EEC) and the European Communities (Birds and Natural Habitats) Regulations 2011.

The assessment relates to the construction, operation and decommissioning of the Project which comprises the wind farm, the Derrybrien – Agannygal 110 kV overhead line (OHL), the Agannygal Substation and all associated works. A peat slide occurred during the construction of the wind farm in October 2003. The slide and works undertaken in response to the slide are also addressed in the assessment.

The purpose of this report is to determine if the Project, either alone or in combination with other plans and projects, has had or is likely to have had, is having or is likely to have significant effects on any European site(s)[1] in view of the site's conservation objectives.

[1] Natura 2000 Sites are also referred to as European sites in this report

1.2 Statement of competence

The remedial Natura Impact Statement has been prepared by **Ciara Hamilton**, Senior Ecologist with ESB Engineering and Major Projects (EMP), with specialist input from ecological consultants working on behalf of ESB EMP - **Dr. Brian Madden**, Biosphere Environmental Services and **Gerard Morgan**, Aquatic Service Unit.

Ciara holds a MSc in Ecosystem Conservation and Landscape Management and is a full member of the Chartered Institute of Ecology and Environmental Management (CIEEM). She has over 14 years' experience in Environmental Impact Assessment (EIA) and Appropriate Assessment (AA), for various development projects including wind energy, powerlines, road, light rail and port expansions. Ciara has considerable experience in the assessment of electricity infrastructure projects including high voltage transmission lines, substations and underground cables. She has also worked on large scale renewable energy projects across Ireland from pre-planning impact assessment stage through to the implementation and monitoring of mitigation measures during the operational stage.

Brian Madden (BA Mod, PhD) qualified in Natural Sciences in the early 1980s and earned a doctorate degree in 1990 for research in peatland ecosystem processes. Brian is an expert ornithologist and has carried out various surveys for the National Parks and Wildlife Service, including survey of breeding birds of western machair systems and co-ordination of the National Peregrine Survey in 2002. He has worked on impact assessments for wind energy projects throughout Ireland since the 1990s and has been involved in the Derrybrien Wind Farm project since 2004.

Gerard Morgan holds an honours BSc in Zoology and MSc in freshwater ecology. Ger has managed the Aquatic Services Unit, a UCC-based environmental consultancy specialising in aquatic systems, since 1986. He has over 30 years' experience in ecological consultancy, specialising in water quality impacts of a wide range of infrastructural projects including roads, bridges, pipelines, wind farms, power transmission and port & harbour facilities. He also specialises in protected species surveys, including for fish and pearl mussels. He is a specialist in algal surveys and identifications in rivers and lakes and is recognised by the EPA as a practitioner of the Q-value biotic index system.

2 Appropriate Assessment

2.1 Regulatory context

The EU Habitats Directive 92/43/EEC provides legal protection for habitats and species of European importance through the establishment of a network of designated conservation areas known as the Natura 2000 Network. The Natura 2000 network includes sites designated as Special Areas of Conservation (SAC) under the EU

Habitats Directive and Special Protection Areas (SPA) designated under the EU Birds Directive 79/209/EEC.

The Habitats Directive was initially transposed into Irish national law in 1997, with the European Communities (Natural Habitats) Regulations, SI 94/1997. These Regulations have since been amended by SI 233/1998 & SI 378/2005. The European Communities (Birds and Natural Habitats) Regulations 2011 consolidate the European Communities (Natural Habitats) Regulations 1997 to 2005 and the European Communities (Birds and Natural Habitats) (Control of Recreational Activities) Regulations 2010.

The requirements for an Appropriate Assessment are set out under Article 6(3) of the Habitats Directive 92/43/EEC which state:

6(3) Any plan or project not directly connected with or necessary to the management of the site (Natura 2000 sites) but likely to have significant effect thereon, either individually or in combination with other plans or projects, shall be subject to Appropriate Assessment of its implications for the site in view of the sites conservation objectives. In the light of the conclusions of the assessment of the implications for the site and subject to the provisions of paragraph 4, the competent national authorities shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the site concerned and, if appropriate, after having obtained the opinion of the general public.

This provision is transposed into Irish law by Part XAB of the Planning and Development Act, 2000 as amended. Section 177U(4) of the said Act provides for screening for Appropriate Assessment as follows:

"The competent authority shall determine that an appropriate assessment of [...] a proposed development [...] is required if it cannot be excluded, on the basis of objective information, that the [...] proposed development, individually or in combination with other plans or projects, will have a significant effect on a European site."

Section 177U(5) provides as follows:

"The competent authority shall determine that an appropriate assessment of a […] proposed development, […], is not required if it can be excluded, on the basis of objective information, that the […] proposed development, individually or in combination with other plans or projects, will have a significant effect on a European site."

2.2 Appropriate Assessment process

The key stages in the Appropriate Assessment (AA) process relating to Article 6 (3) of the Habitats Directive and addressed in this report are set out below, as per European and Irish Government guidance (EC 2018, EC 2001 and DoEHLG 2009 (Rev 1 2010)). The outcome of each successive stage determines if a further stage in the process is required.

Stage 1. Screening for Appropriate Assessment

The first step in the screening process is to determine if the plan or project is directly connected to or necessary for the management of a Natura 2000 site. The process

then identifies whether a plan or project, either alone or in combination with other plans or projects, is likely to have significant effects on a Natura 2000 site in view of its conservation objectives.

Stage 2. Appropriate Assessment

This stage considers whether the plan or project, alone or in combination with other projects or plans, will have adverse effects on the integrity of a Natura 2000 site, and includes any mitigation measures necessary to avoid, reduce or offset negative effects. A Natura Impact Statement (NIS) must be prepared as part of this stage of the process. The AA is carried out by the competent authority, and is supported by the NIS.

2.3 Conservation Status of habitats and species

Definitions of conservation status, integrity and significance used in this assessment are defined in accordance with ‘Managing Natura 2000 sites: The provisions of Article 6 of the 'Habitats' Directive 92/43/EEC’ (European Commission, 2018).

- The conservation status of a natural habitat is defined as the sum of the influences acting on a natural habitat and its typical species that may affect its long-term natural distribution, structure and functions as well as the long-term survival of its typical species.
- The conservation status of a species is defined as the sum of the influences acting on the species concerned that may affect the long-term distribution and abundance of its population.
- The integrity of a Natura 2000 site is defined as the coherence of the site’s ecological structure and function, across its whole area, or the habitats, complex of habitats and/or populations of species for which the site is or will be classified.
- Significant effect should be determined in relation to the specific features and environmental conditions of the protected site concerned by the plan or project, taking particular account of the site’s conservation objectives.

Favourable conservation status

The overall aim of the Habitats Directive is to maintain or restore the favourable conservation status of habitats and species of community interest.

European and national legislation places a collective obligation on Ireland and its citizens to maintain habitats and species in the Natura 2000 network at favourable conservation condition. The Government and its agencies are responsible for the implementation and enforcement of regulations that will ensure the ecological integrity of these sites.

The maintenance of habitats and species within Natura 2000 sites at favourable conservation condition will contribute to the overall maintenance of favourable conservation status of those habitats and species at a national level. Article (1) of the

Habitats Directive (92/43/EEC) describes favourable conservation status for habitats and species as follows:

Favourable conservation status of a habitat is achieved when:

- its natural range, and area it covers within that range, are stable or increasing, and
- the specific structure and functions which are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future, and
- the conservation status of its typical species is favourable.

Favourable conservation status of a species is achieved 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.

3 Methodology

3.1 Overview

The baseline date for the assessment of environmental effects in the rEIAR is the date when the environmental impact assessment (EIA) should originally have been carried out and taken into account by the decision-maker. The decisions in relation to the planning applications and appeals for the Derrybrien Wind Farm and grid connection were made in the period 1998 – 2001. Therefore, for the purposes of this rNIS the baseline date is circa 1998 to 2001.

Baseline data to inform the construction phase impacts was collected from a desktop review of existing datasets and the original Environmental Impact Statements (EISs)[2] prepared for the Project. Aerial photography from the OSi Mapviewer was used to assist in determining the type and distribution of habitats within the Project area prior to the commencement of the construction phase.

Ecological monitoring of the Project has been ongoing since the construction phase (i.e. 2003 onwards) to present. The monitoring has included bird, bat, terrestrial habitat and aquatic ecology and fisheries field surveys. The results of these surveys have informed the impact assessment of the operational phase of the Project and have also

[2] EIS submitted with GCC Reg. Ref. 97/3470 / ABP Reg. Ref. PL.07.106290 – 'the Phase 1 EIS',
EIS submitted with GCC Reg. Ref. 97/3652 / ABP Reg. Ref. PL.07.106292 – 'the Phase 2 EIS',
EIS submitted with GCC Reg. Ref. 00/4581 / ABP Reg. Ref. PL.07.122803 – 'the Phase 3 EIS'

provided the receiving environment conditions against which the potential impacts associated with the decommissioning phase can be assessed.

3.2 Assessment criteria

This assessment has been undertaken in accordance with all relevant legislation and with regard to the following best practice guidelines:

- Directive 92/43/EEC, Office for Official Publications of the European Communities, Luxembourg. European Commission;
- Directive 2009/147/EEC, Office for Official Publications of the European Communities, Luxembourg. European Commission;
- European Communities (Birds and Natural Habitats) Regulations 2011, as amended;
- Appropriate Assessment of Plans and Projects in Ireland: Guidance for Planning Authorities (Department of the Environment Heritage and Local Government, 2009 (Revision 1, 2010));
- Assessment of plans and projects significantly affecting Natura 2000 sites: Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC (European Commission, 2001); and
- Managing Natura 2000 sites. The provisions of Article 6 of the 'Habitats' Directive 92/43/EEC (European Commission, 2018).
- Assessing Connectivity with Special Protection Areas (SPAs) Guidance. Published by Scottish Natural Heritage (SNH, 2016a).

3.3 Desk review

A desktop study was conducted to examine the potential ‘Zone of Influence’ (refer to Section 3.4) of the Project and to identify any European sites within this area which may have been affected or have the potential to be affected as a result of the Project.

The National Parks and Wildlife Service (NPWS) website database was examined in relation to designated nature conservation areas and relevant reports. GIS data was accessed using the NPWS mapviewer (accessed date July 2020).

Specific data requests were made to the NPWS in relation to a number of protected species. Information on the distribution of hen harrier breeding territories in the hinterland of the wind farm site (up to approximately 5 km distance from project boundary) for the pre-construction period 2000-2003 was provided by NPWS.

The desktop study included a review of historic and current mapping including aerial photographs, historic and current reports and data relating to the wind farm site and adjoining areas.

The following databases, websites and reports have been consulted:

- The National Parks and Wildlife Service (NPWS) of the Department of Culture, Heritage and the Gaeltacht (DCHG) (www.npws.ie);
- The National Biodiversity Data Centre (NDBC) (www.biodiversityireland.ie);

- Bat Conservation Ireland (www.batconservationireland.org);
- Aerial photography (past and present) and photographs taken at the site;
- Ordnance survey data (past and present) www.osi.ie;
- Information on water quality in the area available from www.epa.ie;
- Information on local watercourse catchments from www.catchments.ie;
- Information on soils, geology and hydrogeology in the area available from www.gsi.ie;
- Information on the status of EU protected habitats and species in Ireland (NPWS, 2019a, 2019b and 2019c);
- Review of specially requested records from the NPWS Rare and Protected Species Database for the hectads which overlap with the study area.
- Monitoring data for the Lesser Horseshoe Roost at Lough Cutra Castle was provided by National Parks and Wildlife Service.
- A search of the local planning authorities' websites for planning applications with bat data within 10 km of the Derrybrien Wind Farm within the last 10 years.
- Galway County Council Planning Website http://www.eplanning.ie/GalwayCC/searchexact to search for planning applications.

The Galway County Council website was used to search for planning applications relevant to the current assessment, in particular with regard to in-combination effects.

Literature sources:

- A review of the Environmental Assessments (3 phases) carried out in the late 1990s by Saorgus Energy Ltd. for the Derrybrien Wind Farm project:

  Environmental Impact Statement (EIS) submitted with GCC Reg. Ref. 97/3470 / ABP Reg. Ref. PL.07.106290 – 'the Phase 1 EIS',
  EIS submitted with GCC Reg. Ref. 97/3652 / ABP Reg. Ref. PL.07.106292 – 'the Phase 2 EIS',
  EIS submitted with GCC Reg. Ref. 00/4581 / ABP Reg. Ref. PL.07.122803 – 'the Phase 3 EIS',

- Anon (2004) *Investigation into the effects of Landslide of Peat bog at Derrybrien North into the Owendalulleegh River Catchment – Second Report – July 2004*. Shannon Regional Fisheries Board
- Inis Environmental Services (2004a). Summer assessment of the lesser horseshoe bat roost at Lough Cutra demesne.
- Inis Environmental Services (2004b). Impact assessment of Derrybrien Peat Slide on habitats, cormorants and Bat fauna of Lough Cutra, County Galway.
- Inis Environmental Services (2004c). Derrybrien Windfarm Peat Slip Environmental Impact Assessment on the Owendalulleegh River. March 2004.
- Wilson (2012) Derrybrien Wind Farm Bat Assessment (Draft report)

3.4 Zone of influence

The 'zone of influence' (ZoI) for a project is the area over which ecological features may be subject to significant effects as a result of the project and associated activities. This is likely to extend beyond the project site, for example where there are ecological or hydrological links beyond the site boundaries. The ZoI will vary for different ecological features depending on their sensitivity to an environmental change. It may therefore be appropriate to identify different zones of influence for different features. The features affected could include habitats, species, ecosystems and the processes on which they depend (CIEEM, 2018)

Departmental guidance states that '*A distance of 15 km is currently recommended in the case of plans and derives from UK guidance (Scott Wilson et al., 2006). For projects, the distance could be much less than 15km and in some cases less than 100m, but this must be evaluated on a case-by-case basis….'* (DoEHLG, 2009 (Rev 1 2010))

The first step in determining the ZoI is to analyse the characteristics of the Project and identify the range of ZoI using the source-pathway-receptor conceptual model. Impacts associated with the Project, both known and potential have been used to establish the potential zone(s) of influence.

The mechanism for defining the ZoI is summarised as follows:

- The nature, size and location of the project have been considered;
- The sensitivities of the relevant ecological receptors have been considered; and
- The known and potential impact sources and pathways have been identified.

The ZoI for birds will vary with species and type of impact: relevant factors include conservation status, sensitivity to disturbance and species core foraging distances, as described in the Scottish Natural Heritage Guidelines (SNH, 2016a). Target bird species occurring within the study area were identified during the desk review and core foraging ranges were established for these species. For hen harrier, the core foraging range from nest sites during the breeding season is 2 km, with a maximum range of 10 km. With regards to merlin, the core foraging range from nest sites during the breeding season is 5 km. Whooper swan has a core foraging range from night roosts during the winter season of less than 5 km. Based on the bird species which have been identified as target species for the purpose of this assessment, the ZoI for birds is considered to be 10 km.

Bats are highly mobile species, and capable of travelling large distances to forage and during migration. Of particular importance is the area around a bat roost in which habitat availability and quality will have an influence on the resilience and conservation status of that roost (the core sustenance zone (CSZ)). For Irish bat species the core sustenance zone ranges from approximately 1 to 4 km (Collins, 2016), although individual flights can be longer. Shiels *et al.* (1999) found that the maximum (mean) flight distance recorded for individuals from two Leisler's bat maternity roosts ranged

from approximately 4.5 km to 7.5 km throughout the year. Given the long distances that can be travelled by bats a ZoI of 10 km for bat species is considered appropriate for the Project. This distance is supported by current multi-agency guidance on assessing impacts of wind farms on bats, 'Bats and onshore wind turbines: survey, assessment and mitigation' (SNH *et al.,* 2019) which suggests that relevant bat information within 10 km of the wind energy site is obtained as well as the location, number and size of turbines in other wind energy developments within the surrounding 10 km.

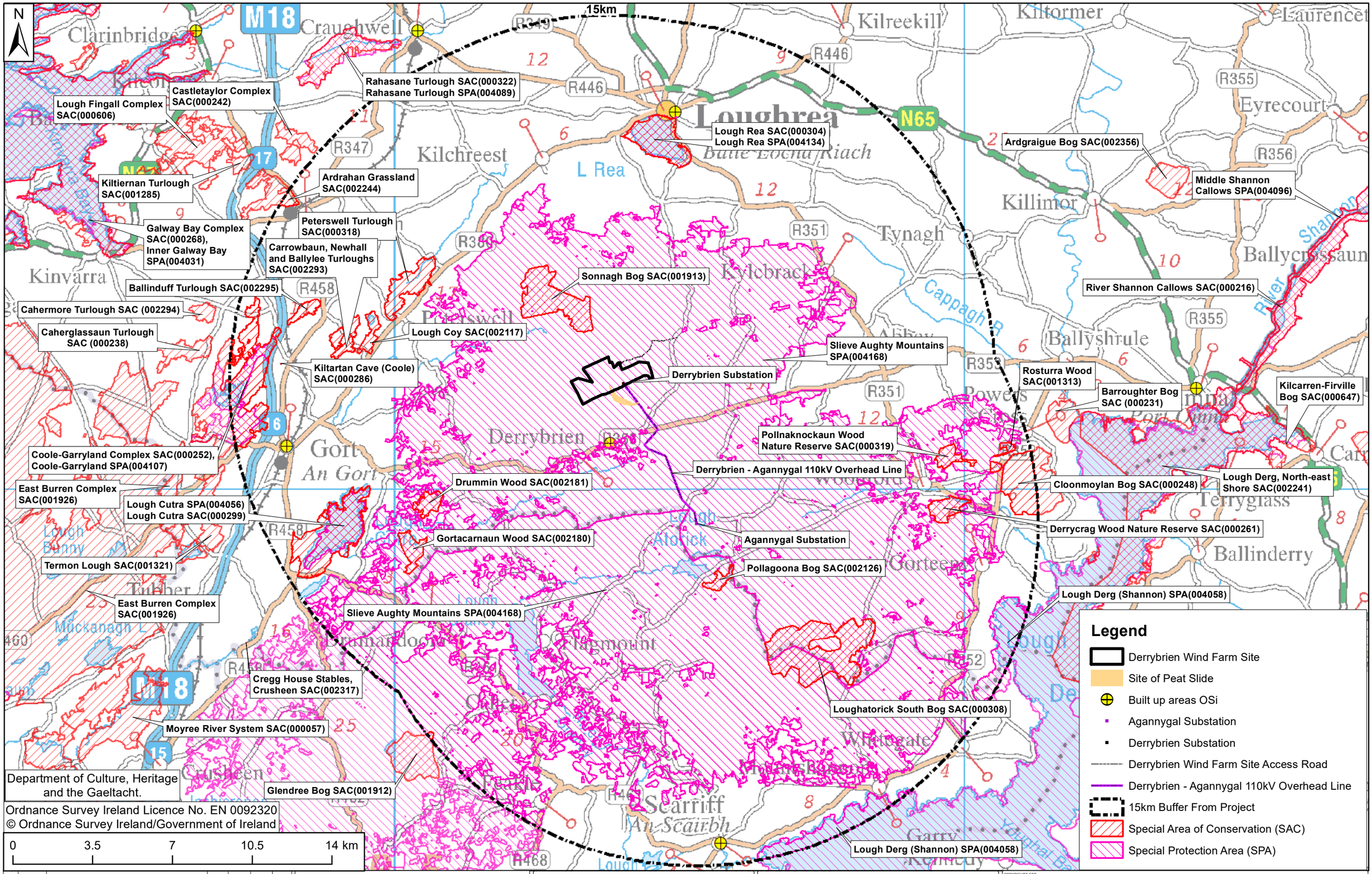
The ZoI for terrestrial habitats is considered to be within the red line boundary of the Project and immediately adjoining the site boundary. Direct impacts to habitats would be confined to the footprint of the development within the site boundary and any ancillary works. Habitats immediately adjoining the site boundary were assessed in relation to indirect impacts.

The Derrybrien Wind Farm site drains to three river catchments. The Owenaglanna flows east becoming the Duniry River eventually discharging into Lough Derg, whereas the Boleyneendorrish and the Owendalulleegh Rivers flow westward, the latter discharging to Lough Cutra and the former joining a nexus of tributaries and dropping underground into the karst geology just north east of Gort. The outflow from Lough Cutra, the Beagh River drops underground in the Punch Bowl and emerges again as the Cannahowna River which then flows north to Gort. Thereafter, known as the Gort River, it flows north before dropping underground at Pollatoophil at Castletown and emerges west north west near Kiltartan where it is joined by the combined flows of the Boleyneendorrish and Kilchreest Rivers which drain the northern slopes of the Slieve Aughty Mountains. These combined flows then continue west underground emerging into the Coole River which flows due south to the Coole-Garryland wetland complex. Flows from here continue entirely underground until they emerge west north west in Galway Bay at Kinvarra. All these underground watercourses discharge to the sea at Kinvarra Bay. A small section of the OHL and Agannygal Substation drain to Lough Atorick which is within one of the sub-basins of the Bleach River. The Bleach River flows from Lough Atorick on into Lough Graney which in turn flows into the lower portion of Lough Derg at Scarriff Co. Clare, part of the River Shannon catchment.

The peat slide which occurred at the wind farm in 2003 (described in Section 4.2.1.2), had a profound impact on fisheries in the upper sections of the Owendalulleegh River (refer to Chapter 8 Aquatic Ecology and Fisheries of the rEIAR). On account of this, all European sites hydrologically connected to the Owendalulleegh River system, downstream of the wind farm project, as far as the sea at Kinvarra (hydrologically over 45 km from the Project), have been included in this assessment. Although not impacted by the peat slide, the same has been applied to the other river systems within the catchments of the Project and all European sites hydrologically connected within these catchments have been included for assessment.

Based on this review the potential ZoI for European sites designated for terrestrial habitats and species was determined to be 15 km (conservative approach). All European sites within a 15 km radius of the wind farm, OHL and Agannygal Substation as shown on **Figure 1** have been identified and included for assessment in this report.

The potential ZoI for European sites designated for water-dependent habitats and species has been defined as those sites hydrologically connected to the river systems draining the Project. In the case of the Owendalulleegh River, the ZoI extends up to 45 km downstream.



REV	DATE	REVISION DESCRIPTION	DRN	PROD	VER	APP
0	29/07/20	Issued for substitute consent	E.O'S	E.O'S	C.H	P.K

PURPOSE OF ISSUE - PRELIMINARY UNLESS INDICATED

CLIENT APPROVAL ☐ PLANNING ☒ TENDER ☐ CONSTRUCTION ☐ AS-BUILT ☐

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CLIENT: **Gort Windfarms Ltd**

PROJECT: **Derrybrien Wind Farm Project**

CONTRACT

PRODUCTION UNIT: **Civil & Environmental Engineering**

DRAWING TITLE: **Figure 1- European Sites within 15km radius of Project**

DRAWN	PRODUCED	VERIFIED	APPROVED	APPROVAL DATE
E.O'Shea	E.O'Shea	C.Hamilton	P.Kavanagh	29/07/2020

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DRAWING NUMBER: **QS-000280-01-D460-017-001-000**

3.5 Field surveys

Extensive ecological monitoring surveys have been undertaken within the Project area and its environs over the lifetime of the Project. The data generated from this monitoring has provided essential information on the status of the receiving environment during and post construction and has been used to assess actual and potential impacts during the operation of the wind farm as well as impacts which are likely during the continued operation and decommissioning phase of the Project. Some of these surveys began during the construction stage between 2003 and 2005.

3.5.1 Bird surveys

Hen harrier and merlin

A programme for monitoring of hen harrier distribution within the Derrybrien Wind Farm commenced in March 2004. The monitoring was in compliance with Condition 9 of Galway County Council Planning Ref. 02/3560:

"***9**. The developer shall retain the services of a suitably qualified and experienced bird specialist to undertake appropriate surveys of this site for the Hen Harrier. Details of the surveys to be undertaken shall be agreed in writing with the planning authority prior to commencement of development.*

REASON: To ensure that the developer contributes towards knowledge of the local Hen Harrier population and of the impact of windfarms on that species."

The objectives of the monitoring programme, which has continued at intervals up to the present (see below), were as follows:

- To determine if hen harriers that may nest in the vicinity (up to c.5 km from wind farm site) use any part of the wind farm site for nesting and/or foraging purposes
- To determine what distance foraging birds will approach wind turbines
- To determine if birds habituate to the presence of turbines

The survey methodology used was that as recommended for monitoring hen harriers at wind farm projects in upland areas by the National Parks & Wildlife Service (NPWS Hen Harrier Survey Methodology, Draft 12/03/03). At the time (2004), this was based on survey techniques established by Madders (2002); these were later developed by Scottish Natural Heritage as standard methods for survey of birds at onshore wind farm sites (current version SNH, 2017).

The method involves survey of the core wind farm site through the breeding season (March/April to July/August), with coverage also of a wide area (up to 5 km) around the wind farm site to establish locations of nesting pairs in the vicinity. Part of the route of the Derrybrien to Agannygal overhead line grid connection was included as part of the wider 5 km study zone. The distance of 5 km was as recommended by NPWS methodology based on the distance where majority of hunting is done from a nest site.

With the use of VHF transmitter tags, Irwin *et al.* (2012) showed that 89% of hunting was done within 5km of the focal nest.

The core site survey area was defined as the wind farm site and a strip approximately 500 m beyond the outermost turbines. Two principal vantage points (VPs) were established within the wind farm from which observations were made, as follows:

Vantage Point (VP)	Description
VP A : M 60560 05219	On track out on open bog with views back west into centre of site and views east over Caheranearl to Earl's Chair.
VP B : M 58704 04749	Looking over clearfell, open bog and forest edge at northwest corner of site from track c.300m north of '365m' high point on Cashlaundrumlahan.

Six hours of observations were made from each VP in each month of survey. Casual observations were also made from various other locations whilst travelling around the wind farm.

The wider area around the site, to approximately 5 km from the site boundary, was checked for breeding occupancy based largely on information available from previous surveys. This wider area is known as the hinterland or peripheral area. Surveys here were mainly in the early part of the season (March-May) when territorial birds are most active. However, later visits were made to occupied territories to assess breeding success.

Monitoring surveys for breeding birds were carried out in the following years:

- 2004 – construction works had commenced but were on hold due to peat slide and no turbines yet erected, site still largely afforested
- 2006, 2007, 2009, 2011, 2015, 2018 – operational phase

While not requested in Planning Condition no. 9, all other bird species observed or heard were recorded during the vantage point surveys and general time spent within the wind farm site and the surrounding areas. Post-construction monitoring of operational wind farms usually only focuses on target or key species. Hen harrier and merlin were identified as target species given the designation of the Slieve Aughty Mountains SPA for both species, and the fact that both species are of high conservation importance.

Monitoring surveys for wintering birds were carried out in the following years:

Winter 2011-12: a survey was carried out from November 2011 to January 2012. This included observations from the vantage points within the wind farm (9 hours in November, 7 hours in December, 8 hours in January) and search for night roosting hen harriers in the hinterland area (on six dates between November and January). The winter roost survey followed the method of the Irish Hen Harrier Winter Survey (O'Donoghue, 2019).

Winter 2019-20: a survey commenced in October 2019 and continued to March 2020. This included vantage point watches within the wind farm (6 hrs from each VP per month) and search for night roosting hen harriers in the hinterland area (following the method of the Irish Hen Harrier Winter Survey, O'Donoghue 2019).

3.5.2 Bat surveys

Bat survey work was undertaken at Lough Cutra Castle Demesne following the peat slide that occurred in 2003, as this site is designated as an SAC for lesser horseshoe bat. Further bat survey work was undertaken at the wind farm site in order to assess the impact of the operational wind farm on all bat species but with a particular emphasis on the lesser horseshoe bat, as a number of SACs designated for this Annex II and Annex IV species are present in the surrounding landscape.

Bat surveys 2004

Bat surveys were undertaken in the Lough Cutra Castle Demesne in March and August 2004 by Inis Environmental Services (2004a). The purpose of the surveys was to gather information on the spring and summer bat fauna on the shores of Lough Cutra focusing on lesser horseshoe bat and to determine if the peat slide had any impact on the local bat population.

Bat surveys 2011

A bat activity survey was undertaken on 5th November 2011 across the operational wind farm and in the wider landscape using bat detectors. During the survey each turbine was visited and bat activity was recorded using a variety of bat detectors (Heterodyne Bat Detector: Pettersson D100; Time Expansion Bat Detector: Pettersson D240; Frequency Division Bat Detector: Bat Box Duet). Time was spent at each turbine location during the survey and the networks of tracks between each turbine were also driven slowly with the bat box mounted on the window of each vehicle pointing upwards to record any bat passes. Bats were identified by their ultrasonic calls coupled with behavioural and flight observations. The survey results were included in the 2012 bat study report (Wilson, 2012).

Bat surveys 2016

Further bat survey work was commissioned at the wind farm site in 2016 and was undertaken by BSG Ecology.

The aims of bat survey work undertaken at the wind farm site between April and September 2016 were to establish:

- The species of bat using the wind farm over the period
- Areas of the wind farm and adjacent habitats subject to particular use by bat species

- The likelihood of roosts occurring in close proximity to the wind farm
- An indication of whether bat mortality was occurring
- A baseline for the assessment of likely impacts on bat species

Survey methods were derived with reference to guidance documents produced by BCI (2012), Natural England (2014) and the Bat Conservation Trust (Hundt, 2012).

Field surveys to inform the assessment for the site comprised the following elements:

- Driven transect survey
- Static bat detector survey
- A search, using specially trained dogs, for bat corpses (accompanied by a scavenger removal study).

Bat surveys 2019

Bat survey methods employed by BSG Ecology in 2019 were derived with reference to guidance documents produced by Bat Conservation Ireland (BCI) (2012), and multi-agency guidance published by Scottish Natural Heritage (SNH *et al.*, 2019) .

Sampling was completed during the autumn (29 August to 8 October) at each of 32 turbine locations using the static detectors (11 detectors were rotated between the 32 locations). The same locations were sampled as the surveys in 2016, along with an additional 14 locations which were spread evenly across the site. Ten consecutive nights of data were collected at each location.

Bat data were analysed using the same processes and parameters as the 2016 data.

Further details with regard to bat survey methodologies employed on the Project can be found in Chapter 7 Biodiversity of the EIAR.

3.5.3 Aquatic ecology and fisheries surveys

The following aquatic ecology and fisheries surveys have been undertaken on receiving waters in the study area:

(i) Macroinvertebrate Q-value surveys in 2011, 2014, 2018, 2019 and 2020

(ii) Electrofishing surveys in 2011, 2014 and 2019

(iii) Water chemistry surveys in 2011, 2018 and 2019.

(iv) A benthic grab sampling survey in Lough Cutra, to characterise the nature of the bottom substrates in the lake and to assess the type of soft sediment benthic macroinvertebrates present (October 2019)

Macroinvertebrate Q-value Surveys

A total of 37 sites: 2011 (11), 2014 (6), 2018 (7), 2019 (26) and 2020 (1) were surveyed for Q-value assessment within the project drainage area and some small adjoining

watercourses. **Figure 2** includes all these sites along with a few where water samples were also collected. Several sites were surveyed in more than one year. They were distributed along the main channel of the Owendalulleegh and Boleyneendorrish rivers, as well as on the smaller streams in these catchments draining the wind farm site or lands immediately adjoining the wind farm site. Two sites were also surveyed in the Duniry catchment to which a tiny portion of the footprint of the wind farm drains to the east. Finally, two sites were surveyed on two small streams draining the OHL corridor and the Agannygal Substation, one that eventually joins the main channel of the Owendalulleegh and the other which flows into the northern shore of Lough Atorick to the south of the study area. The strategy underlying the choice of sites was to cover all the smaller and larger streams draining the wind farm, the Agannygal Substation and the OHL.

Electrofishing surveys

Electrofishing surveys were carried out at a total of 19 sites as follows: 2011 (12), 2014 (6), 2019 (11). Several sites were visited on more than one occasion across the three survey years. Survey sites were situated mainly on tributary streams draining the wind farm site in the two main catchments (Owendalulleegh and Boleyneendorrish) but also at a number of main channel sites in both catchments and at a site in the upper reaches of the Duniry catchment (2011) – see **Figure 2.** The choice of survey site was prompted by a number of considerations. These included the need to assess the smaller tributaries, in particular, given that the 2003 peat slide most profoundly affected a small tributary, and in the absence of pre-slide fish records it was important to get an understanding of the significance of these small streams to the overall population within each catchment. It was also considered prudent to survey a number of main channel sites both upstream and downstream of the peat slide impacted stretch on the Owendalulleegh in order assess the current populations in both the affected and unaffected stretches and to gauge the likely importance of the unaffected stretch towards the recovery of the population in the impacted stretch after the slide. Finally, because IFI's fishing surveys over the past decade have been in the lower reaches of the Owendalulleegh it was considered important to sample at least one site within this area to compare the fish densities and age structures derived from the current surveys with those obtained by IFI. A single main channel site was surveyed also on the Boleyneendorrish River.

Water Chemistry

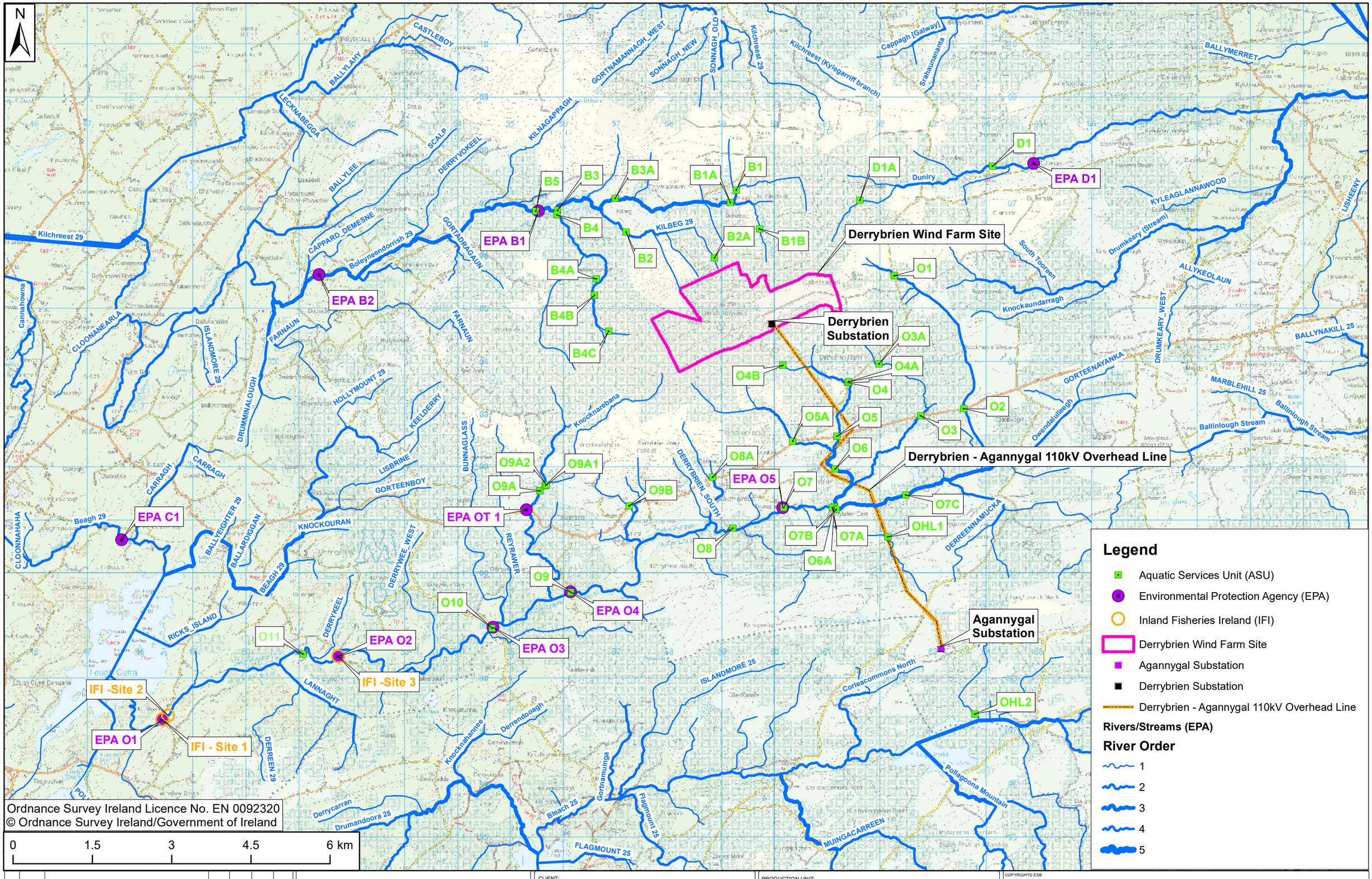
Water chemistry surveys were undertaken at 27 sites, all bar 3 also sampled for Q-values, 2011 (11), 2018 (7) and 2019 (15) – **Figure 2**. They were mainly situated on tributaries rather than on the main channels. Chemistry data was required in order to characterise the nature of the conservative parameters i.e. pH, conductivity, alkalinity, anions and cations etc., i.e. those that would be influenced by the nature of the overburden as well as the underlying geology in the various sub-catchments. In addition,

the nutrient content was assessed to see if these data could help explain some of the water quality findings derived from the Q-value surveys.

Grab Sampling for Sediments and Invertebrates on Lough Cutra

The survey entailed taking a single Van Veen grab sample (0.047m^2) of the bottom sediment at 11 sites from the lower reaches of the Owendalulleegh River to the outflow of the Beagh River..

Further details with regard to aquatic ecology survey methodologies employed on the Project can be found in Chapter 8 of the rEIAR Aquatic Ecology and Fisheries.



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PROJECT: Derrybrien Wind Farm Project

CONTRACT

PRODUCTION UNIT: Civil & Environmental Engineering

DRAWING TITLE: Figure 2 - Locations of ASU,EPA & IFI Sampling Points

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4 Screening for Appropriate Assessment

4.1 Introduction

Screening determines whether appropriate assessment is necessary by examining:

1. Whether a plan or project can be excluded from AA requirements because it is directly connected with or necessary to the management of the site, and
2. The potential effects of a project or plan, either alone or in-combination with other projects or plans, on a Natura 2000 site in view of its conservation objectives and considering whether these effects will be significant (DoEHLG, 2009 (Rev 1 2010).

The proposed development is not directly connected with or necessary to the management of any European site.

Screening for AA involves the following:

1. Description of project
2. Identification of relevant European sites and compilation of information on their qualifying interests and conservation objectives
3. Identification of effects – direct, indirect and cumulative and determination as to their likely significance
4. Conclusions of the Screening Report.

4.2 Description of project

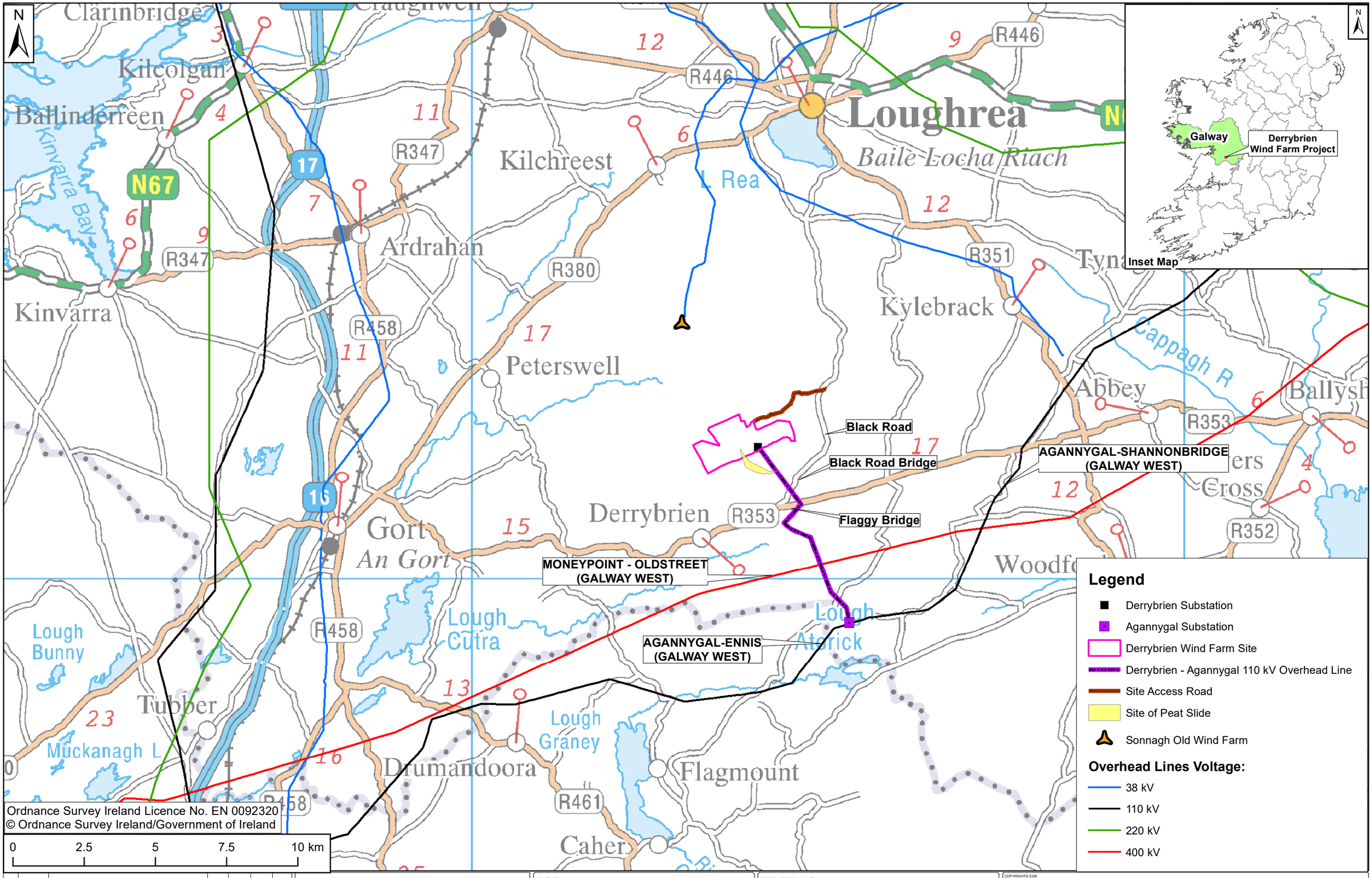
4.2.1 Overview of project

The main components of the Project are:

- Derrybrien Wind Farm and associated ancillary works
- Grid connection comprising Derrybrien - Agannygal 110 kV OHL, Agannygal Substation and associated ancillary works
- Works undertaken in response to the peat slide which occurred during the construction of the wind farm and associated ancillary works

In line with the three main components of the Project identified above, the Project is located on three distinct ‘sites’ – namely the wind farm site and associated discrete ancillary works locations, the site of the grid connection (route of Derrybrien-Agannygal 110 kV OHL and Agannygal Substation) and associated discrete ancillary works locations together with locations of the discrete sites where works were undertaken in response to the peat slide.

The location of the Project is shown in **Figure 3.**



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DRAWING TITLE: **Figure 3 - Project Location**

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4.2.1.1 Wind Farm and Grid connection

The main Project is a 70 turbine wind farm together with associated grid connection comprising a 7.8 km 110kV OHL, substation and connection to the pre-existing Ennis-Shannonbridge 110kV OHL.

4.2.1.2 Peat Slide Event and response works

A peat slide occurred during Project construction on the 16th October 2003. Works were undertaken in response to this unforeseen event. This section provides a brief description of the peat slide event and the measures/works undertaken in response to the peat slide.

The peat slide originated within the wind farm site close to the southern boundary, as excavation works were underway at the location for the foundations for turbine T68.

The peat slide involved the disturbance and partial displacement of peat and forest debris mainly onto land downslope of the peat slide area to Black Road Bridge.

The site of the peat slide extended approximately 1.65 km downslope from turbine T68 and displaced peat and forestry over an area of approximately 25 ha. The majority of the peat slide area was in Coillte coniferous forests outside and to the south of the wind farm site.

From the peat slide area, debris from the slide entered the valley of the stream, a tributary of the Owendalulleegh River, located in the Derrybrien North sub-catchment into an area of flatter ground down to the Black Road Bridge approximately 1.0 km downslope from the slide area. This was the primary run-out zone for the slide. The location of the peat slide and run-out zone is shown in **Figure 4**.

Some peat was transported further down the Owendalulleegh River with some peat being deposited along the river banks. The peat debris remobilised on the 30th October 2003 after heavy rain[3]. In the days and weeks after the peat slide, following subsequent rainfall events, water entered the upper reaches of the stream and caused the peat slide debris to move downstream.

A site walkover by geotechnical specialists in 2019 (downslope of Black Road Bridge) showed little/no visual evidence of any remaining peat debris deposited along the banks of the streams and rivers. Over time, any material deposited along the river banks has been eroded or degraded.

The estimated volume of peat in the peat slide area, based on the extent of the peat slide area was 450,000m^3. Estimates suggest that possibly 50 to 70% of the failed debris left the peat slide area. The remaining material within the peat slide area comprised typically isolated detached rafts of peat, peat debris and a thin covering of intact basal peat. The balance of the debris remains within the site of the peat slide.

[3] Based on review of hourly data for Shannon synoptic station (nearest then-active station with hourly data) and daily data for Derrybrien II daily station. In the month prior to the 16th October slide a daily average of 1.6mm rain fell at Derrybrien met station, well below the long-term average (1982-2019) of 3.9mm. No rainfall was recorded on the 16th October for either station. The 39.3mm rainfall on 30th October was the highest daily rainfall at the station since 1999 when 64mm fell.

N

KILBEG
TOORMACNEVIN
BOHABOY
FUNSHADAUN
COPPANAGH
DRUMMIN
BOLEYBEG
CULLENAGH
DRUMKEARY WEST
ALLYKEOLAUN
KNOCKAUNDARRAGH
BOLEYNEENDORRISH
REYNABRONE
DRUM
KYLENAGAPPA
KNOCKMOYLE WEST
KNOCKMOYLE EAST
DERRYBRIEN NORTH
KNOCKOURA
KNOCKDRUMMORE
BALLYCORBAN
MARBLEHILL
GORTEENAYANKA
LOUGHPARK
GORTNAKILLA
ROSSEESHAL
SILVERSTREAM
CAPPAGHCON WEST
KEELDERRY
R353
CLOGHVOLEY
BALLINLOUGH
TULLA
ACRES
SLATEFIELD
DERRYBRIEN WEST
Derrybrien
LAGGOO
REYRAWER
MOYGLASS
COMMONS WEST
BUNNAGLASS
DERREENNAMUCKA
DERRYBRIEN EAST
DERRYBRIEN SOUTH
DERRYWEE EAST
LOUGHATORICK NORTH
INCHAMORE
DERRYWEE WEST
TOORLEITRA
SCALP
LOUGHATORICK SOUTH
GORTAVEHA
SLIEVEANORE
LOUGHATORICK SOUTH
POLLAGOONA MOUNTAIN

Inset Map
Galway
Derrybrien Wind Farm Project

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0 1 2 3 4 km

Legend

Townland Boundaries
Overhead lines

Location of Wind Farm and Ancillary Works

Derrybrien Wind Farm Site
Derrybrien Wind Farm Site Entrance
Derrybrien Substation
Construction Compound (Hardstands)
Upgrade works to section of Black Road
Coillte track (turbary road) upgraded

Location of Grid Connection and Ancillary Works

Derrybrien - Agannygal 110kV Overhead Line
Agannygal Substation
Upgrade works to Access Road to Agannygal Substation
Connection works to Ennis-Shannonbridge 110kV OHL span

Location of works associated with peat slide

Site of Peat Slide
Barrages
Pre-existing Coillte Track
New Access Track Constructed
Borrow Pit / Quarry Adjacent to Barrage 1
Bridge Repairs (Private)
Bridge Repairs (Public)
Stepping Stones
Crooked Bridge

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PROJECT: **Derrybrien Wind Farm Project**

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Figure 4 - Project Works and Townlands

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The peat slide occurred in the Owendalulleegh River Catchment with the bulk of the debris settling out in the approximately 4 km^2 lake area of Lough Cutra. The finer buoyant material is likely to have over time been carried through Lough Cutra via the Beagh/Gort River and eventually discharged into Galway Bay at Kinvarra.

4.2.2 Project location

4.2.2.1 Wind farm site

Derrybrien Wind Farm site is located in the northern part of the Slieve Aughty Mountains approximately 11 km south of Loughrea County Galway and 12.7 km north north east of Gort, Co. Galway. The wind farm site is in the south of the county approximately 4.6 km from the border with County Clare and 21 km from the border with County Tipperary in the south east. The centre of the site is at ITM co-ordinates E 559572.0998, N 705010.181.

The wind farm site is located within the townlands of Coppanagh, Boleyneendorrish, Kilbeg, Toormacnevin, Funshadaun, Bohaboy, Derrybrien North and Derrybrien West.

The site is leased from a private landowner. The overall area of the site is approximately 344.5 ha, but the wind farm infrastructure occupies only a very small proportion of this (31.1 ha - approximately 9% of site).

The wind farm site is accessed from a Coillte access road in the townlands of Bohaboy, Funshadaun and Coppanagh, via a minor public road known as the Black Road (approximately 3.1 km from the wind farm to the Black Road/Coillte junction). Access to the Black Road is via the R353 Regional Road, which originates near Portumna, crossing over Flaggy Bridge before passing through the village of Derrybrien to join the N66 Loughrea - Gort National Secondary Road near Gort. From Gort the Black Road is accessed via the N66 for a distance of 1.7 km and the R353 for a distance of 14 km. Alternatively, the Black Road /Coillte access road can be accessed via minor public roads from Loughrea a distance of approximately 10 km.

4.2.2.2 Grid connection

The grid connection constructed for exporting the electricity generated at the wind farm to the national grid, comprises the OHL ,the Derrybrien Substation (located within the wind farm site), the Agannygal Substation and associated access track/road.

The Derrybrien – Agannygal 110 kV route (7.8 km) is located approximately 10 km south of Loughrea and located within the townlands of Loughatorick North, Derrybrien East, Derreennamucka and Derrybrien North.

Access to the OHL structures is from nearby roads and forestry tracks.

The Agannygal Substation is located within the townland of Loughatorick North and the approximate centre point is at ITM co-ordinates E 563118, N 698593.

The nearest villages to Agannygal Substation are the following: Derrybrien -5 km to the north west of the site, Ballynakill – 8.7km to the north east, Woodford – 10 km to the east and Flagmount - 8.4 km to the south west.

4.2.2.3 Peat slide and associated works

Measures undertaken in response to the peat slide included the rebuilding of short sections of floating road within the wind farm site at two locations in the vicinity of T68 and T23-T70 (which also acted as barrages) and the installation of eight barrages (four boulder and four earthen) along and downslope of the route of the slide between the wind farm and downstream of Flaggy Bridge.

Of the eight barrages originally built, two (Barrages 1 and 2) are located upstream of Black Road Bridge and now act as Coillte access tracks, two (Barrages 3 and 4) are within a tributary of the Owendalulleegh River and four are no longer in place.

Peat from the peat slide which had accumulated on adjacent land and peat excavated for the construction of Barrages 2 and 3 was placed in three peat repositories, one immediately upslope of the Black Road Bridge and two between Black Road Bridge and Flaggy Bridge.

The location of the peat slide and works associated with the peat slide are mainly located within the townlands of Derrybrien North. Some minor works are located in the townland of Derrybrien East.

4.2.3 Project setting

4.2.3.1 Overview

The site is largely bounded by Coillte-owned coniferous forestry plantations. The closest settlement to the wind farm site is the village of Derrybrien some 2 km to the south. The nearest occupied houses are located just over 2 km from the wind farm site.

The Slieve Aughty Mountains within which Derrybrien Wind Farm is located have some of the largest concentrations of coniferous forest in the country which was mainly planted in the 1960s and 1970s and much of which is located on peat bog. The forest cover is one of the defining characteristics of the Derrybrien area and the Slieve Aughty Mountains area generally.

The wind farm site is located on peat bog which had been disturbed by afforestation and turbary, ranging in depth across the site from 1-7m deep, but in the main peat depths are in the range 2-3 m with the average peat depth across the site of approximately 2.6 m. Turf cutting has and continues to take place on the eastern part of the site and also external to the site to the east and immediately adjacent to it.

Most of the wind farm site is within the Owendalulleegh and Boleyneendorrish River Catchments with the remainder draining into the Owenaglanna/Duniry River Catchments. A small section of the overhead line and Agannygal Substation are located in the catchment of Lough Atorick.

Derrybrien Wind Farm is within the Slieve Aughty Mountains SPA which was classified as an SPA in March 2007 and formally designated by Statutory Instrument in March 2012. The SPA encompasses the entire Slieve Aughty range from just south of Lough Rea in the north to Lough Derg in the east and beyond Lough Graney to the south west. The SPA is designated for the protection of hen harrier and merlin.

The majority of the Derrybrien – Agannygal 110 kV OHL route is covered by shallow to locally deep blanket peat which was largely forested in 1998. Prior to the construction of Agannygal Substation, the ground at the site comprised a shallow layer of peat (approximately 1m) over glacial till.

4.2.3.2 Hydrological Context

The wind farm site partially extends over the catchments of three rivers, the Owendalulleegh and Boleyneendorrish in the Galway Bay South East EPA catchment and Duniry in the Lower Shannon EPA catchment[4][5].

The Derrybrien-Agannygal 110kV Overhead Line is predominately located within the Owendalulleegh catchment with a short section close to Agannygal Substation and Agannygal Substation itself being located within the Bleach catchment within the Lough Derg WMU.

The site of the peat slide and associated offsite works is within the Owendalulleegh catchment.

The location of project works relative to the hydrological Water Management Units, catchments and sub-catchments are shown in **Figure 5**.

The sub-catchments directly connected to the wind farm site are described briefly below.

- The Owendalulleegh River System drains approximately two-thirds (67%) of the wind farm site through a number of small hill slope stream tributaries – Cloghvoley (designated as subcatchment SC6), Derrybrien North (SC7, further divided into SC7(a), (b), (c) and (d) owing to the large portion of the wind farm which drains to the respective streams) and Derrybrien South (SC8 and SC9). The Owendalulleegh River rises in the townland of Gorteenayanka and flows westward to the south of the site to Lough Cutra approximately 22 km downstream. It then flows to the northwest through a heavily karstified region where it disappears underground. It reaches Kinvarra town approximately 15 km further downstream, at which point it enters Galway Bay.
- The Boleyneendorrish River drains approximately 31% of the site via subcatchments SC1, SC2, SC3 and SC4. It flows westward to the northwest through a heavily karstified region before also entering the sea at Kinvarra town.

[4] Catchment information from EPA Database
[5] Sub-catchment information obtained from OPW Flood Studies Update (FSU) portal

- The Duniry River drains a very small section of the overall site (<1%) to the northeast, designated as subcatchment SC5. The river is a tributary of the River Kilcrow which flows into Lough Derg on the River Shannon.

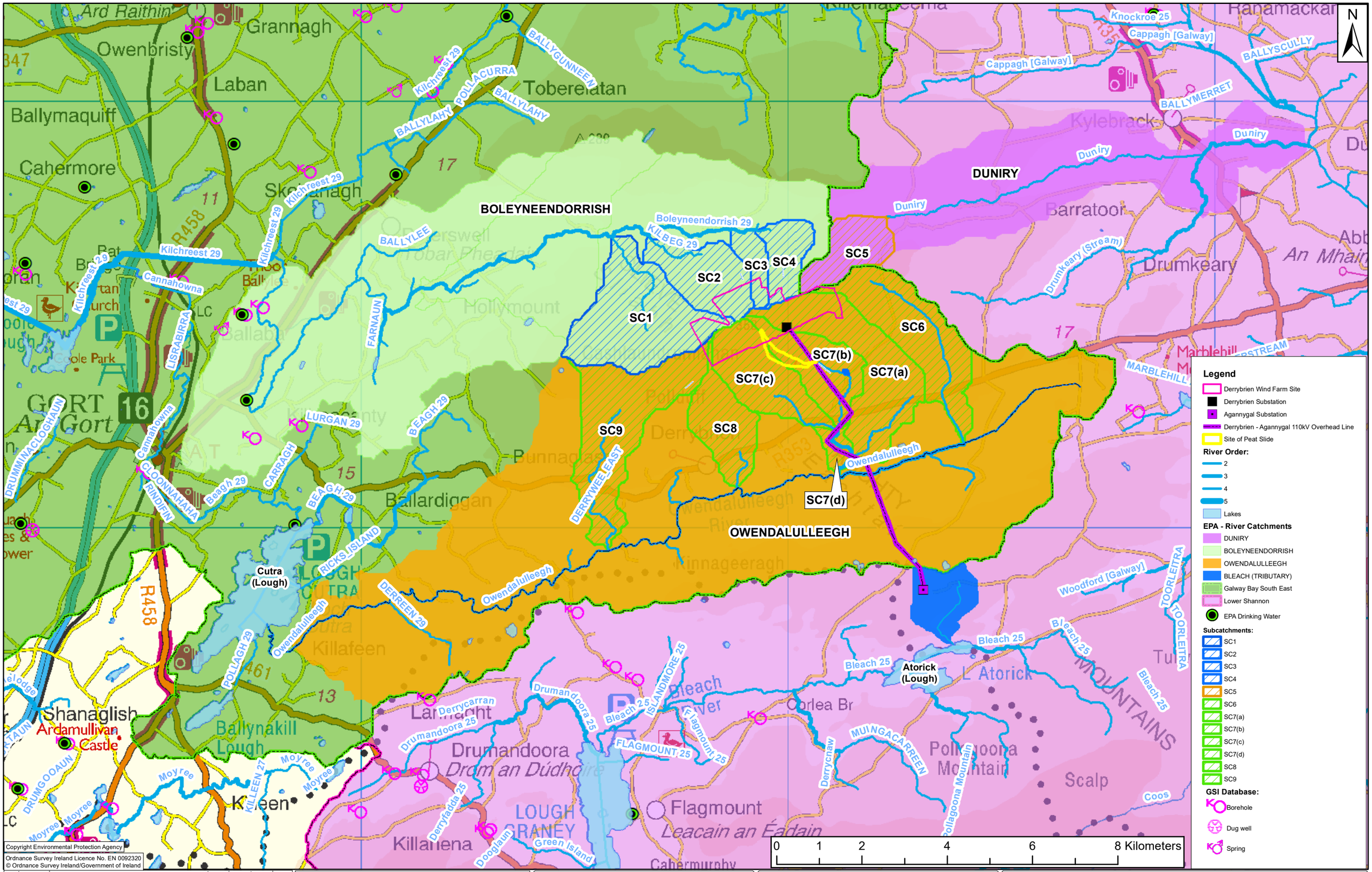

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Figure 5 - Hydrological and Hydrogeological Context

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4.2.4 Project timelines

The main phases of the project lifecycle are listed below:

- **Pre-Development Phase (1998-June 2003):** This phase ran from the baseline date (1998) to commencement of construction (June 2003). The majority of the project site was in use as per the baseline conditions as managed commercial forestry (which had been planted between 1963 and 1994) and turf cutting under turbary rights[6] undertaken in non-forested areas in the east of the wind farm site.
- **Construction Phase 1 (June -October 2003):** This phase comprised construction works up to the peat-slide including initial tree felling to facilitate construction of wind farm site access roads, construction of site access tracks and construction of approximately 50% of the turbine bases.
- **Peat Slide and Response Phase (October 2003-June 2004):** This phase covers the period from the occurrence of the peat slide to the resumption of construction activity on the Project during which works were carried out in response to the slide.
- **Construction Phase 2 (June 2004-March 2006):** This phase covers all construction works post-peat slide to commercial operation of the project, which included the bulk of felling, civil works and electrical works associated with the wind farm site and grid connection, some works associated with the peat slide and wind farm commissioning.
- **Operational Phase (March 2006-2040):** In order to capture the operational works and activities which have occurred, are occurring and will occur in future, this phase is sub-divided as follows:

  - works and activities which have occurred associated with the operation of the project from the start of commercial operations (March 2006) to date of application for substitute consent (mid- 2020)

  --ongoing and future works and activities associated with the continued operation of the project from mid-2020 to cessation of wind farm generation activities on the site (estimated 2040)

- **Decommissioning Phase (2040-2042):** This decommissioning phase covers the final decommissioning and reinstatement of the project site (estimated 2040-2042).

4.2.5 Project phases

4.2.5.1 Overview

The Project was constructed between June 2003 and March 2006. The current impact assessment addresses likely significant effects of the project during that time as well as

[6] A right of turbary means the right to cut and carry away turf from another person's land for use as fuel in the house of the holder of the turbary right.

post construction impacts associated with ongoing site maintenance and projected site decommissioning.

The Project can be described under the following headings

(i) Construction of the wind farm between 2003 and 2006.

(ii) Construction of the grid connection (OHL and Agannygal Substation).

(iii) Containment works required from 2003 to 2006 to stabilise a peat slide which occurred during the construction phase of the wind farm in October 2003.

(iv) Maintenance works on the wind farm and along the OHL during the operational lifetime of the wind farm

(v) Decommissioning works associated with the wind farm, the OHL Agannygal Substation and the residual containment measures required to stabilise peat slide in 2003.

4.2.5.2 Construction phase: circa June 2003-March 2006

The following characters of the Project construction phase are noted as part of this assessment:

- Site clearance and the felling of approximately 222 ha of commercial conifer plantation
- The construction of 70 turbines, with hub height and blade length of 49 m and 26 m respectively, and associated foundations, hardstands and underground cables.
- Construction of site access tracks – approximately 17.5 km in total, 15.5 km of new access tracks were constructed, largely comprising floating roads and 2.0 km of existing floating roads were upgraded;
- The construction of an on-site 110 kV/20 kV substation with control house
- The erection of two anemometer masts
- The use of three borrow pits during the construction phase
- The construction of an overhead line, approximately 7.8 km in length, connecting the wind farm to the national grid via Agannygal Substation including removal of forest plantation estimated at 33.1 ha along the overhead line corridor. The OHL comprises 43 structures, including 34 double wood pole structures, 2 end masts (1 within Derrybrien Substation), 6 angle masts and 1 intermediate mast. There are two additional masts within Agannygal Substation associated with the connection to the National Grid on the Ennis-Shannonbridge 110kV line.
- The construction of Agannygal Substation and access road including removal of forest plantation from site (1.6 ha).
- Access to Agannygal Substation-(a) upgrading of pre-existing Coillte track (approx. length 2.9km, approx. width 3.5m) and (b) construction of new access road (approx. length 0.14km, approx. width 3.5m) from public road to Agannygal Substation

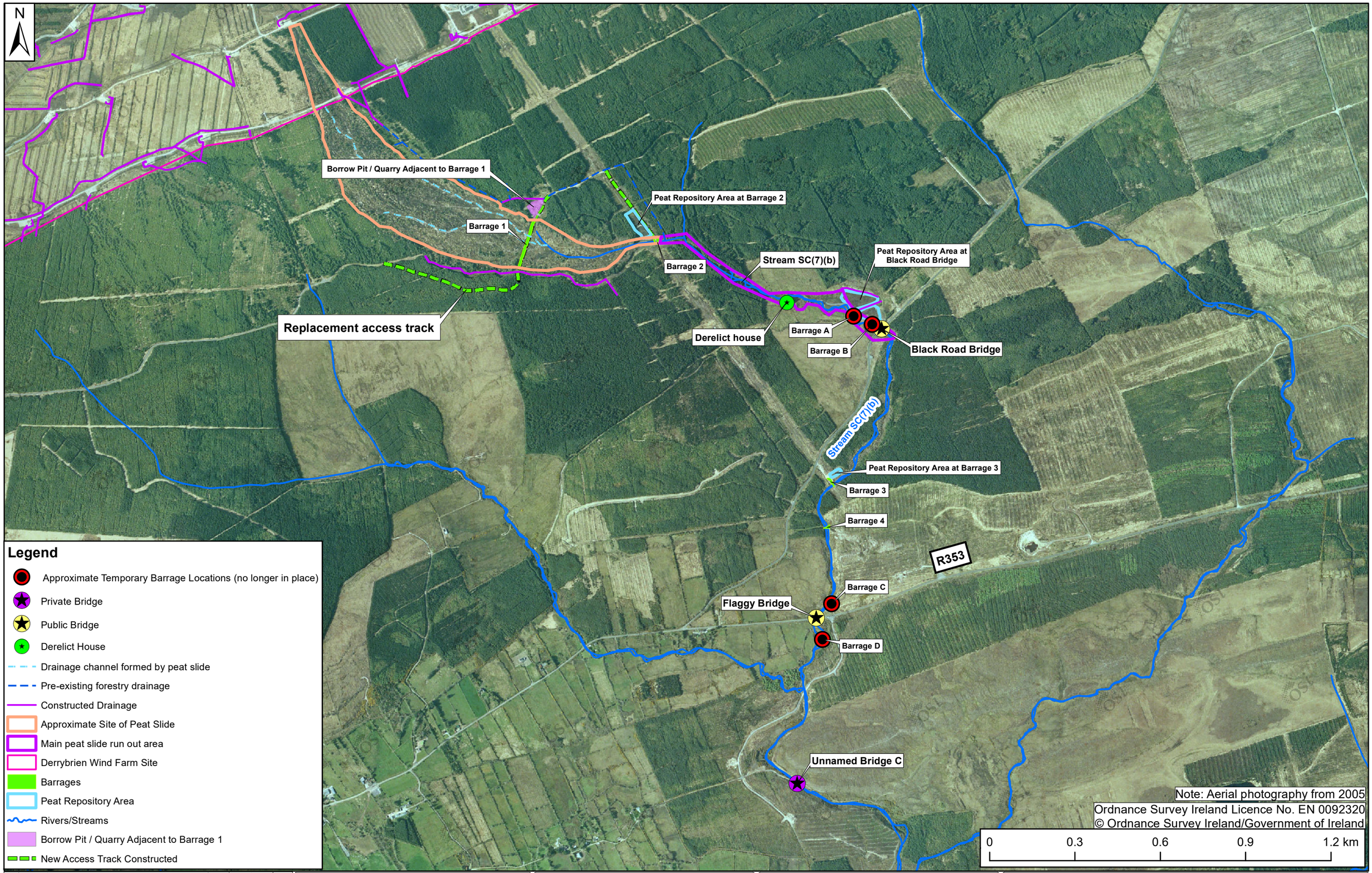
- The construction of various barrages in response to the peat slide which occurred in October 2003.

Construction works on site commenced in June 2003 with tree felling operations which were undertaken by a contractor on behalf of Coillte. Civil engineering works commenced in July 2003 with road construction and excavations at turbine locations. The works were stopped on 16th October 2003 due to a peat slide on site. Construction works re-commenced in June 2004, including work on the Derrybrien to Agannygal 110kV overhead line and Agannygal Substation, and were complete by March 2006.

4.2.5.3 Peat slide and associated works October 2003

The following works were undertaken in response to the peat slide which occurred in October 2003 (see **Figure 6**):

- Felling and site preparation works
- Construction of Borrow pit adjacent to Barrage 1 for sourcing material for barrages. Approximate plan area 2,314 m^2 (0.23 ha), estimated volume 1371 cum.
- Barrage 1-approximate max length 94 m, max width 8 m, estimated volume 900 cum rock/boulders
- Replacement of forestry access road across area of peat slide and Barrage 1 - approximate length 830 m, width 4.5 m (approx.)
- New access track to Barrage 2 -approximate length 284 m, approximate width 4.5 m
- Barrage 2: approximate max length 17 m, max width 20 m, estimated volume 650 cum rock/boulders
- Peat repository area at Barrage 2 -approximate max length 34 m, max width 108 m, estimated area 3498 m^2
- Barrage 3: approximate max length 41 m, max width 9m; estimated volume 350 cum rock/boulders
- Peat repository area at Barrage 3 -approximate max length 41.5 m, max width 16 m; estimated area 597 m^2
- Barrage 4: approximate max length 25 m, max width 10m; estimated volume 300 cum rock/boulders
- Peat repository area at Black Road Bridge- repository in two sections -north west section and south east section:
- North west section: approximate max length 130 m and width 73 m; estimated area 5322 m^2.
- South east section: approximate max length 68 m and width 51 m; estimated area 2898 m^2.
- Drainage works within and in the vicinity of the site of the peat slide area and peat repository areas
- Repairs to bridges on public roads (Black Rd Bridge and Flaggy Bridge)
- Repair to Bridge repairs on private land (Unnamed Bridge C)



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PROJECT: **Derrybrien Wind Farm Project**

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Figure 6 - Location of and Approximate Extent of Peat Slide and Main Peat Slide Run Out Area

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4.2.5.4 Operation Phase: 2006 - Mid 2020

The main activities undertaken on site which are not specifically related to the Vestas (maintenance of turbines) contract are as follows:

- Maintenance of access tracks
- Cutting back of tree growth in previously felled areas
- Substation inspection and maintenance.
- Maintenance of existing drainage network
- Maintenance of existing cables and ducting

Maintenance of access tracks

Throughout the operation of the wind farm routine access track maintenance and repair works have been undertaken. In 2014, improvement works were carried out on the floating roads (over approximately 6 km) which comprised the placing of geogrid reinforcement followed by approximately 150 mm crushed rock capping material and 10mm granular blinding along road surface. Minor works to repair large potholes were also carried out at selected locations along sections of the road network. The potholes were filled with Class 6F2 granular capping material using an 18-tonne rubber-tyred excavator. The fill material imported to the site was stockpiled on the crane hard standings and brought to the locations of the localised repairs using the 9-tonne dumper.

The 2014 road improvement works included remedial works to improve and widen the existing floating road over culverts at Turbines T10, T24, T35, T50, T66 where the existing road was too narrow and where the side slope down into the drainage channel was too steep, which posed a health and safety risk to vehicles using the road.

Cutting back of tree growth in previously felled areas

Periodic tree-topping work is required to clear shrubs and small trees (typically conifers <4-5 m high) where natural re-growth, from areas felled prior to construction, could potentially impact the operation and maintenance of the windfarm. Typically this will involve clearing the vegetation for a distance of about 10 m to either side of the site access tracks in selected areas that will be scheduled on a priority basis as part of a multi-year annual maintenance plan under the supervision of the ESB site maintenance manager. The tree topping will be carried out using a light 10 tonne wide-tracked excavator with a saw head attachment, which is a specialist low-ground bearing pressure forestry machine suitable for working directly on the peat. All of the overgrown vegetation will be cut and left in place on the peat slopes with no additional handling to minimise machine movements and loading on the peat.

Substation inspection and maintenance

Inspection and maintenance – Mobile Elevated Work Platform (MEWP) loading on hardstanding areas and service vehicle loading on floating roads. Therefore, there should be no requirement for high capacity mobile cranes to carry out the maintenance and repair works at the substation.

Cables and ducting

Between September 2005 and 2020 the only maintenance work that was carried out on the installed cables was the maintenance of adequate backfill cover to cables in cable trenches.

In September 2017, as part of an upgrade to the turbine control systems, approximately 7.6 km of new 12 core single-mode fibre-optic cable was installed on the site to improve the response of communication signals between the turbine controllers and the central control system. The total length of ducting was approximately 2.55 km. A mole plough was used to bury the ducts directly in the peat at a depth of 0.5-0.6 m with a warning tape overhead without having to open up a trench. At the 5 road crossings the 50mm ducting was fed through a 75mm diameter galvanized pipe that was pushed horizontally through the peat under the floating roads to avoid having to open up a trench in the roads.

Maintenance of the drainage network

Periodic inspections of the site between 2005 and 2020 were undertaken to assess maintenance requirements for short and long-term stability. The resultant drainage works undertaken related to maintenance of drainage around turbines and general site drainage.

Minor drainage works were carried out by hand. More substantial works were carried out by mechanical excavation with a wide-tracked 13-tonne low ground bearing pressure excavator suitable for working directly on the peat.

The majority of the drainage improvement works were carried out within 6 years of completion of the wind farm (i.e. up to 2011). A major drainage maintenance programme was completed on the site in 2011. Since 2011, inspections have resulted in only minor repair works to the drainage network, which indicates that maintenance requirements for the site drainage are at a residual level.

Turbulence felling

In order to optimise productivity of the wind farm, Coillte agreed to undertake offsite phased tree felling (46.2 ha in total) under felling licence immediately to the west of the wind farm site in 2016, 2017 and 2018. It is noted that these areas had been scheduled for felling in 2015 as part of Coillte's normal tree felling programme and that the felled areas were replanted. Specific requirements relating to hen harrier were set out in the licence. Felling was to be spread out over three years and no operations were allowed during the hen harrier breeding season (1st April to 15th August inclusive) without express permission. Operations were to adhere to the Forest Service document - *"Procedures regarding disturbance operations and hen harrier SPAs".*

4.2.5.5 Decommissioning of Wind Farm Project

Decommissioning is the final closing down of the project when it has reached the end of its operational life. The envisaged operating life of the wind farm is approximately 35 years from initial project operation i.e. to 2040.

Wind Farm site

Decommissioning of the wind farm will involve the removal of the above ground elements of the wind farm and will entail:

- De-energising of the site which will involve initially high voltage (HV) disconnection followed by low voltage (LV) disconnection of turbines.
- Controlled dismantling of turbines (blades, nacelle, and tower) and masts.
- Removal of substation building and foundations. Hardstand will be left in-situ.
- Removal of de-energised underground LV cables, electrical control systems and ducts.

It is not proposed to replant the wind farm site with trees although natural regrowth of previously felled areas will likely continue.

The duration of the decommissioning phase is expected to be approximately 24 months.

Full proof loading of floating roads was undertaken in 2018 with design crane loads covering all operational and decommissioning activities and site inspections of all infrastructure was undertaken.

The following elements of the wind farm will be left in place after decommissioning: The turbine bases, crane pads, access tracks (including floating roads), trackside drainage network, on-site peat repository/storage area and borrow pits are to be left in-situ.

Derrybrien to Agannygal 110kV Overhead Line

Decommissioning of the OHL will entail the removal of the OHL infrastructure between the Derrybrien and Agannygal Substations. Indicative access routes for decommissioning works have been identified and these will be subject to detailed design (see **Figures 7.1** and **7.2)**.

The existing forestry access tracks typically comprise a 3m wide track constructed of crushed rock which has been founded on the mineral soil underlying the peat. Minor upgrades of sections of these tracks may be required. The OHL wooden poles and mast elements will be cut at the base and removed from site. Structure foundations will remain in-situ. It is not proposed to replant the route of the overhead line with trees although natural regrowth of previously felled areas will likely continue.

Decommissioning of Agannygal Substation

The decommissioning of Agannygal Substation will involve the removal of the above ground elements of the substation and will entail:

- De-energising of the electrical equipment in site
- Removal of substation building and equipment

The decommissioning and removal of all equipment is anticipated to take approximately 12 weeks. The removal of the substation building will take approximately 2 weeks.

The hardstanding area for the substation and control building will be left in place after decommissioning as will the access road to the site.

The substation and control building will be dismantled from the hardstanding area. Demolition of the control building will be carried out on the hardstand areas with mechanical demolition

equipment and hydraulic breakers for the reinforced concrete foundations. There will be no blasting on the site.

Ennis-Shannonbridge Overhead Line reinstatement

When the Derrybrien-Agannygal 110kV OHL is ultimately removed, reinstatement of the Ennis-Shannonbridge 110kV OHL will be required, involving the re-conductoring of the OHL span at Agannygal Substation. The full section of line between angle masts will be wheeled and re-tensioned (approximate length 1.3 km).

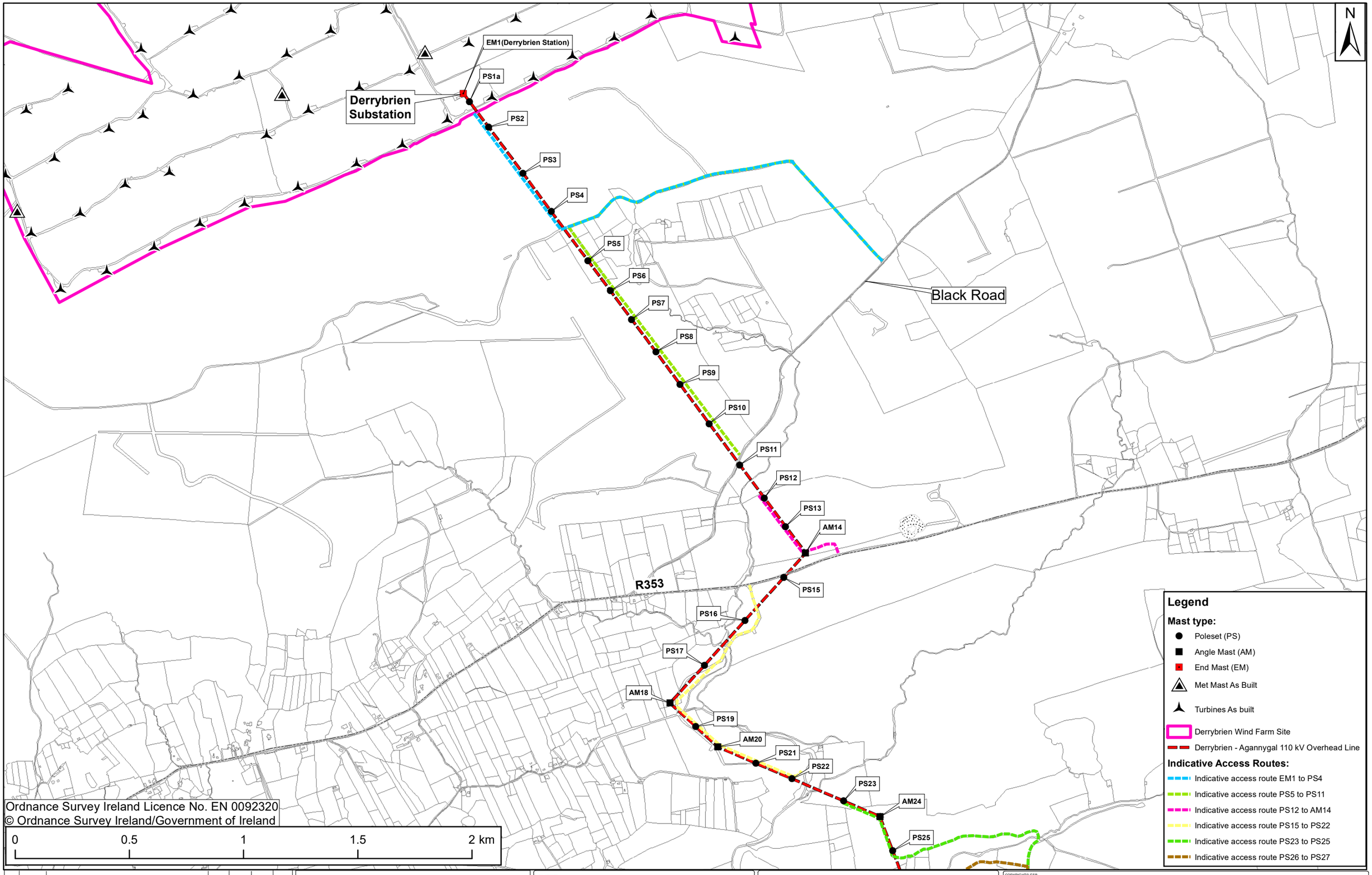

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Figure 7.1 - Derrybrien - Agannygal OHL - Indicative Decommissioning Access Routes (Sheet 1 of 2)

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N

PS22
PS23
AM24
PS25
PS26
PS27
PS28
PS28a
PS29
INT30
PS31
PS32
PS33
AM34
PS35
PS36
PS37
AM38
PS39
PS40
EM41
Agannygal Substation
EM1 (Agannygal - Shannonbridge OHL)
EM1 (Agannygal - Ennis OHL)

Legend

Mast type:

- Poleset (PS)
- Intermediate Mast (INT)
- Angle Mast (AM)
- End Mast (EM)
- Derrybrien - Agannygal 110 kV Overhead Line

Indicative Access Routes:

- Indicative access route PS15 to PS22
- Indicative access route PS23 to PS25
- Indicative access route PS26 to PS27
- Indicative access route PS28 to PS31
- Indicative access route PS32 to AM34
- Indicative access route PS35 to PS37
- Indicative access route AM38 to EM41
- 110 kV Overhead Line
- 400 kV Overhead Line
- Agannygal Substation

0 0.25 0.5 1 1.5 2 Kilometers

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DRAWING TITLE:
Figure 7.2 - Derrybrien - Agannygal OHL - Indicative Decommissioning Access Routes (Sheet 2 of 2)

DRAWN	PRODUCED	VERIFIED	APPROVED	APPROVAL DATE
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Measures associated with peat slide

The four remaining barrages constructed following the peat slide are no longer required as containment/stability measures. Barrages 1 and 2 form part of the Coillte forestry access track network and for this reason it is envisaged they will remain in place long term. Barrages 3 and 4 no longer serve a purpose and it is proposed to remove them both subject to the approval of IFI. It is proposed that the barrage material would be brought to Borrow Pit 3 on the wind farm site. The repositories associated with peat storage following the slide are now heavily vegetated and bunded and they will remain in place.

Methodology for removal of Barrages 3 & 4

The following construction sequence is given for the removal of the barrages.

- For each of the barrages to be decommissioned, works shall be undertaken after at least 4-5 days of dry weather and during a period when further dry weather is expected, during the spring / summer months or as per agreed with Inland Fisheries Ireland (IFI). The works at each barrage are expected to last no more than one week.
- In-stream works shall be carried out in accordance with the '*Guidelines on Protection of Fisheries during Construction Works in and adjacent to Waters*' (IFI, 2016). Contact shall be made with IFI prior to works commencing including agreement of methodology.
- Each watercourse shall be blocked upstream of the works area using sand bags and a timber weir and the remaining water shall be over pumped. The pump will be bunded and located away from the watercourse and have a silt bag on its outlet. A tight mesh will be fitted on the suction hose before pumping commences. Water will be discharged to vegetation, preferably on the downstream side of the barrage.
- Any retained debris up against the barrage on the upstream side will be removed prior to removal works commencing on the actual barrage. The debris will be removed for a distance of 3 – 5 m upstream of the upslope toe of the barrage.
- For removing the retained debris from the upstream side of the barrage, for Barrages 3 and 4 the excavator may need to access and position itself on the upstream side of the barrage. However, if feasible it is preferable that a long-reach excavator remove debris from a distance outside the banks of the watercourse to avoid the risk of unnecessary destabilisation of the banks.
- The debris upslope of the barrage will be trimmed to a stable configuration, so the debris is stable following the removal of the barrage. A stable configuration will vary depending on the type of debris. The debris is likely to comprise peat, clay/silt and sand and possibly fragments of rock.

4.2.6 Related Projects

On 20th May 2003, Coillte was granted a two-year felling licence by the Forest Service under the Forestry Act 1946, to fell 263 ha of forestry on the wind farm site. In lieu of the clear-felling and non-replanting of 263 ha of Lodgepole pine and Sitka spruce on the wind farm site, the Felling Licence (Ref FL 3983) required the licensee, within 1 year from the expiry date of the felling licence, to plant 119.3 ha within identified townlands in Counties Roscommon and Tipperary to comprise 55% Sitka spruce, 30% Diverse conifers and 15% Broadleaved species.

In subsequent correspondence between Coillte and the Forest Service, Coillte committed to plant the appropriate portion of this 119.3 ha or an appropriate equivalent yield class area agreed with the Forest Service, as a percentage of the 263 ha clearfelled under the terms of the felling licence. If all 263 ha were not clearfelled, Coillte agreed to plant this appropriate portion within the 12 months from expiry of felling licence.

Coillte has advised that the planting was carried out within forestry compartments at lands in County Roscommon and County Tipperary. The townlands within which the forestry compartments are located are as listed in Table 1. The planting locations in County Tipperary and Roscommon are over 50 km and 80 km respectively from the wind farm site and are not physically connected to the Project area.

Table 1. Derrybrien Felling Licence-Townlands within which trees were planted

County	Townland	Planting Year	Compartment	Area (ha) (approximate)
Roscommon	ARDCORCORAN	2008	73915C	17.8
Roscommon	BRACKLOON	2008	68170Q	5.2
Roscommon	BRACKLOON	2008	68170Q	13.3
Roscommon	OLDTOWN	2008	73918K	16.0
Tipperary	FOILMAHONMORE	2006	44777M	8.2
Tipperary	COONMORE	2003	44751I	24.4
Tipperary	COONMORE	2006	44778H	14.3
Tipperary	KNOCKNABANSHA	2007	44776R	51.7

Additionally, all the lands in the compartments set out in Table 1. had been under use for horticultural plantation (Christmas trees) prior to the year 2000, which was not considered to be afforestation by the Forest Service. When planting with commercial forest plantation occurred the lands were then considered to be afforested and became part of the National Forest estate.

Approximately 222 ha of forestry was felled on the wind farm site during construction rather than 263 ha and the area of planting required using the equivalent yield class in the licence would have thus been reduced pro-rata. The reduced requirement would have been approximately 101 ha. However, the total area of the listed forest compartments is 151.8 ha.

The planting locations relative to Derrybrien are shown on **Figure 8** and the townland locations in Counties Roscommon and Tipperary are shown in **Figures 9** and **10** respectively. A cumulative assessment of the impacts of the wind farm and the tree planting has been carried out in Section 4.6 of this report.

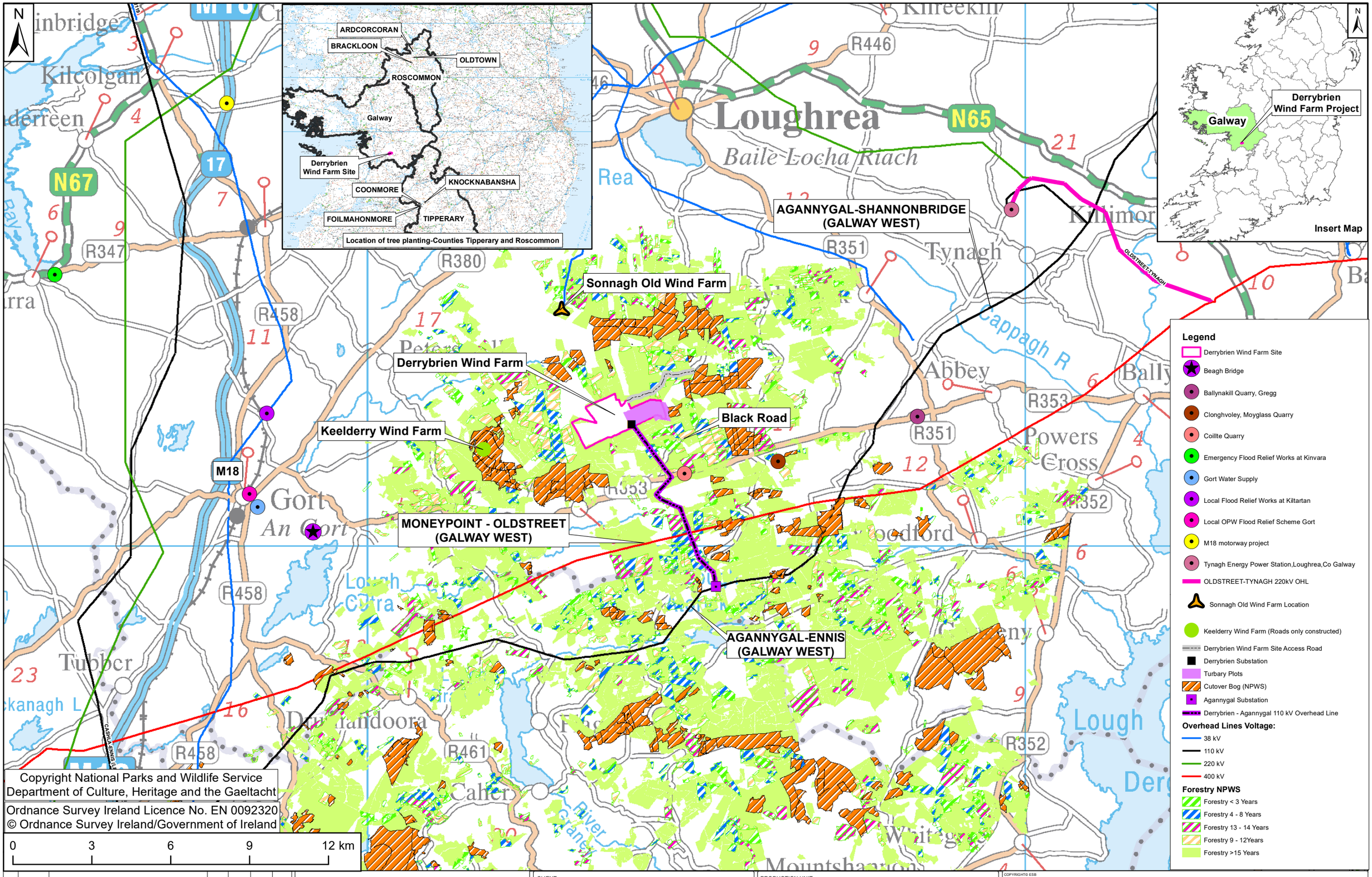

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Figure 8 - Location of Projects/Activities considered for cumulative impact assessments

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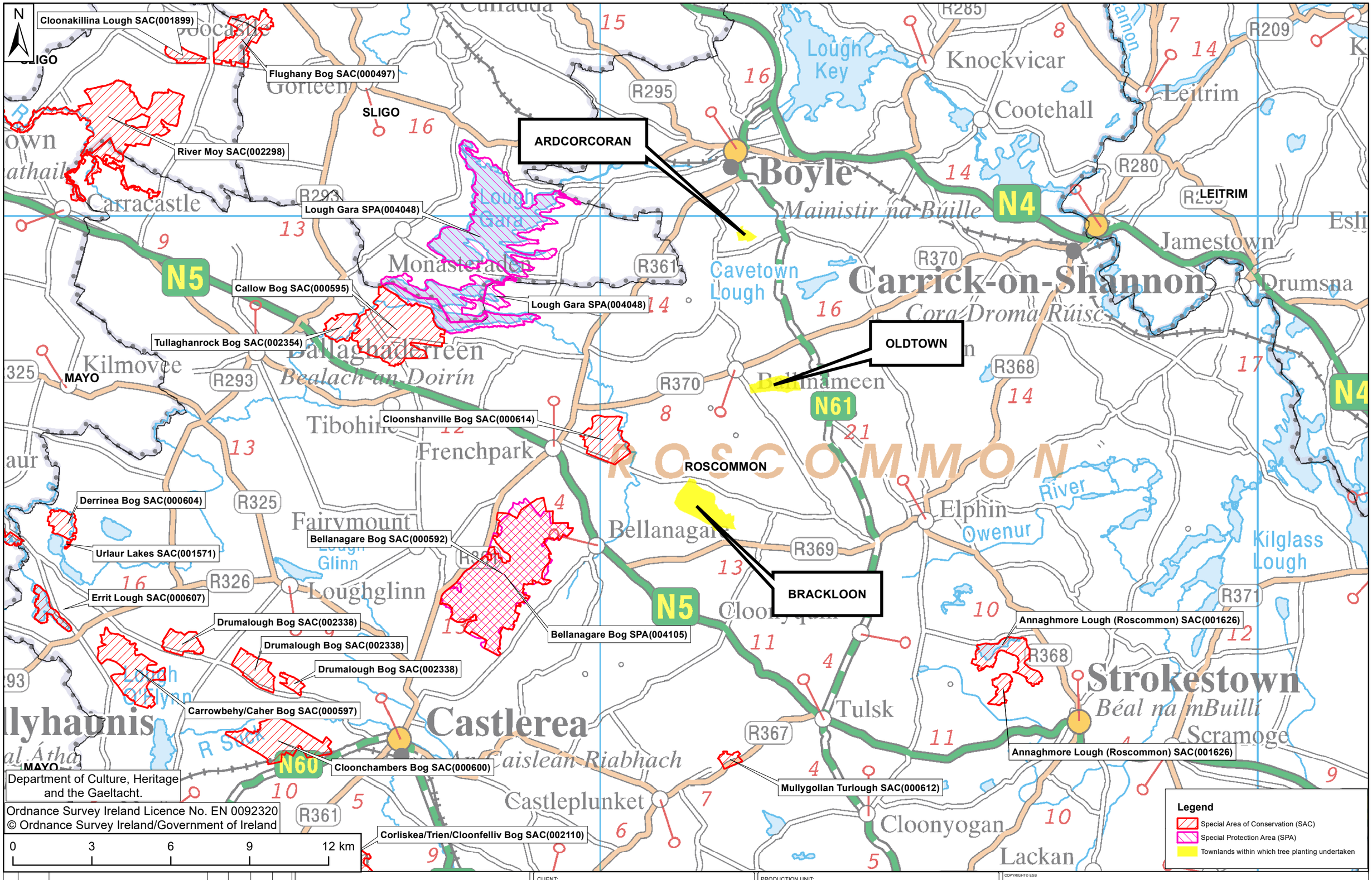

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Legend

- Special Area of Conservation (SAC)
- Special Protection Area (SPA)
- Townlands within which tree planting undertaken

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DRAWING TITLE: **Figure 9 - Location of tree planting in lieu of forestry felled for Project - County Roscommon**

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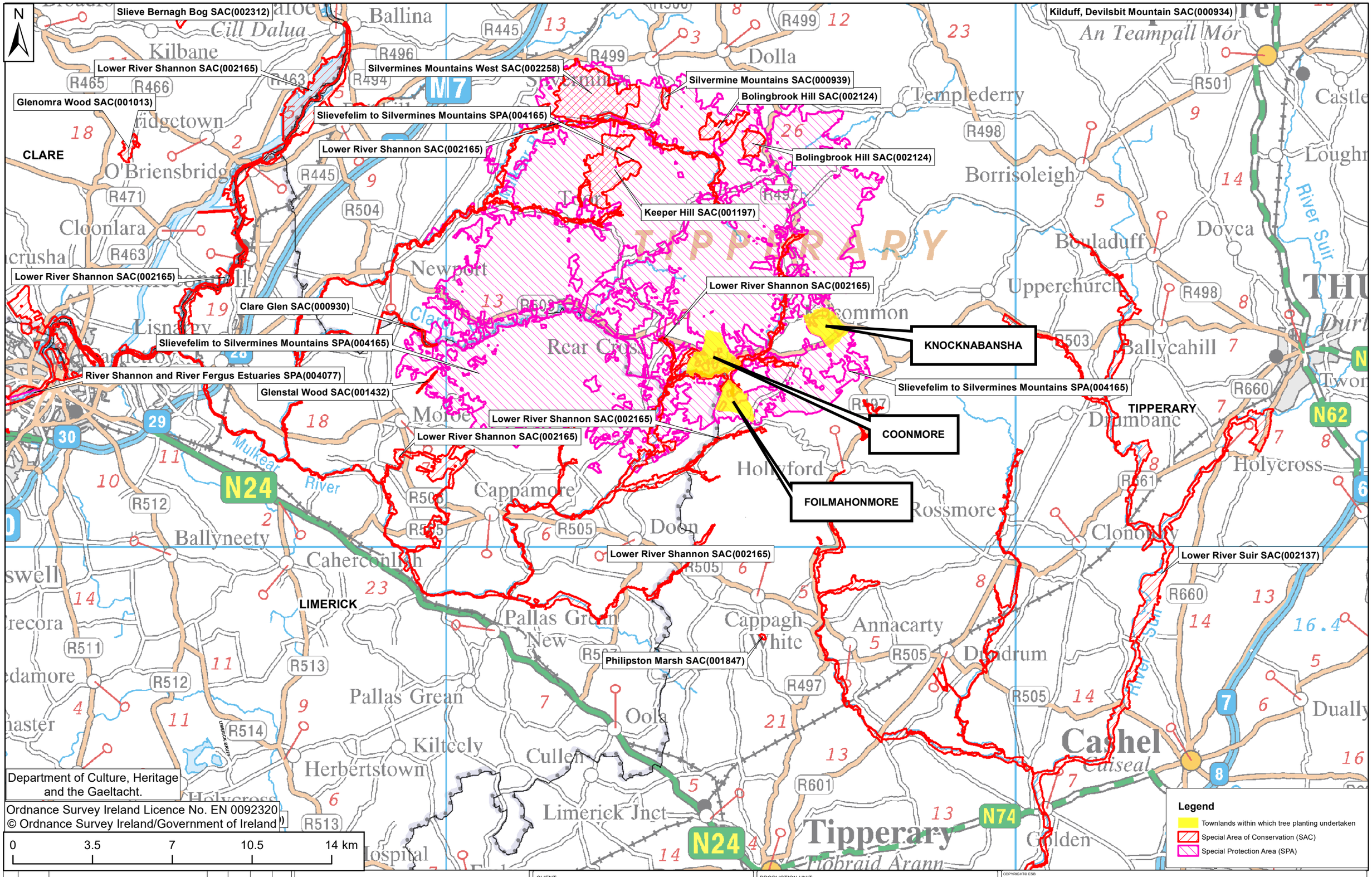

Department of Culture, Heritage and the Gaeltacht.

0 3.5 7 10.5 14 km

Legend

- Townlands within which tree planting undertaken
- Special Area of Conservation (SAC)
- Special Protection Area (SPA)

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DRAWING TITLE: **Figure 10 - Location of tree planting in lieu of forestry felled for Project - County Tipperary**

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4.3 Identification of European Sites

All European sites identified within a 15 km radius of the Project have been identified as being within the Zone of Influence of the Project (refer to Section 3.4). 24 sites have been identified within the 15 km radius of the wind farm project (5 SPAs and 19 SACs). Some of these sites are hydrologically linked to the wind farm and while these hydrologically pathways are over a distance greater than 15 km the actual sites are located within the 15 km radius.

A further 6 European sites outside of the 15 km radius have been identified as being within the ZoI of the Project (i.e. having the potential to have been or be impacted by the Project) owing to the hydrological connection between these sites and the Project area. One of these sites is a SPA (Inner Galway Bay SPA). The other 5 sites are SACs - Galway Bay SAC; Cahermore Turlough SAC; Caherglassun Turlough SAC; Barroughter Bog SAC and Lough Derg North East Shore SAC. These sites were identified using GIS data downloaded from www.npws.ie (accessed July 2020).

All but two of the 30 European sites identified had been proposed for designation under the Habitats and Birds Directives by the time works began on the Project. The Slieve Aughty Mountains SPA was not proposed as a SPA until March 2007 and Lough Rea SPA was not proposed as a SPA until February 2007. Work commenced on the wind farm project in June 2003 and commenced operation in March 2006.

Although many sites were not formally designated by Statutory Instrument (S.I.) until much later, legal protections, consummate with those set out in the Directives, have applied to the sites since initially proposed for designation either as Sites of Community Importance (SCI) for SACs or proposed Special Protection Areas (pSPAs).

Table 2 presents information relating to these European sites including their Qualifying Interests / Special Conservation Interests and Conservation Objectives. Most of the sites have generic conservation objectives. References are provided for those sites which have specific conservation objectives.

Table 2. Details of European Sites identified within potential zone of influence of the Wind Farm Project

European Sites (Natura 2000)	Date site proposed for Classification	Statutory Instrument	Distance from Wind Farm Project (Approximate)	Qualifying Interest / Special Conservation Interest	Conservation Objectives
Slieve Aughty Mountains SPA (004168)	Date site classified as SPA : 2007-03 https://www.npws.ie/protected-sites/spa/004168	S.I. No. 83 of 2012. 21 March 2012 http://www.irishstatutebook.ie/eli/2012/si/83/made/en/pdf	The entire wind farm project is within the boundary of the SPA.	– Hen Harrier (*Circus cyaneus*) [A082] – Merlin (*Falco columbarius*) [A098]	To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA.
Sonnagh Bog SAC (001913)	Date site proposed as SCI: 1997-11 https://www.npws.ie/protected-sites/sac/001913	S.I. No. 657 of 2019 17 December 2019 http://www.irishstatutebook.ie/eli/2019/si/657/made/en/print?q=habitats&years=2019	1.5 km north west of wind farm site 2.8 km north west of grid connection	– Blanket bogs (* if active bog) [7130]	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.
Drummin Wood SAC (002181)	Date site proposed as SCI: 1999-12 https://www.npws.ie/protected-sites/sac/002181	S.I. No. 248 of 2016 17 May 2016 http://www.irishstatutebook.ie/eli/pdf/2016/en.si.2016.0248.pdf	7.4 km south west of wind farm site 9.3 km west of grid connection	– Old sessile oak woods with Ilex and Blechnum in the British Isles [91A0]	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.
Peterswell Turlough SAC (000318)	Date site proposed as SCI: 1997-11	None	7.7 km north west of wind farm site	– Turloughs [3180]	To maintain or restore the favourable conservation condition

European Sites (Natura 2000)	Date site proposed for Classification	Statutory Instrument	Distance from Wind Farm Project (Approximate)	Qualifying Interest / Special Conservation Interest	Conservation Objectives
	https://www.npws.ie/protected-sites/sac/000318		9.8 km north west of grid connection	– Rivers with muddy banks with Chenopodion rubri p.p. and Bidention p.p. vegetation [3270]	of the Annex I habitat(s) and/or the Annex II species for which the SAC has been selected.
Lough Rea SPA (004134)	Date site classified as SPA: 2007-02 https://www.npws.ie/protected-sites/spa/004134	S.I. No. 72 of 2010 19 February 2010 http://www.irishstatutebook.ie/eli/2010/si/72/made/en/pdf	8.9 km north of wind farm site 9.7 km north of grid connection	– Shoveler (*Anas clypeata*) [A056] – 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 for this SPA. To maintain or restore the favourable conservation condition of the wetland habitat at Lough Rea SPA as a resource for the regularly-occurring migratory waterbirds that utilise it.
Lough Rea SAC (000304)	Date site proposed as SCI: 1998-05 https://www.npws.ie/protected-sites/sac/000304	S.I. No. 447 of 2017 12 October 2017 http://www.irishstatutebook.ie/eli/2017/si/447/made/en/pdf	8.9 km north of wind farm site 9.7 km north of grid connection	– Hard oligo-mesotrophic waters with benthic vegetation of Chara spp. [3140]	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.
Lough Coy SAC (002117)	Date site proposed as SCI: 1997-11	None	9 km north west of wind farm site	– Turloughs [3180]	To maintain or restore the favourable conservation condition of the Annex I habitat(s) and/or the

European Sites (Natura 2000)	Date site proposed for Classification	Statutory Instrument	Distance from Wind Farm Project (Approximate)	Qualifying Interest / Special Conservation Interest	Conservation Objectives
	https://www.npws.ie/protected-sites/sac/002117		11 km north west of grid connection		Annex II species for which the SAC has been selected.
Pollagoona Bog SAC (002126)	Date site proposed as SCI: 1997-08 https://www.npws.ie/protected-sites/sac/002126	S.I. No. 602 of 2019 29 November 2019 http://www.irishstatutebook.ie/eli/2019/si/602/made/en/print?q=habitats&years=2019	9 km south east of wind farm site 2 km south of grid connection	– Blanket bogs (* if active bog) [7130]	To restore the favourable conservation condition of Blanket bogs (* if active bog) in Pollagoona Bog SAC (NPWS 2017)
Gortacarnaun Wood SAC (002180)	Date site proposed as SCI: 1999-09 https://www.npws.ie/protected-sites/sac/002180	S.I. No. 247 of 2016 17 May 2016 http://www.irishstatutebook.ie/eli/pdf/2016/en.si.2016.0247.pdf	9 km south west of wind farm site 11 km west of grid connection	– Old sessile oak woods with Ilex and Blechnum in the British Isles [91A0]	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.
Carrowbaun, Newhall and Ballylee Turloughs SAC (002293)	Date site proposed as SCI: 2003-02 https://www.npws.ie/protected-sites/sac/002293	S.I. No. 295 of 2016 3 June 2016 http://www.irishstatutebook.ie/eli/2016/si/295/made/en/pdf	9.6 km west of wind farm site 11.9 km west of grid connection	– Turloughs [3180]	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.

European Sites (Natura 2000)	Date site proposed for Classification	Statutory Instrument	Distance from Wind Farm Project (Approximate)	Qualifying Interest / Special Conservation Interest	Conservation Objectives
Lough Cutra SPA (004056)	Date site classified as SPA: 1995-11 https://www.npws.ie/protected-sites/spa/004056	S.I. No. 243 of 2010. 26 May 2010 http://www.irishstatutebook.ie/eli/2010/si/243/made/en/pdf	10 km south west of wind farm site 12 km west of grid connection 20 km from wind farm site hydrologically	– Cormorant (*Phalacrocorax carbo*) [A017]	To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA.
Lough Cutra SAC (000299)	Date site proposed as SCI: 2003-03 https://www.npws.ie/protected-sites/sac/000299	S.I. No. 446 of 2017 12 October 2017 http://www.irishstatutebook.ie/eli/2017/si/446/made/en/pdf	10 km south west of wind farm site 12 km west of grid connection 20 km from wind farm site hydrologically	– *Rhinolophus hipposideros* (Lesser Horseshoe Bat) [1303]	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.
Ballinduff Turlough SAC (002295)	Date site proposed as SCI: 2003-02 https://www.npws.ie/protected-sites/sac/002295	S.I. No. 526 of 2016 12 October 2016 http://www.irishstatutebook.ie/eli/2016/si/526/made/en/pdf	11.7 km north west of wind farm site 13.7 km north west of grid connection	– Turloughs [3180]	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.
Pollnaknockaun Wood Natura Reserve SAC (000319)	Date site proposed as SCI: 1997-08	S.I. No. 241 of 2016 17 May 2016	12.6 km south east of wind farm site 10.9 km east of grid connection	– Old sessile oak woods with Ilex and Blechnum in the British Isles [91A0]	To maintain the favourable conservation condition of Old sessile oak woods with Ilex and Blechnum in the British Isles in

European Sites (Natura 2000)	Date site proposed for Classification	Statutory Instrument	Distance from Wind Farm Project (Approximate)	Qualifying Interest / Special Conservation Interest	Conservation Objectives
	https://www.npws.ie/protected-sites/sac/000319	http://www.irishstatutebook.ie/eli/pdf/2016/en.si.2016.0241.pdf			Pollnaknockaun Wood Nature Reserve SAC (NPWS 2018)
Loughatoric South Bog SAC (000308)	Date site proposed as SCI: 1997-11 https://www.npws.ie/protected-sites/sac/000308	S.I. No. 474/2019 20 September 2019 http://www.irishstatutebook.ie/eli/2019/si/474/made/en/print?q=habitats&years=2019	12.8 km south east of wind farm project 6 km south east of grid connection	– Blanket bogs (* if active bog) [7130]	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.
Kiltartan Cave (Coole) SAC (000286)	Date site proposed as SCI: 2002-01 https://www.npws.ie/protected-sites/sac/000286	S.I. No. 239 of 2016 17 May 2016 http://www.irishstatutebook.ie/eli/pdf/2016/en.si.2016.0239.pdf	12.7 km west of wind farm site 15 km west of grid connection	– Caves not open to the public [8310] – *Rhinolophus hipposideros* (Lesser Horseshoe Bat) [1303]	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.
Derrycrag Wood Nature Reserve SAC (000261)	Date site proposed as SCI: 1997-08 https://www.npws.ie/protected-sites/sac/000261	S.I. No. 238 of 2016 17 May 2016	13 km south east of wind farm site 10 km east of grid connection	– Old sessile oak woods with Ilex and Blechnum in the British Isles [91A0]	To maintain the favourable conservation condition of Old sessile oak woods with Ilex and Blechnum in the British Isles in

European Sites (Natura 2000)	Date site proposed for Classification	Statutory Instrument	Distance from Wind Farm Project (Approximate)	Qualifying Interest / Special Conservation Interest	Conservation Objectives
		http://www.irishstatutebook.ie/eli/pdf/2016/en.si.2016.0238.pdf			Derrycrag Wood Nature Reserve SAC (NPWS 2018)
Coole-Garryland Complex SAC (000252)	Date site proposed as SCI: 1998-05 https://www.npws.ie/protected-sites/sac/000252	None	13.4 km west of wind farm site 15.5 km west of grid connection	– Natural eutrophic lakes with Magnopotamion or Hydrocharition - type vegetation [3150] – Turloughs [3180] – Rivers with muddy banks with Chenopodion rubri p.p. and Bidention p.p. vegetation [3270] – Juniperus communis formations on heaths or calcareous grasslands [5130] – Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (* important orchid sites) [6210] – Limestone pavements [8240] – Taxus baccata woods of the British Isles [91J0]	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.

European Sites (Natura 2000)	Date site proposed for Classification	Statutory Instrument	Distance from Wind Farm Project (Approximate)	Qualifying Interest / Special Conservation Interest	Conservation Objectives
Coole-Garryland SPA (004107)	Date site classified as SPA: 1996-10 https://www.npws.ie/protected-sites/spa/004107	S.I. No. 236 of 2010 26 May 2010 http://www.irishstatutebook.ie/eli/2010/si/236/made/en/pdf	13.8 km west of wind farm site 16 km west of grid connection	– Whooper Swan (*Cygnus cygnus*) [A038]	To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA.
Ardrahan Grassland SAC (002244)	Date site proposed as SCI: 2002-01 https://www.npws.ie/protected-sites/sac/002244	S.I. No. 522 of 2019 22 October 2019 http://www.irishstatutebook.ie/eli/2019/si/522/made/en/print?q=habitats&years=2019	14.6 km north west of wind farm site 16 km north west of grid connection	– Alpine and Boreal heaths [4060] – Juniperus communis formations on heaths or calcareous grasslands [5130] – Limestone pavements [8240]	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.
Rosturra Wood SAC (001313)	Date site proposed as SCI: 1997-08 https://www.npws.ie/protected-sites/sac/001313	S.I. No. 243 of 2016 17 May 2016 http://www.irishstatutebook.ie/eli/pdf/2016/en.si.2016.0243.pdf	15.5 km east of wind farm site 13.7 km east of grid connection	– Old sessile oak woods with Ilex and Blechnum in the British Isles [91A0]	To maintain the favourable conservation condition of Old sessile oak woods with Ilex and Blechnum in the British Isles in Rosturra Wood SAC (NPWS 2018)
Cloonmoylan Bog SAC (000248)	Date site proposed as SCI: 1997-11	None	15.9 km east of wind farm site	– Active raised bogs [7110]	To maintain the favourable conservation condition of Bog

European Sites (Natura 2000)	Date site proposed for Classification	Statutory Instrument	Distance from Wind Farm Project (Approximate)	Qualifying Interest / Special Conservation Interest	Conservation Objectives
	https://www.npws.ie/protected-sites/sac/000248		13.7 km east of grid connection	– Degraded raised bogs still capable of natural regeneration [7120] – Depressions on peat substrates of the Rhynchosporion [7150] – Bog woodland [91D0]	woodland in Cloonmoylan Bog SAC (NPWS 2016) To restore the favourable conservation condition of Active raised bogs / Degraded raised bogs still capable of natural regeneration / Depressions on peat substrates of the Rhynchosporion in Cloonmoylan Bog SAC (NPWS 2016)
Glendree Bog SAC (001912)	Date site proposed as SCI: 1997-11 https://www.npws.ie/protected-sites/sac/001912	None	16 km south west of wind farm site 15 km south west of grid connection	– Blanket bogs (* if active bog) [7130]	To restore the favourable conservation condition of Blanket bogs (* if active bog) in Glendree Bog SAC (NPWS 2019)
Barroughter Bog SAC (000231)	Date site proposed as SCI: 1997-11 https://www.npws.ie/protected-sites/sac/000231	None	18 km east of wind farm 22 km from wind farm site hydrologically	– Active raised bogs [7110] – Degraded raised bogs still capable of natural regeneration [7120] – Depressions on peat substrates of the Rhynchosporion [7150]	To restore the favourable conservation condition of Active raised bogs / Degraded raised bogs still capable of natural regeneration / Depressions on peat substrates of the Rhynchosporion in Barroughter Bog SAC (NPWS 2015)

European Sites (Natura 2000)	Date site proposed for Classification	Statutory Instrument	Distance from Wind Farm Project (Approximate)	Qualifying Interest / Special Conservation Interest	Conservation Objectives
Lough Derg (Shannon) SPA (004058)	Date site classified as SPA: 1995-11 https://www.npws.ie/protected-sites/spa/004058	S.I. No. 331/2019 2 July 2019 http://www.irishstatutebook.ie/eli/2019/si/331/made/en/print?q=Lough+Derg	18 km south east of wind farm site 13 km east of grid connection 23 km from wind farm site hydrologically	– Cormorant (Phalacrocorax carbo) [A017] – Tufted Duck (Aythya fuligula) [A061] – Goldeneye (Bucephala clangula) [A067] – Common Tern (Sterna hirundo) [A193] – Wetland and Waterbirds [A999]	To maintain or restore the favourable conservation condition of the wetland habitat at Lough Derg (Shannon) SPA as a resource for the regularly-occurring migratory waterbirds that utilise it.
Lough Derg, North-east Shore SAC (002241)	Date site proposed as SCI: 2002-01 https://www.npws.ie/protected-sites/sac/002241	S.I. No. 74 of 2018 6 February 2018 http://www.irishstatutebook.ie/eli/2018/si/74/made/en/print?q=Lough+Derg	18 km east of wind farm 23 km from wind farm site hydrologically	– Juniperus communis formations on heaths or calcareous grasslands [5130] – Calcareous fens with Cladium mariscus and species of the Caricion davallianae [7210] – Alkaline fens [7230] – Limestone pavements [8240] – Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion,	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.

European Sites (Natura 2000)	Date site proposed for Classification	Statutory Instrument	Distance from Wind Farm Project (Approximate)	Qualifying Interest / Special Conservation Interest	Conservation Objectives
				Alnion incanae, Salicion albae) [91E0] – Taxus baccata woods of the British Isles [91J0]	
Caherglassaun Turlough SAC (000238)	Date site proposed as SCI: 2002-01 https://www.npws.ie/protected-sites/sac/000238	None	16 km west of wind farm project 40 km from wind farm site hydrologically	– Turloughs [3180] – Rivers with muddy banks with Chenopodion rubri p.p. and Bidention p.p. vegetation [3270] – Rhinolophus hipposideros (Lesser Horseshoe Bat) [1303]	To restore the favourable conservation condition of Turloughs in Caherglassaun Turlough SAC (NPWS 2019) To maintain the favourable conservation condition of Rivers with muddy banks with Chenopodion rubri p.p. and Bidention p.p. vegetation / Lesser Horseshoe Bat in Caherglassaun Turlough SAC (NPWS 2019)
Cahermore Turlough SAC (002294)	Date site proposed as SCI: 2003-02 https://www.npws.ie/protected-sites/sac/002294	S.I. No. 250/2016 17 May 2016 http://www.irishstatutebook.ie/eli/2016/si/250/made/en/print?q=Cahermore+Turlough+	16 km west of wind farm project 40 km from wind farm site hydrologically	– Turloughs [3180]	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.

European Sites (Natura 2000)	Date site proposed for Classification	Statutory Instrument	Distance from Wind Farm Project (Approximate)	Qualifying Interest / Special Conservation Interest	Conservation Objectives
Galway Bay Complex SAC (000268)	Date site proposed as SCI: 1999-08 https://www.npws.ie/protected-sites/sac/000268	None	21 km north west of wind farm project 45 km from wind farm site hydrologically	– Mudflats and sandflats not covered by seawater at low tide [1140] – Coastal lagoons [1150] – Large shallow inlets and bays [1160] – Reefs [1170] – Perennial vegetation of stony banks [1220] – Vegetated sea cliffs of the Atlantic and Baltic coasts [1230] – Salicornia and other annuals colonising mud and sand [1310] – Atlantic salt meadows (Glauco-Puccinellietalia maritimae) [1330] – Mediterranean salt meadows (Juncetalia maritimi) [1410] – Turloughs [3180] – Juniperus communis formations on heaths or	To maintain the favourable conservation condition of Mudflats and sandflats not covered by seawater at low tide / Large shallow inlets and bays / Reefs / Perennial vegetation of stony banks / Salicornia and other annuals colonising mud and sand / Turloughs / Calcareous fens with Cladium mariscus and species of the Caricion davallianae / Alkaline fens / Harbour Seal in Galway Bay Complex SAC (NPWS 2013) To restore the favourable conservation condition of Coastal lagoons / Atlantic salt meadows (Glauco-Puccinellietalia maritimae) / Mediterranean salt meadows (Juncetalia maritimi) / Juniperus communis formations on heaths or calcareous grasslands / Otter in Galway Bay Complex SAC (NPWS 2013)

European Sites (Natura 2000)	Date site proposed for Classification	Statutory Instrument	Distance from Wind Farm Project (Approximate)	Qualifying Interest / Special Conservation Interest	Conservation Objectives
				calcareous grasslands [5130] – Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (* important orchid sites) [6210] – Calcareous fens with Cladium mariscus and species of the Caricion davallianae [7210] – Alkaline fens [7230] – Limestone pavements [8240] – Lutra lutra (Otter) [1355] – Phoca vitulina (Harbour Seal) [1365]	
Inner Galway Bay SPA (004031)	Date site proposed as SCI: 1994-11 https://www.npws.ie/protected-sites/spa/004031	S.I. No. 515/2019 16 October 2019 http://www.irishstatutebook.ie/eli/2019/si/515/	21 km north west of wind farm site 45 km from wind farm site hydrologically	– Great Northern Diver (Gavia immer) [A003] – Cormorant (Phalacrocorax carbo) [A017]	To maintain the favourable conservation condition of the listed Special Conservation Interest species in Inner Galway Bay SPA (NPWS 2013)

European Sites (Natura 2000)	Date site proposed for Classification	Statutory Instrument	Distance from Wind Farm Project (Approximate)	Qualifying Interest / Special Conservation Interest	Conservation Objectives
		made/en/print?q=Inner+Galway+Bay+		– Grey Heron (Ardea cinerea) [A028] – Light-bellied Brent Goose (Branta bernicla hrota) [A046] – Wigeon (Anas penelope) [A050] – Teal (Anas crecca) [A052] – Shoveler (Anas clypeata) [A056] – Red-breasted Merganser (Mergus serrator) [A069] – Ringed Plover (Charadrius hiaticula) [A137] – Golden Plover (Pluvialis apricaria) [A140] – Lapwing (Vanellus vanellus) [A142] – Dunlin (Calidris alpina) [A149]	To maintain the favourable conservation condition of wetland habitat in Inner Galway Bay SPA as a resource for the regularly occurring migratory waterbirds that utilise it (NPWS 2013)

European Sites (Natura 2000)	Date site proposed for Classification	Statutory Instrument	Distance from Wind Farm Project (Approximate)	Qualifying Interest / Special Conservation Interest	Conservation Objectives
				– Bar-tailed Godwit (Limosa lapponica) [A157] – Curlew (Numenius arquata) [A160] – Redshank (Tringa totanus) [A162] – Turnstone (Arenaria interpres) [A169] – Black-headed Gull (Chroicocephalus ridibundus) [A179] – Common Gull (Larus canus) [A182] – Sandwich Tern (Sterna sandvicensis) [A191] – Common Tern (Sterna hirundo) [A193] – Wetland and Waterbirds [A999]	

4.3.1 Brief description of European sites

All of the following descriptions have been sourced from NPWS site synopses (referenced in Section 6) and found at www.npws.ie.

4.3.1.1 Slieve Aughty Mountains SPA (004168)

The Slieve Aughty Mountains SPA is a very large site that extends from just south of Lough Rea in the north to as far south as Scariff in Co. Clare. The peaks are not notably high or indeed pronounced, with a maximum of 378 m near Cappaghabaun Mountain. The site includes many small and medium sized lakes, notably Lough Graney and Lough Atorick. Important rivers which rise in the site include the Owendalulleegh and Graney. Lough Derg occurs immediately to the south-east of the site. The Slieve Aughty hills are predominantly comprised of Old Red Sandstone. Outliers of Lower Palaeozoic provide occasional outcrops capping the hills.

The site consists of a variety of upland habitats, though approximately half is afforested. The coniferous forests include first and second rotation plantations, with both pre-thicket and post-thicket stands present. Substantial areas of clearfell are also present at any one time. The principal trees are sitka spruce (*Picea sitchensis*) and lodgepole pine (*Pinus contorta*). Almost one-third of the site is unplanted blanket bog and heath, with both wet and dry heath present. Well developed blanket bog occurs at several locations. The remainder of the site is largely rough grassland that is used for hill farming. This varies in composition, with some wet areas with rushes (*Juncus* spp.) and some areas with scrub encroachment.

The SPA is of importance for supporting nationally important populations of hen harrier and merlin. Red grouse, a Red-listed species, is widespread in the bog and heath habitats throughout the site.

4.3.1.2 Sonnagh Bog SAC (001913)

Sonnagh Bog is located at the northern end of the Slieve Aughty Mountains, approximately 8 km south-west of Loughrea in Co. Galway. The site ranges in altitude from 198 m to 317 m. The topography of the site is of a narrow plateau and valleys, one of which is occupied by Lough Belsrah.

Sonnagh Bog is important as a good example of an intact, lightly grazed, highland blanket bog. Blanket Bog is a rare and increasingly threatened habitat that is listed with priority status on Annex I of the E.U. Habitats Directive.

4.3.1.3 Drummin Wood SAC (002181)

Drummin Wood is situated on sloping ground in the foothills of the Slieve Aughty Mountains in Co. Galway, at an altitude of approximately 50-70 m, some 3 km east of Lough Cutra. The area is drained by the Owendalulleegh River, which occurs to the south. Woodland occupies about 60% of the area of the site. Most of the woodland is referrable to a type known as the ‘Blechno-Quercetum petraeae association, sub-association coryletosum’.

The other main habitats on the site are heath and areas dominated by Bracken (*Pteridium aquilinum*). The heath is of good quality and includes species such as Heather (*Calluna vulgaris*), Cross-leaved Heath (*Erica tetralix*), Purple Moor-grass (*Molinia caerulea*) and Tormentil (*Potentilla erecta*). A stream and small lake (Lodgehill Lough) occur within the site, along with some marsh and wet grassland vegetation.

4.3.1.4 Peterswell Turlough SAC (000318)

Peterswell Turlough is a large and important site which shows an excellent range of vegetation along the turlough-callow gradient and includes a summer-dry turlough filled by a river. Further, Peterswell Turlough is part of a complex of turloughs running down to Lough Coy and Ballylee. The site is the lower valley and sink for the Kilchreest River, with a tributary from Castledaly

4.3.1.5 Lough Rea SPA (004134)

Lough Rea, a hard water lake, is situated directly south of the town of Loughrea, Co. Galway. The lake is 2.5 km at its longest axis. It is an important ornithological site for the nationally important populations of Shoveler and Coot and the regionally/locally important populations of a further ten species that it holds.

4.3.1.6 Lough Rea SAC (000304)

Lough Rea is a hard water lake, a habitat listed on Annex I of the E.U. Habitats Directive. The site is largely surrounded by intensively farmed pasture and consequently the main threat to the lake comes from agricultural run-off.

4.3.1.7 Lough Coy SAC (002117)

Lough Coy is situated approximately 6.5 km north-east of Gort in Co. Galway and lies close to the Slieve Aughty hills. The site consists of a small permanent lake in the middle of an almost circular turlough basin. There are drift deposits, as well as outcropping rocks and boulders on the relatively steep side walls, and small areas of scrub towards the top of the basin. Areas of improved grassland above the normal flood line are included in the site for hydrological reasons. Lough Coy is part of a complex of small sites (along with nearby Blackrock, Ballylee and Bullaunagh turloughs)

The main land use within the site is cattle grazing which is quite heavy at the lake margins and on parts of the slopes. There is some removal of gravel from the drift deposits on the north western edge.

Lough Coy is an excellent example of a eutrophic (nutrient-rich) turlough. The extreme water fluctuation supports a distinctive zonation of vegetation and provides many niches for specialist plants

4.3.1.8 Pollagoona Bog SAC (002126)

Pollagoona Bog is located close to the Clare-Galway county boundary, 300 m south-east of Lough Atorick and 10 km south-west of Woodford. The bog is situated on a shallow saddle, on flat to gently sloping land surrounded by conifers at an altitude of 150 m. The site is a small blanket bog that shows some features of a raised bog.

4.3.1.9 Gortacarnaun Wood SAC (002180)

This site is situated in the foothills of the Slieve Aughty Mountains in Co. Galway, approximately 2 km east of Lough Cutra. The northern boundary is marked by the Owendalulleegh River. Gortacarnaun Wood consists of a substantial area of woodland on sloped ground between approximately 60 and 90 m. The woodland is classified as the 'Blechno-Quercetum petraeae var. coryletosum' type.

4.3.1.10 Carrowbaun, Newhall and Ballylee Turloughs SAC (002293)

The Carrowbaun, Newhall and Ballylee Turloughs SAC complex is a group of three turloughs which are hydrologically linked in times of high flood. The site is at the southern end of a larger complex of turloughs which includes the SACs Lough Coy and Peterswell. It is usually the last of these to flood. The vegetation of Carrowbaun, Newhall and Ballylee has been largely modified by drainage works, fertilization and over-grazing, which reduce their botanical value.

4.3.1.11 Lough Cutra SPA (004056)

Lough Cutra is a large oligo/mesotrophic freshwater lake lying on limestone but with much sediment washed down from the sandstone hills above. The Owendalulleegh River is the main in-flowing river. Woodland occurs around much of the lakeshore. While much of this is planted, wet woodland with willows (*Salix spp*.) and Alder (*Alnus glutinosa*) is also represented. The lake has a number of islands, some of which are wooded.

Historical data for Lough Cutra show that it was a long-established breeding site for Cormorant (166 pairs in 1985), with birds recorded breeding on Parsons Island and appearing to commute to the coast for feeding (2009 site synopsis). However, declines were reported in 1996 (34 pairs) and monitoring conducted in 2010 as part of a study undertaken by Tierney *et al.* (2011) revealed that the colony at Lough Cutra had been recently abandoned. More recent counts undertaken in May 2017 showed that cormorants were present at the site but no breeding activities were recorded (Data provided by NPWS in 2018).

4.3.1.12 Lough Cutra SAC (000299)

Lough Cutra is a large oligo/mesotrophic freshwater lake lying on limestone, but with much sediment washed down from the sandstone hills above. Woodland occurs around much of the lakeshore, as well as on a number of islands. These woodlands provide feeding grounds for Lesser Horseshoe bats which roost at the site. Between 1999 and 2001 up to 93 bats were recorded in hibernation at Lough Cutra Castle and it is thought likely that a summer

nursery roost also occurs here. A peak count of 142 bats was recorded in 2010. The most recent count data received from the NPWS show that the population of Lesser Horseshoe bat at the site is stable with 128 bats recorded in 2018.

4.3.1.13 Ballinduff Turlough SAC (002295)

Ballinduff Turlough is situated in a narrow basin in the limestone lowlands of south Co. Galway. It is part of the Coole Lough complex of lakes and turloughs, most of which are Special Areas of Conservation (SACs) or Natural Heritage Areas (NHAs). There are rock outcrops around the northern half and glacial drift in the south. The hydrology of the site is probably controlled by a complex of swallow holes and subsidence near Coolfin. During floods the turlough drains overland towards Coole Lough.

4.3.1.14 Pollnaknockaun Wood Natura Reserve SAC (000319)

Pollnaknockaun Wood is a large area of former oakwood with significant remnants of the original stands of Sessile Oak (Quercus petraea) and even larger areas of intact ground flora. Old Oak Woodlands are listed on Annex I of the E.U. Habitats Directive.

4.3.1.15 Loughatoric South Bog SAC (000308)

Loughatorick South Bog is located about 8 km north-west of Mountshannon, straddling the Clare/Galway border. It occupies the summit of Scalp Mountain and extends down the gentle slopes to the south and to the east. Scalp is one of the southernmost, and lower, of the Slieve Aughty Mountains, reaching a height of 325 m. At this elevation, the bog is an intermediate between lowland and mountain blanket bog and can be described as a highland blanket bog. Much of the rest of the Slieve Aughty range is heavily afforested, but this bog is remarkably intact, making it all the more valuable.

4.3.1.16 Kiltartan Cave (Coole) SAC (000286)

Kiltartan cave is a natural limestone cave situated north of Coole Park in Co. Galway, just off the main Galway-Ennis road. It is used as a hibernating site for the Lesser Horseshoe Bat. This cave, which has been well documented since 1863, is a segment of an abandoned streamcourse of the Gort River. A 3 m descent into the cave divides into two main passages. The cave contains the following representative cave features: elliptical phreatic tube with local modification by roof collapse, roof tube still preserved in places, gour pools, straw stalactites and botryoidal calcite deposits. Water levels within the cave are known to fluctuate in winter with some passages filling completely with water; during severe flooding in 1994/95, all sections of the cave were filled with water except for small pockets in the roof.

The Lesser Horseshoe Bat, an Annex II species, uses the cave as a hibernation site. Numbers of Lesser Horseshoe Bats counted prior to the serious flooding in 1994/95 varied between 44 and 70. During the floods the cave was filled to the entrance. Following the floods, bat numbers remained low (10-15) until January 2001, when 41 individuals were counted. Most hibernating bats are found on the right hand side of the cave entrance, in a

passage historically known as the ‘Bat Passage’, which runs north for 40 m and is floored by boulders. Coole Wood is within 500 m of the cave.

This is a particularly fine example of a fossil streamway cave, which contains many features of geological interest. Caves are listed on Annex I of the E.U. Habitats Directive. The presence of a significant population of Lesser Horseshoe Bat makes the site of international importance.

4.3.1.17 Derrycrag Wood Natura Reserve SAC (000261)

Derrycrag Wood is an old oak woodland, situated 1.5 km south-east of Woodford, Co. Galway, and is traversed by the Woodford River. The underlying rock is Old Red Sandstone, which is overlain in places by drift. The soils vary from thin, acidic podzols to deeper, gleyed brown earths. The site is dominated by planted conifers, but fragments of old oak woodland still occur.

Before commercial conifer planting in the 1930s and 1940s, this would have been part of the largest oak woodlands in the country. In the fragments remaining, the Sessile Oak (Quercus petraea) canopy can be up to 17m tall. The woodland also contains Rowan (Sorbus aucuparia) and Downy Birch (Betula pubescens), and Holly (Ilex aquifolium) and Yew (Taxus baccata) are locally abundant. Hazel (Corylus avellana) and Ash (Fraxinus excelsior) occur on the slightly richer soil.

Management of the wood includes the gradual removal of all conifers except for a few areas with mature Scots Pine. The cleared areas, however, are vulnerable to invasion by non-native species, e.g. Beech (Fagus sylvaticus) and to grazing by deer.

4.3.1.18 Coole-Garryland Complex SAC (000252)

The Coole-Garryland Complex is situated in a low-lying karstic limestone area west of Gort, in Co. Galway. It contains a series of seasonal lakes (turloughs), which are fed by springs and a partly submerged river, surrounded by woodland, pasture and limestone heath. The more well-known turloughs present in the site include Lydacan, Crannagh North, Raheen, Crannagh South, Coole, Garryland, Newtown and Hawkhill. The turloughs at Coole-Garryland are particularly good examples of this habitat type.

The Coole River itself is of particular interest for the occurrence of a rare riverine habitat characterised by Trifid Bur-marigold (Bidens tripartita), Red Goosefoot (Chenopodium rubrum) and species of Knotgrass (Polygonum spp.). In the habitat ‘natural eutrophic lake’ at the site, species such as Pondweeds (Potamogeton perfoliatus and P. berchtoldii), Water-starworts and Rigid Hornwort (Ceratophyllum demersum) are to be found.

4.3.1.19 Coole-Garryland SPA (004107)

The Coole-Garryland SPA is situated in a low-lying karstic limestone area west of Gort, Co. Galway. It comprises a series of turloughs, which are fed by springs and a partly submerged river, surrounded by woodland, pasture and limestone heath. Coole Lough is the largest and most permanent of the turloughs, and retains some water throughout the year. Water levels vary greatly depending on rainfall and this has consequences on the numbers of

birds present. During prolonged dry spells, higher numbers of some species are present as birds from other sites in the catchment are attracted to the permanent waters of Coole Lough.

Coole-Garryland SPA is of international importance for its population of Whooper Swan, a species that is listed on Annex I of the E.U. Birds Directive. Coole Lough, a Wildfowl Sanctuary, has particular significance for wintering waterfowl as during prolonged dry spells it is one of the few sites in the catchment which retains open water. Coole Lough and Garryland Wood is a Ramsar Convention site, and parts of the Coole-Garryland SPA are designated as Statutory Nature Reserves and are managed by the National Parks and Wildlife Service.

4.3.1.20 Ardrahan Grassland SAC (002244)

This site lies immediately west and north of Ardrahan in south Co. Galway. It is dominated by a large flat limestone area with a mosaic of calcareous habitats including limestone pavement, alpine heath, Juniper scrub and species rich dry grasslands. In contrast, the south-west of the site consists of a small marl lake and adjoining fens and marshes, with Juniper heath frequent on the higher ground. Soils associated with limestone pavement are generally thin rendzina, deeper pockets are more mineral rich and support limestone grassland and scrub in places. The site contains a good example of limestone pavement, a priority habitat listed on Annex I of the E.U. Habitats Directive, a small though excellent example of the Annex I habitat alpine heath, along with one other Annex I habitat, Juniper scrub.

Land use at this site consists mainly of the traditional practise of winter grazing by cattle. This is a low intensity farming practise generally confined to the Burren in Ireland and one that is vital to the maintenance of the high scientific interest of this site. However, recent agricultural improvement has damaged the scientific interest of part of the site through loss of habitat in the turlough and limestone pavement areas. Intensification of the land usage around Brackloon Lough could lead to a deterioration in the water quality of the lake.

4.3.1.21 Rosturra Wood SAC (001313)

Rosturra Wood comprises part of what was formerly a large stand of Sessile Oak (Quercus petraea) woodland. It is situated about 3 km east of Woodford, Co. Galway and consists of two separate areas. In the 1930s and 1940s much of the wood was cleared and planted with coniferous species. However, the wood retains significant remnants of the original stands of Sessile Oak and its associated ground flora. The wood is situated on rich loamy soils and consequently the size and quality of the hardwood and the diversity of the ground flora is greater than in most Irish Sessile Oak woods. Almost half of Rosturra Wood is designated as a Statutory Nature Reserve.

Oak woods are rare in Ireland and those found on rich soils which are not the result of planting are even more rare. The remnants of original oak wood at Rosturra Wood (and at the neighbouring Derrycrag Wood and Pollnaknockaun Wood) are part of what was, until 1940, the largest area of natural oak wood in the country. Oak and Yew woodland such as

that found at Rosturra Wood are habitats of considerable conservation significance and are listed on Annex I of the E.U. Habitats Directive.

4.3.1.22 Cloonmoylan Bog SAC (000248)

Cloonmoylan Bog is a very large expanse of level raised bog, situated close to the western shore of Lough Derg, near Woodford in Co. Galway. It lies at an altitude of approximately 50 m above sea-level.

This site contains a large area of good quality, intact active raised bog habitat. The surface displays a typical, undulating pattern of pools, wet channels and low hummocks. A wide variety of bog mosses occur over the surface of the bog, forming hummocks and wet lawns and colonising the pools.

At least half of the surface of the peat dome comprises degraded raised bog. These areas have significantly lower water levels than in adjoining active areas of bog and this results in the presence of a more species-poor peatland flora and a much lower cover of peat-forming Sphagnum mosses. The vegetation is generally dominated by more robust bog species such as Deergrass, Common Cottongrass, Heather, Cross-leaved Heath (Erica tetralix), Bog Asphodel and Carnation Sedge.

4.3.1.23 Glendree Bog SAC (001912)

Glendree Bog is located in the Slieve Aughty range of hills, 13 km north-west of Scarriff in Co. Clare. This highland blanket bog consists of a series of small plateaux and valleys, rimmed with sandstone outcrops. Lough Ea occurs on its eastern boundary.

Adding to the diversity of the site are three lakes and two small streams. The lakes, and especially the largest (Lough Ea), provide good examples of oligotrophic lakes, with characteristic species, including Shoreweed (Littorella uniflora), Water Lobelia (Lobelia dortmanna), and the regionally rare Quillwort (Isoetes lacustris).

The main threat to Glendree Bog is peat-cutting; significant areas of turbary are found adjacent to the track winding through the centre of the site.

Glendree is a very species-rich bog, on account of the wide diversity of habitats it contains. It is of particular importance because of the national scarcity of highland blanket bog and because of the presence of Quillwort, a regionally rare species.

4.3.1.24 Barroughter Bog SAC (000231)

Barroughter Bog is a relatively small raised bog, situated on the shores of Lough Derg in Co. Galway, a few kilometres east of Woodford, and bounded in the north by the Cappagh River.

A threat to the extent and quality of the central and most interesting habitat is present in the form of active "hopper" turf extraction around 90% of the bog's perimeter.

Barroughter Bog is a raised bog of considerable conservation value. Given its relatively small size, the area of outstanding quaking habitat is remarkably large. Its proximity to the shores of Lough Derg, with its succession from open water through extensive reed beds

and marginal scrub, to raised bog, adds to its importance. It is also the only raised bog on the shores of Lough Derg.

4.3.1.25 Lough Derg (Shanon) SPA (004058)

The site is a Special Protection Area (SPA) under the E.U. Birds Directive, of special conservation interest for the following species: Cormorant, Tufted Duck, Goldeneye and Common Tern. 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 Derg (Shannon) SPA is of high ornithological importance as it supports nationally important breeding populations of Cormorant and Common Tern. In winter, it has nationally important populations of Tufted Duck and Goldeneye.

4.3.1.26 Lough Derg, North-east Shore SAC (002241)

Lough Derg, the lowest order lake on the River Shannon, is one of the largest bodies of freshwater in Ireland. This SAC, however, only includes the northern shore of the lake from the mouth of the Cappagh River in the north-west to just below Black Lough at the north-eastern shore.

This is a site of significant ecological interest, with six habitats listed on Annex I of the E.U. Habitats Directive. Four of these are priority habitats - Cladium fen, alluvial woodland, limestone pavement and Yew woodland. Other annexed habitats present include alkaline fen and Juniper scrub formations on heath and calcareous grasslands.

The main threats to the quality of the site are water polluting activities resulting from intensification of agricultural activities around the lake shore, uncontrolled discharge of sewage, which is causing eutrophication of the lake, and housing and boating development which has resulted in the destruction of lakeshore habitats. There is also significant fishing and shooting pressure on and around the lake. Forestry can result in the loss of some areas of wetland habitat.

4.3.1.27 Caherglassaun Turlough SAC (000238)

Caherglassaun is a large lake located 6 km north-west of Gort and 5 km south-east of Kinvarra in the low-lying farmland of east Co. Galway. Situated in a natural depression just 2 km to the north-west of Coole Nature Reserve, this site comprises a permanent lake at its core, while the rest of the basin functions as a turlough. At times of high water, the site can flood to a depth of 10-15 m. Because of its proximity to sea-level, the lake fluctuates 30 cm or so in a tidal cycle, but it is delayed significantly behind tidal height at Kinvarra.

Caherglassaun Turlough SAC is designated for the Annex I habitats - Turloughs [3180], Rivers with muddy banks with Chenopodion rubri p.p. and Bidention p.p. vegetation [3270] and the Annex II Species Rhinolophus hipposideros (Lesser Horseshoe Bat) [1303]. A bat roost exists within the site. Lesser Horseshoe Bat and Natterer's Bat

Any development which would involve drainage or alteration of the water table would threaten this site. Presence of grazers will also influence the site - low grazing levels would facilitate the further development of woodland at the site.

4.3.1.28 Cahermore Turlough SAC (002294)

Cahermore Turlough SAC is situated in the limestone lowlands of south Co. Galway, about 5 km north-west of Gort and 5.5 km south-east of Kinvara. The site is designated for the Annex I habitat - Turloughs [3180] and is part of a series of lakes and turloughs in the region. The nearest is Caherglassaun Turlough, the water levels of which are slightly higher than Cahermore.

The turlough is on the dry end of the spectrum, and there is no standing water in summer except for a few small ponds dug for cattle. A few collapse features occur in the drift on the southern side with a regular swallow-hole at the edge of the flooded area. Another hole occurs in the south-east corner. The turlough appears to flood largely from the southern side.

4.3.1.29 Galway Bay Complex SAC (000268)

Situated on the west coast of Ireland, this site comprises the inner, shallow part of a large bay which is partially sheltered by the Aran Islands. A diverse range of marine, coastal and terrestrial habitats, including several listed on Annex I of the E.U. Habitats Directive, occur within the site, making the area of high scientific importance.

Galway Bay South holds a very high number of littoral communities (12). They range from rocky terraces, to sandy beaches with rock or sand dunes behind. The intertidal sediments of Galway Bay support good examples of communities that are moderately exposed to wave action.

Fishing and aquaculture are the main commercial activities within the site. A concern is that sewage effluent and detritus of the aquaculture industry could be deleterious to benthic communities. Reef and sediment communities are vulnerable to disturbance or compaction from tractors accessing oyster trestles. The Paracentrotus lividus populations have been shown to be vulnerable to over-fishing. Extraction of maerl in Galway Bay is a threat. Owing to the proximity of Galway city, shoreline and terrestrial habitats are under pressure from urban expansion and recreational activities. Eutrophication is probably affecting some of the lagoons and is a continued threat. Drainage is a general threat to the turlough and fen habitats. Bird populations may be disturbed by aquaculture activities.

4.3.1.30 Inner Galway Bay SPA (004031)

Inner Galway Bay SPA is a very large, marine-dominated site situated on the west coast of Ireland. The inner bay is protected from exposure to Atlantic swells by the Aran Islands and Black Head. Subsidiary bays and inlets (e.g. Poulnaclough, Aughinish and Kinvarra Bays) add texture to the patterns of water movement and sediment deposition, which lends variety to the marine habitats and communities. The terraced Carboniferous (Viséan) limestone platform of the Burren sweeps down to the shore and into the sublittoral. The long shoreline

is noted for its diversity, and comprises complex mixtures of bedrock shore, shingle beach, sandy beach and fringing salt marshes. Intertidal sand and mud flats occur around much of the shoreline, with the largest areas being found on the sheltered eastern coast between Oranmore Bay and Kinvarra Bay. A number of small islands and rocky islets in the Bay are included within the site.

The site is a Special Protection Area (SPA) under the E.U. Birds Directive, of special conservation interest for the following species: Black-throated Diver, Great Northern Diver, Cormorant, Grey Heron, Light-bellied Brent Goose, Wigeon, Teal, Redbreasted Merganser, Ringed Plover, Golden Plover, Lapwing, Dunlin, Bar-tailed Godwit, Curlew, Redshank, Turnstone, Black-headed Gull, Common Gull, Sandwich Tern and Common Tern. 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.

Inner Galway Bay supports an excellent diversity of wintering wetland birds, with divers, grebes, cormorants, dabbling duck, sea duck and waders all well represented. The site has several important populations of breeding birds, most notably colonies of Sandwich Tern (81 pairs in 1995) and Common Tern (98 pairs in 1995 on Green Island and 46 pairs in 2001 on Mutton Island). A large Cormorant colony occurs on Deer Island - this had 200 pairs in 1985 and 300 pairs in 1989.

4.4 Identification of potential impacts

The potential impacts associated with the construction, operation and decommissioning of the Derrybrien Wind Farm Project and the peat slide and associated works which occurred in 2003 are identified in this section. The impacts identified below are those which are likely to have occurred, which are occurring or which can reasonably be expected to occur based on the nature and scale of the Project and the Qualifying Interests and Special Conservation Interests of the European sites identified in Table 2.

Potential impacts due to construction activities

- Loss of habitat (including subsequent alteration/change of habitat)
- Mortality of individual birds / bats
- Disturbance of birds / bats due to presence of personnel/machinery.
- Pollution of surface waters and impact on fisheries owing to an increase in runoff of inorganic and peat solids, combined with increased nutrients from clearfelling.

Potential impacts due to peat slide and associated activities

- Loss of habitat (including subsequent alteration/change of habitat)
- Mortality of individual birds / bats
- Disturbance of birds due to presence of personnel/machinery.
- Pollution of surface waters and impact on aquatic life owing to peat solids.

Potential impacts due to operation and maintenance activities

- Collision risk to birds and bats associated with operating turbines.
- Collision risk to birds with overhead powerline.
- Displacement of birds and bats due to operation of turbines.
- Disturbance to species associated with maintenance activities on site e.g. removal of self-sown conifers, road and drain maintenance.
- Impacts on reproductive output in relation to wind turbine proximity.
- Barrier effects.
- Pollution of receiving waters with siltation due to maintenance activities.

Potential impacts during decommissioning

- Disturbance/displacement of birds and bats associated with dismantling of above ground components of wind farm and OHL (24 month duration).
- Pollution of receiving waters with siltation due to machinery on site associated with dismantling of wind farm and OHL components and removal of instream barrages.

4.5 Assessment of significance of effects

All sites identified as being within the ZoI of the project have been assessed in the following section to determine if there is an impact pathway between the Project and the sites, if the Project is likely to have had or to have an effect on these sites and if the effects are likely to have been or to be significant. The source (potential impacts from the Project), pathways (hydrological, physical or ecological connectivity) and receptors (Qualifying Interests and Special Conservation Interests of the European sites) were examined to determine potential source – pathway – receptor connectivity. This was undertaken using GIS software and various data sources including NPWS and EPA data.

Most European sites that are within the same river catchment or which have a hydrological connection have been grouped together for assessment, as many of the potential impacts on these sites are similar (or related) owing to their connectivity and features of interest.

The potential for impacts and likelihood of significant effects on the features of interest identified in this report is based on information collated from the desk study, the nature of the project, site visits and the detailed information provided in the relevant chapters of the rEIAR.

4.5.1 Slieve Aughty Mountains SPA (004168)

The Slieve Aughty Mountains SPA is designated for hen harrier and merlin, both Annex I listed species.

In the most recent national survey for hen harrier in 2015, the SPA held 8-14 breeding pairs, which equates to 8.9% of the national population and 20.3% of the SPA network population (Ruddock *et al.* 2016). Comparative data for the SPA from the national surveys in 2005, 2010 and 2015 are given below:

2005 Population	2010 Population	2015 Population	% change 2005-2015
24-27 pairs	15-23 pairs	8-14 pairs	-48.1%

From an analysis by Moran & Wilson-Parr (2014), the SPA has between 33.4% and 37.4% suitable nesting habitat and 50.0% to 54.0% suitable foraging habitat. At the time of analysis, there were 31,744 ha in forest/woodland cover (equating to 53.4% of total SPA area) of which 5,789.5 ha to 8,173.9 ha was classed as suitable for nesting hen harriers.

The size of the merlin population within the SPA is not well known but is likely to exceed 5 pairs (NPWS, 2015).

The Project is entirely within the Slieve Aughty Mountains SPA. The SPA had not been publicly notified at the time of the planning and construction of the project (classified as a SPA in March 2007 and formally designated by Statutory Instrument in March 2012 (S.I. No. 83 of 2012)). For the purposes of this report all aspects of the Project will be

assessed, whether pre – or post – designation, in terms of potential impact on the hen harrier and merlin populations within the Slieve Aughty Mountains.

Construction phase / peat slide

Construction works on site commenced in June 2003 with tree felling operations. Civil engineering works commenced in July 2003 with road construction and excavations at turbine locations. The works were stopped on 16th October 2003 due to a peat slide on site. Construction works re-commenced in June 2004, including work on the Derrybrien to Agannygal 110kV OHL and Agannygal Substation, and were complete by March 2006. The principal impacts on birds which occurred or had the potential to have occurred during the construction phase of the Project were:

(i) Loss of habitats (including subsequent alteration/change of habitat),

(ii) Disturbance to birds (noise, human presence etc.)

Operation phase

During the operational phase of the Project since 2006, there has been potential for various impacts on the Special Conservation Interests of the SPA. Identified potential impacts are:

- collision;
- displacement;
- impacts on reproductive output in relation to wind turbine proximity;
- barrier effects;
- development of habitats;

In addition, consideration needs to be given to wind farm maintenance works - these are principally maintenance and periodic upgrade of access tracks, clearing of drains, the cutting back of tree re-growth in previously felled areas, and substation inspections and maintenance.

Continued operation and decommissioning phases

The impact of the continued operation and decommissioning of the Project also needs to be investigated to determine the potential for future impacts on the SPA and if mitigation measures are required to minimise the significance of effects arising from identified impacts.

As the present assessment has identified the following:

- The occurrence of construction phase impacts on habitats and birds (prior to SPA designation),
- The potential for various impacts on the Special Conservation Interests of the SPA during the operation phase, including collision risk with turbines and/or overhead lines,
- The potential for various impacts on the Special Conservation Interests of the SPA during the continued operation and decommissioning phases, which may require mitigation (including monitoring of hen harrier territories in proximity to the Project),

the potential for significant effects on the Slieve Aughty Mountains SPA arising from these impacts will be further assessed in the Natura Impact Statement (section 5).

4.5.2 Sonnagh Bog SAC (001913)

Sonnagh Bog is important as a good example of an intact, lightly grazed, highland blanket bog. Blanket Bog is a rare and increasingly threatened habitat that is listed with priority status on Annex I of the E.U. Habitats Directive.

The Project is over 1.4 km from this SAC and separated from the Sonnagh Bog by the Boleyneendorrish River.

There is no impact pathway between the Project and this SAC. The Project has not had nor is likely to have any effect on this site.

4.5.3 Lough Rea SPA (004134)

This SPA is designated for two waterbird species, shoveler and coot and provides good quality feeding and roosting habitat for both. Shoveler duck prefer shallow eutrophic waters rich in plankton, and occur on a variety of habitats while wintering in Ireland, including coastal estuaries, lagoons and inland lakes and callows. They also feed on small molluscs, insects and larvae, seeds and plant material and are frequently seen dabbling around the edges of waterpools. Winter distribution is more widespread than breeding distribution, birds are found on lakes, coastal estuaries and river systems, but show a clear preference for large inland lakes.

Coot feed on both plants and animals, but mainly on plants. Food taken from the water surface, including emergent plants and whilst diving. Food includes plant shoots, seeds, insects, algae and fish.

The wind farm site and OHL corridor have never contained habitats suitable for these wetland bird species. The small (0.1 ha) lake within the wind farm site is dystrophic and contains very little plant or animal life. The SPA is located approximately 9 km north of the wind farm and these bird species have not been recorded near the wind farm site during vantage point surveys..

It is considered that there is no potential for the Project to directly affect the Special Conservation Interests of this SPA. The Project is also within different river catchments to the Lough Rea SPA and therefore has no potential to indirectly affect the wetland habitats for which the site has been designated. The Project has not had nor is likely to have any effect on this site.

4.5.4 Lough Rea SAC (000304)

Lough Rea SAC is designated for the Annex I habitat Hard oligo-mesotrophic waters with benthic vegetation of Chara spp. [3140]. The SAC is located approximately 9 km north of the Project and is within a different river catchment (Kilcolgan River) to the Project. There is no impact pathway between the Project and this SAC and no potential

for direct or indirect impacts on the SAC.. The Project has not had nor is likely to have any effect on this site.

4.5.5 Drummin Wood SAC (002181)

Drummin Wood is situated on sloping ground in the foothills of the Slieve Aughty Mountains, at an altitude of approximately 50-70 m, some 3 km east of Lough Cutra. The SAC is designated for old sessile oak woods with Ilex and Blechnum in the British Isles.

A tributary of the Owendalulleegh known as the Derrykeel, runs along the eastern boundary of Drummin Wood SAC. Although hydrologically connected to the Owendalulleegh River, Drumin Wood is situated 1 km upstream of the main river channel. There is no potential for the Project to directly or indirectly impact this SAC. The Project has not had nor is likely to have any effect on this site.

4.5.6 Gortacarnaun Wood SAC (002180)

Gortacarnaun Wood SAC is designated for the Annex I habitat Old sessile oak woods with Ilex and Blechnum in the British Isles [91A0}. This site is situated in the foothills of the Slieve Aughty Mountains in Co. Galway.

The Owendalulleegh River flows along the northern boundary of this site approximately 14.3 km downstream of the Project and Lough Cutra is approximately 2 km to the west of the site. Gortacarnaun Wood consists of a substantial area of woodland on sloped ground between approximately 60 and 90 m.

The peat slide which occurred during construction of the Project in October 2003 did impact the full length of the Owendalulleegh River. However, a survey of the river and river banks undertaken by the Shannon Regional Fisheries Board shortly after the slide recorded that the physical impact on river morphology was greatest from Flaggy Bridge on the R353 to the first major tributary confluence (Anon, 2004). Gortacarnaun Wood SAC is located 13 km downstream of this confluence. Given the elevation of the woodland and the distance downstream from the main impact of the slide, the slide is not likely to have had an impact on the qualifying feature of the site. Considering the distance downstream from the Project the continued operation and decommissioning of the Project are not likely to have any effect on this SAC.

4.5.7 Lough Cutra SPA (004056)

Lough Cutra SPA is designated for breeding cormorant (*Phalacrocorax carbo*). The lake was once a long-established breeding site for cormorant (166 pairs in 1985), however declines were reported in 1996 (34 pairs) and monitoring conducted in 2010 as part of a study undertaken by Tierney *et al.* (2011) revealed that the colony had been recently abandoned. More recent counts undertaken in May 2017 showed that cormorants were present at the site, but no breeding activities were recorded (Data provided by NPWS in 2018).

The peat slide which occurred during the construction of the wind farm in October 2003, resulted in peat entering the upper reaches of the Owendalulleegh River and flowing along its length to Lough Cutra (approximately 22 km downstream). At the time of the event a visible plume was observed at the confluence of the Owendalulleegh River with Lough Cutra.

A survey undertaken in July 2004 (Inis Environmental Services, 2004b) to assess the impact of the peat slide on the ecology of Lough Cutra, found that the cormorants were no longer breeding at the lake and that limited, or no breeding activity had been recorded for a number of years (as per NPWS). A further survey of lakes in the general area of south Galway/ North Clare found a large colony of breeding cormorant had established itself on Illaunmore at Muckanagh Lough, ten kilometres south west of Lough Cutra. It was believed that these birds had relocated to this area from Lough Cutra.

Although the cormorants were not recorded breeding at the site at the time of the peat slide or in the years preceding the event, given that peat material from the slide did enter the lake, a more detailed assessment is required to determine the impact of this on water quality and fisheries within the lake, both of which have the potential to affect the population of cormorants for which the lake is designated.

The impact of the continued operation and decommissioning of the Project also needs to be investigated further to determine the potential for future impacts on the SPA and if mitigation measures are required to ensure the protection of water quality and fisheries in the Owendalulleegh River and Lough Cutra.

Maintenance activities required for the continued operation of the Project and decommissioning works have the potential to generate silt which may impact water quality and fisheries in the Owendalulleegh River and therefore Lough Cutra, in the absence of mitigation. The potential for significant effects on Lough Cutra arising from these activities is uncertain in the absence of mitigation measures; such effects and any associated mitigation must be further assessed in the Natura Impact Statement (see Section 5).

4.5.8 Lough Cutra SAC (000299)

Lough Cutra is a large oligo/mesotrophic freshwater lake lying on limestone, but with much sediment washed down from the sandstone hills above. The lake is relatively large in size (385 ha). A series of connected woodlands on the western side of the lake have been included in the boundary of this SAC as foraging habitat for the lesser horseshoe bats which roost at the site.

The lesser horseshoe roost at Lough Cutra has been monitored since 1987 (60 bats recorded) by National Parks and Wildlife Service staff. Data from the NPWS lesser horseshoe roost database shows that between 1999 and 2001 up to 93 bats were recorded in hibernation at Lough Cutra Castle. A summer nursery roost also occurs here. The data show that in general bat numbers at the roost have either increased or remained stable since the roost was first counted in 1987. The population has remained stable following the construction of the wind farm, with a peak roost count recorded in January 2010 (142 individuals). The most recent count of 129 bats in 2018 indicates

that the local population of lesser horseshoe bats has a favourable conservation status which is the same as the national population.

Construction phase / peat slide

The peat slide which occurred during the construction of the wind farm in October 2003, resulted in peat entering the upper reaches of the Owendalulleegh River and flowing along its length to Lough Cutra (approximately 22 km downstream). At the time of the event a visible plume was observed at the confluence of the Owendalulleegh River with Lough Cutra.

Those habitats within range of the lesser horseshoe roost at Lough Cutra would have been unaffected by the peat slide at Derrybrien with the exception of Lough Cutra itself. The principal foraging habitat for lesser horseshoe bats has been shown through radio tracking studies to be woodlands with some use of pasture and wetlands, rarely foraging over open water (Biggane (2004a, 2004b, Bontadina et. al. (2002).

A survey of bats in the Lough Cutra Castle Demesne was undertaken in March and August 2004 by Inis Environmental Services (2004a) to assess the impact of the peat slide on bats roosting and foraging at the lake. The assessment found the following - *Lesser horseshoe bats were noted feeding along the lakeshore in vegetation to the southeast and southwest of the castle and along an inlet of the lake to the southwest. Earlier studies in March 2004 also indicated that bats feed along the woodland paths and in the woods themselves.*

Activity along the lakeshore and over the lake was most intense on the night of August 8th 2004. During observations in the area of the lake behind the castle, soprano pipistrelle, common pipistrelles, Daunbenton's bats and Leisler's were all active at the same time over the lake. It was very clear that insects were abundant in the vicinity of the lake especially where there was vegetation to provide shelter towards the lakeshore.

Given that any waterborne peat entered into the lake at the opposite side via the River Owendalulleegh, it is improbable that there has been any significant impact upon the invertebrate fauna that would constitute the prey items of the bat species of the castle and lodges.

In summary, bat activity, diversity and abundance was high in the Lough Cutra Estate and on Lough Cutra in August 2004. This clearly demonstrates that the slide did not have a significant effect on invertebrates in the lake on which bats feed.

Wilson (2012) also concluded that the peat slide, whilst causing a fish kill and degradation of water quality in the Owendalulleegh River, was not likely to have impacted on local bat populations in particular the lesser horseshoe bats in Lough Cutra Castle.

Given that the lesser horseshoe bat population at Lough Cutra Castle has ultimately remained stable and in some years has increased there would appear to be no effect on this population from the peat slide and subsequent pollution event.

Operation phase

Lesser horseshoe bats are typically associated with broadleaved woodland, and are agile flyers, foraging very close to vegetation (Dietz *et al.*, 2009; Schofield & Mitchell-Jones, 2011). Summer roosts are predominantly in buildings, and winter roosts in caves and mines (Dietz *et al.*, 2009). The commercial plantation and open habitats available in the wind farm site and surrounding area are considered to be of negligible importance to lesser horseshoe bat.

The wind farm is approximately 13.5 km from Lough Cutra Castle. Collins (2016) describes CSZ for different bat species (based on extensive literature reviews). The term core sustenance zone refers to the area surrounding a communal bat roost within which habitat availability and quality will have a significant influence on the resilience and conservation status of the colony using the roost (Collins, 2016). The core sustenance zone for lesser horseshoe bats is given as 2 km. Therefore, bats from the Lough Cutra Castle roost are unlikely to commute to the wind farm to forage. Research has shown that lesser horseshow bats were found to travel no more than 4.2 km from maternity roosts (Bontadina *et al.*, 2002).

A minimum of five bat species were recorded at Derrybrien Wind Farm in 2016 and 2019 as a result of a combination of static survey, driven transect work and searches for bat corpses using dogs. Lesser horseshoe bat was not recorded at the site, and effects on the species are therefore considered not likely to have occurred or to have the potential to occur during the continued operation of the wind farm.

The decommissioning strategy for the Project has been designed so that only above ground wind farm and OHL infrastructure will be removed in order to reduce the requirement for ground excavation and potential siltation. The foundations of the Derrybrien and Agannygal Substations will be removed but hardstands will remain in place. Decommissioning of barrages 3 and 4 located in an upper tributary of the Owendalulleegh River will involve the removal of the boulders that form the main structure of the barrages and to also remove the finer silt material which has accumulated behind the structures. This activity could potentially result in a localised release of silt into the river which would not have an impact on the invertebrate fauna that would constitute the prey items of the bat species of Lough Cutra Castle and lodges. The decommissioning phase of the Project will have no effect on the qualifying feature of the SAC.

4.5.9 Kiltartan Cave (Coole) SAC (000286)

Kiltartan cave is a natural limestone cave used as a hibernating site for the lesser horseshoe bat. The site is almost 13 km from the wind farm site, therefore there is no potential for the development to impact directly on the Annex I habitat '*Caves not open to the public [8310]'.*

Bats do not tend to be active during the hibernation season. Even during the breeding season, their most active season, lesser horseshow bats were found to travel no more than 4.2 km from the maternity roost (Bontadina *et al.*, 2002).

As described above in Section 4.5.8, the commercial plantations and open habitats available in the Project area are considered to be of negligible importance to lesser horseshoe bat. Given the nature of the habitats on site and the distance between Kiltartan Cave and the wind farm there would have been no impact on lesser horseshoe bats from this or any other known SACs designated for this species during the construction phase of the project.

Bats can be vulnerable to collision with operational wind turbines, however lesser horseshoe bat has not been recorded at the wind farm site during surveys in 2016 and 2019, and therefore is not likely to be impacted during the operational and decommissioning phases of the Project.

It can be concluded that the Project has not had nor is likely to have any effect on the qualifying features of this SAC.

4.5.10 Peterswell Turlough SAC (000318)

Peterswell (Blackrock)Turlough is part of a larger complex of turloughs which includes Lough Coy SAC and the Carrowbaun, Newhall and Ballylee Turloughs SAC.

Peterswell Turlough SAC spills over land into Lough Coy Turlough and there are underground connections between Peterswell Turlough and the Ballylee Turlough SAC and also to the Coole-Garryland Turlough complex. The flood levels in Lough Coy and Peterswell Turlough could be slightly influenced by downstream flood levels at Ballylee but generally turlough levels are influenced by the upstream inflow volume and the groundwater outlet capacity within the turlough itself. Their water quality will not be directly affected by the downstream turloughs

The Kilchreest (Owenshree) River passes through the Peterswells Turlough which is upstream of the Boleyneendorrish River. The Boleyneendorrish River which drains the northwest of the wind farm site joins the Kilchreest River approximately 2.5 km downstream in the Carrowbaun, Newhall and Ballylee Turloughs SAC, which is 22 km downstream of the wind farm.

There is no impact pathway between the Boleyneendorrish River and this SAC. The Project has not had nor is likely to have any effect on this SAC.

4.5.11 Lough Coy SAC (002117)

Peterswell Turlough, Lough Coy and the Carrowbaun, Newhall and Ballylee Turloughs are connected via underground and above surface channels. The Kilchreest (Owenshree) River passes along the northern boundary of this site which is upstream of the Boleyneendorrish River. The Boleyneendorrish River joins the Kilchreest River 1.6 km downstream in the Carrowbaun, Newhall and Ballylee Turloughs SAC.

There is no impact pathway between the Boleyneendorrish River and this SAC. The Project has not had nor is likely to have any effect on this SAC.

4.5.12 Carrowbaun, Newhall and Ballylee Turloughs SAC (002293)

The site is a Special Area of Conservation (SAC) selected for the Annex I priority habitat [3180] Turloughs. The Carrowbaun, Newhall and Ballylee Turloughs SAC complex is a group of three turloughs which are hydrologically linked in times of high flood. The Ballylee Turlough has groundwater connection to Kiltartan Springs, springs in Coole-Garryland, Caherglassaun and Cahermore.

The Boleyneendorrish River flows into the southern part of this SAC for a distance of approximately 400 m before joining the Kilchreest (Owenshree) River entering from the north. The Kilchreest then flows south for a distance of approximately 440 m before the water sinks into the channel floor and disappears in a tangle of scrub at Pollanoween. The river then flows underground west for a distance of approximately 3 km before emerging in the Coole-Garryland SAC/ SPA.

The Boleyneendorrish drains approximately one third of the wind farm site via 4 small subcatchments (SC1 – SC4, see Figure 5). All four tributary streams coalesce downstream of the wind farm ~450m upstream of where the EPA has its most upstream Q-value monitoring site (Ford W. of Pollboy, RS29B040100, B5 in the present study). That site, which is usually surveyed every 3 years, returned High Status (Q5 or Q4-5) results before and after the construction of the wind farm and during its operation phase up until 2018, which was the last time the EPA monitored all three sites on the Boleyneendorrish upstream of the confluence with the Kilchreest River, when all returned High Status results. The following year in 2019 the most upstream site only i.e. Ford W. of Pollboy, RS29B040100, recorded Q4 (Good Status) for the first time since surveys began at the site in 1989. When discussed at the time with the EPA surveyor, the very low water levels were referenced as a possible contributing factor to the decline from High to Good Status. In the same year, just 425 m upstream at the first branch in the river, two sites were monitored for the present study. The northern branch site at B3 returned a High Status (Q 4-5) result, and the southern branch (at B4) in SC1) returned a Q4 (Q4-5) (Good Status verging on High) result.

During the construction phase of the wind farm, trees were clear-felled for site preparation, which would have generated increased nutrient run-off, and construction operations including track construction, additional drains and trenching for cables etc., would have generated increased mineral and peat solids in run-off. These factors were adjudged to have led to slight to moderate, negative impacts of temporary to short-term duration, measured as a reduction of High to Good or Moderate Status (i.e. to Q4 or Q3-4). These impacts would have been largely confined to the 4 minor streams draining the wind farm site and would not have carried over into the main channel at (B1, EPA Forde West of Pollnaboy) or if so only to the upper EPA site referenced above, i.e. in the years between the 3-year EPA survey cycles i.e. between 2003 and 2006. This would have been assisted by the (i) the relatively gently sloping nature of the site which would have reduced the opportunity for erosion of exposed sub-soils and peat, (ii) by silt control measures employed at the time and (iii) by the steep and eroding nature of the streams draining the site which would have dispersed and diluted any nutrients and solids generated exiting the wind farm site. By 2006 at the end of the construction phase all three Boleyneendorrish sites were giving a High Status result, including a Q5 at the site

nearest the wind farm. This adds weight to the contention that any impact would (i) have most likely been confined to the minor tributaries and (ii) any impact on the main channel, had it occurred, would most likely have persisted for at most 1-3 years, and been confined to the upper reaches. For these reasons, combined with the long hydrological pathway between the wind farm and the SAC, the Project is considered not likely to have had an effect on this site during the construction phase.

During the operation phase, when there was relatively few nutrient and silt generating activities undertaken on site, impacts in the Boleyneendorrish catchment would also have been at most minor-negative and again confined largely to the 4 small streams draining that part of the site, with any impact registered in the main channel of the river, likely confined to the upper EPA station. This includes, access road repairs and up-grades undertaken in 2014 for which specific silt control measures were recommended.

The decommissioning stage will see minimal on-site disturbance, with tracks, repositories and drains being left in place and only the turbine above-ground components and Derrybrien Substation foundations removed. These operations will require minor local strengthening of tracks to handle cranes but not within the area of the wind farm draining to the Boleyneendorrish River. Overall, these operations are expected to only have minor, negative and temporary impacts that will be confined to the four small streams draining to the Boleyneendorrish and will not impact the main river, even in the absence of mitigation.

The Owendalulleegh River which was impacted by the peat slide does not influence or affect Ballylee turlough.

The Project has not had nor is likely to have any effect on this SAC.

4.5.13 Ballinduff Turlough SAC (002295)

Ballinduff Turlough is situated in a narrow basin in the limestone lowlands of south Co. Galway, 5 km north-east of Gort. It is part of the Coole Lough complex of lakes and turloughs. The hydrology of the site is probably controlled by a complex of swallow holes and subsidence near Coolfin. During floods the turlough drains overland towards Coole Lough. The SAC is located approximately 400 m north of the Coole-Garryland Complex SAC.

The turlough is late-draining and a pool persists into June or July and re-floods easily. There is a marshy hollow in the middle of the southern section which receives an inflow of water from the south.

The M18 motorway and the Galway-Limerick railway line run between Ballinduff Turlough SAC and the Coole-Garryland Complex SAC. This SAC is not affected by the Boleyneendorrish or Owendalulleegh Rivers and there is no impact pathway between the Project and this SAC. It can be concluded the Project has not had nor is likely to have any effect on this SAC.

4.5.14 Coole-Garryland Complex SAC (000252)

The wind farm project is hydrologically linked to this SAC via the Boleyneedorrish River (c. 22 km hydrologically connection) and the Owendalulleegh River (c. 30 km hydrological connection). The Boleyneendorrish and the Owendalulleegh flow west of the wind farm site, the latter discharging to Lough Cutra and the former joining a nexus of tributaries and dropping underground into the karst geology just north east of Gort. The outflow from Lough Cutra, the Beagh River drops underground in the Punch Bowl and emerges again as the Cannahowna River which then flows north to Gort. Thereafter, known as the Gort River, it flows north before dropping underground at Pollatoophil at Castletown and emerges west north west near Kiltartan where it is joined by the combined flows of the Boleyneendorrish and Kilchreest Rivers which drain the northern slopes of the Slieve Aughty Mountains. All these underground watercourses discharge to the sea at Kinvarra Bay.

The Boleyneendornish joins the Kilchreest River in the Carrowbaun, Newhall and Ballylee Turloughs SAC. The Kilchreest then flows underground west for a distance of approximately 3 km before emerging in the northern part of the Coole-Garryland SAC.

The Gort River disappears underground at Castletown and is shown to have underground connection with Kiltartan, Coole, Caherglassaun and Cahermore. The Coole-Garryland Turlough has potential groundwater connections with Caherglassaun Turlough and possibly direct to Galway Bay in the Kinvarra area and possibly Cahermore Turlough. Caherglassaun has through dye tracing been connected to the springs near Dungory in Kinvarra and also to Cahermore Turlough.

The Cannahowna/Gort river goes underground for approximately 900 m, emerges briefly and then goes underground again before emerging in the northern part of the Coole-Garryland SAC. The Kilchreest (Ballylee River) which emerges from an underground channel flows south for approximately 300 m before flowing into the Cannahowna River. This river then flows south as the Kilchreest River along a surface water channel before entering Coole Lough.

While the peat slide initiated on October 16th, 2003, the main mobilisation of peat down the river valley didn't begin until after heavy rainfall on October 30th. In the days immediately following this, beginning on November 1st 2003 and continuing until January 22nd 2004, Galway County Council (GCC) collected and analysed water samples for a range of physico-chemical parameters including suspended solids, turbidity and colour, from the upper reaches of the Owendalulleegh at Black Road Bridge down through the river until the last bridge 1.5 km upstream of Lough Cutra (Killafeen Bridge), and downstream of Lough Cutra in the Beagh River, and the intake for the Gort Water Supply (the Canahowna River). In addition, for a shorter period, from November 3rd to November 10th colour only was also measured in water samples from Kiltartan and the Coole River, and the intake for the Kinvara water supply scheme. These data demonstrate (i) a pronounced decline in solids concentrations from the upper reaches on the Owendalulleegh in the main impacted tributary between the wind farm site and Flaggy Bridge, down through the 22 km of the river before it enters Lough Cutra and (ii) the very important role that Lough Cutra then played in intercepting suspended solids from the Owendalulleegh before they reached the lake outlet in the Beagh River. For

example, on November 1st, while the solids concentration at Flaggy Bridge on the impacted tributary, 3.3 km below the slide, was 1,410 mg/l, the concentration at Killafeen Bridge 1.5 km upstream of Lough Cutra was just 44 mg/l. On November 3rd when the solids concentration was 54 mg/l at the latter site, it was just half that concentration (27 mg/l) at Cahill's Bridge downstream of Lough Cutra on the Beagh River. By November 5th, the suspended solids concentration at Cahill's Bridge had risen to 32 mg/l and the turbidity to 45.2 NTU (Nephelometric Turbidity Units), which were the highest concentration of either parameter measured downstream of Lough Cutra over the following weeks. Thereafter, turbidity levels, which were a good proxy for suspended solids in the data, dropped steadily and consistently, and by November 18th they had fallen to 10.5 NTU and on the four subsequent occasions on which they were measured, up to and including January 22nd 2004, they averaged around 5 NTU which would have been equivalent to an even lower suspended solids concentration. On the same occasions the turbidity levels in the Gort Water Supply Intake on the Beagh River were always slightly lower. Turbidity and suspended solids were generally not measured at sites downstream of Gort or in Kinvarra at the same time. However, when suspended solids were at their highest downstream of the Beagh River between November 3rd and November 10th colour, which also showed a good correlation with turbidity was measured at Kiltartan, the Coole River and the Kinvarra intake. The colour levels at the Kiltartan and Coole sites which are hydrologically very similar had a colour value roughly half that of the Gort Water Supply intake which clearly demonstrates that the water was being diluted approximately 1:1 by lower colour groundwater and the combined flows of the Boleyneendorrish and Kilchreest Rivers, neither of which was impacted by the peat slide. This would mean a further reduction in already low turbidity and suspended solids levels. Finally, at Kinvarra, the colour level was only about 25% of what was measured at the Gort Water Supply Intake, pointing to a further significant dilution in turbidity and colour due to the influence of groundwater influx in the 7-8 km between the Coole-Garrylands wetland complex and Kinvarra. Corroborating the trend in colour, the average turbidity for the period November 5th to November 10th at the same sites were: 38.6, 25.2, 9.6, 7.9 and 2.3 at Cahill's Bridge, Gort Water Supply Intake, Kiltartan, Coole River and Kinvarra respectively, the corresponding suspended solids at all these sites would have been significantly lower during the same period. These data, taken as a whole, point to a relatively short period of 2 to 3 weeks when elevated turbidity/suspended solids and colour levels in the Owendalulleegh spilled over into the Gort-Kinvarra system but thereafter resumed what were probably more representative seasonal trends in the system for all these parameters. The data also reveals a very rapid decline in the influence from the peat slide from the Black Road Bridge, down through the 22 km of the Owendalulleegh as far as the lake, a subsequent dampening and settlement effect in the lake and thereafter a subsequent decline in all concentrations moving down that system due to additional sedimentation but especially due to the mixing of low solids, low colour groundwater and surface waters from the two other main river systems. The minor increase in suspended solids involved, combined with its short duration and its occurrence at the least biologically active time of the year means that the impact of the slide on the Coole-Garrylands Wetland Complex was likely to have been negligible and not resulted in a significant effect on the site.

Assessment of the potential impacts of both the operation phase and decommissioning phase of the Project have concluded that any impact on water quality would be minor and temporary to short-term and largely confined to the minor streams immediately draining the wind farm and OHL corridor with little or no impact on main channels of the Owendalulleegh and Boleyneendorrish. There would be no effect on Lough Cutra or watercourses or wetland downstream of the lake, even in the absence of mitigation, given the very large distance along the hydrological pathway between the wind farm and the lake. It is considered that the Project has not had nor is likely to have any significant effect on this SAC.

4.5.15 Coole-Garryland SPA (004107)

This site is of international importance for whooper swan (*Cygnus Cygnus*) which use the site for both feeding and roosting purposes, though the flock also visits other feeding areas outside of the site.

Construction phase / peat slide

The potential for impacts to have occurred on the Coole-Garryland Complex owing to the peat slide in 2003 is described in Section 4.5.14. For the reasons stated above it is considered that the slide would not have resulted in significant effects on the habitats supporting the Special Conservation Interest of this SPA.

Operation phase

The Scottish Natural Heritage Guidance (2016) references a core foraging range for whooper swan from roost sites during the winter season of less than 5 km. The purpose of the guidance is to help identify 'connectivity' between development proposals and Special Protection Areas..

Whooper swan is a species that can be vulnerable to collision with operating wind turbines. Whooper swan was not recorded during vantage points watches over the wind farm site during the winter months.

The wind farm site is situated over 13.7 km from this SPA and has never contained nor is likely to contain suitable foraging or roosting habitat for this species.

Whooper swan is not expected to fly through the wind farm with any regularity, therefore it is considered not likely that the Project has or will have any effect on this population of whooper swan.

4.5.16 Caherglassaun Turlough SAC (000238)

Caherglassaun Turlough SAC (approximately 2 km from Coole-Garryland SAC and 5 km from Kinvara, approx. 17 km downstream of the outfall from Lough Cutra)

Caherglassaun is a large lake located 6 km north-west of Gort and 5 km south-east of Kinvarra in the low-lying farmland of east Co. Galway. Situated in a natural depression just 2 km to the north-west of Coole Nature Reserve, this site comprises a permanent lake at its core, while the rest of the basin functions as a turlough. At times of high water, the site can flood to a depth of 10-15 m. Because of its proximity to sea-level, the lake

fluctuates 30 cm or so in a tidal cycle, but it is delayed significantly behind tidal height at Kinvarra.

Caherglassaun Turlough SAC is designated for the Annex I habitats - Turloughs [3180], Rivers with muddy banks with Chenopodion rubri p.p. and Bidention p.p. vegetation [3270] and the Annex II Species *Rhinolophus hipposideros* (Lesser Horseshoe Bat) [1303]. A bat roost exists within the site.

The Gort River disappears underground at Castletown and is shown to have underground connection with Kiltartan, Coole, Caherglassaun and Cahermore. The Coole-Garryland Turlough has potential groundwater connections with Caherglassaun Turlough and possibly direct to Galway Bay in the Kinvarra area and possibly Cahermore Turlough. Caherglassaun has through dye tracing been connected to the springs near Dungory in Kinvarra and also to Cahermore Turlough.

As described in the assessment of the Coole-Garyland SAC (Section 4.5.14) the Owendalulleegh River was impacted during the peat slide. The slide material travelled downstream into the lower reaches of the river, eventually reaching Lough Cutra, approximately 22 km downstream. The bulk of the escaped material settled out in the approximately 4 km^2 lake area of Lough Cutra. The finer buoyant material is likely to have over time possibly during successive floods been carried through Lough Cutra in the Beagh/Gort River and the suspended solids discharged through the various downstream turloughs at Castletown, Kiltartan, Coole-Garryland, Caherglassaun, Cahermore and eventually into Galway Bay via submarine springs and shoreline springs at Kinvarra. The impact of this sediment on the flow regime of these turloughs would have been insignificant as it is likely given its fine nature to be flushed through the system over time and certainly not likely to deposit in the higher flow areas such as at swallow hole outlets.

The minor increase in suspended solids involved, combined with its short duration means that the impact of the slide on this site was likely to have been negligible.

Given the distance between the Project and the SAC there is no potential for an effect on the lesser horseshow bat population within this SAC for reasons discussed in Sections 4.5.8 and 4.5.9..

It is considered that the Project has not had a significant effect on this SAC following the peat slide. Given the distance between the Project and the SAC it is considered that there is no potential for the continued operation or decommissioning phases of the Project to have any effect on the SAC.

4.5.17 Cahermore Turlough SAC (002294)

Cahermore Turlough SAC is situated in the limestone lowlands of south Co. Galway, about 5 km north-west of Gort and 5.5 km south-east of Kinvara. The site is designated for the Annex I habitat - Turloughs [3180] and is part of a series of lakes and turloughs in the region. The nearest is Caherglassaun Turlough, the water levels of which are slightly higher than Cahermore.

The turlough is on the dry end of the spectrum, and there is no standing water in summer except for a few small ponds dug for cattle. A few collapse features occur in the drift on the southern side with a regular swallow-hole at the edge of the flooded area. Another hole occurs in the south-east corner. The turlough appears to flood largely from the southern side.

The Gort River disappears underground at Castletown and is shown to have underground connection with Kiltartan, Coole, Caherglassaun and Cahermore. The Coole-Garryland Turlough has potential groundwater connections with Caherglassaun Turlough and possibly direct to Galway Bay in the Kinvarra area and possibly Cahermore Turlough. Caherglassaun has through dye tracing been connected to the springs near Dungory in Kinvarra and also to Cahermore Turlough.

As described in the assessment of the Coole-Garyland SAC (Section 4.5.14) the Owendalulleegh River was impacted during the peat slide. The slide material travelled downstream into the lower reaches of the river, eventually reaching Lough Cutra, approximately 22 km downstream. The bulk of the escaped material settled out in the approximately 4 km^2 lake area of Lough Cutra. The finer buoyant material is likely to have over time possibly during successive floods been carried through Lough Cutra in the Beagh/Gort River and the suspended solids discharged through the various downstream turloughs at Castletown, Kiltartan, Coole-Garryland, Caherglassaun, Cahermore and eventually into Galway Bay via submarine springs and shoreline springs at Kinvarra. The impact of this sediment on the flow regime of these turloughs would have been insignificant as it is likely given its fine nature to be flushed through the system over time and certainly not likely to deposit in the higher flow areas such as at swallow hole outlets.

The minor increase in suspended solids involved, combined with its short duration means that the impact of the slide on this site was likely to have been negligible.

It is considered that the Project has not had a significant effect on this SAC following the peat slide. Given the distance between the Project and the SAC it is considered that there is no potential for the continued operation or decommissioning phases of the Project to have any effect on the SAC.

4.5.18 Galway Bay Complex SAC (000268)

Situated on the west coast of Ireland, this site comprises the inner, shallow part of a large bay which is partially sheltered by the Aran Islands. A diverse range of marine, coastal and terrestrial habitats, including several listed on Annex I of the E.U. Habitats Directive, occur within the site, making the area of high scientific importance.

Galway Bay South holds a very high number of littoral communities (12). They range from rocky terraces, to sandy beaches with rock or sand dunes behind. The intertidal sediments of Galway Bay support good examples of communities that are moderately exposed to wave action.

The Gort River disappears underground at Castletown and is shown to have underground connection with Kiltartan, Coole, Caherglassaun and Cahermore. The Coole-Garryland Turlough has potential groundwater connections with Caherglassaun

Turlough and possibly direct to Galway Bay in the Kinvarra area and possibly Cahermore Turlough. Caherglassaun has through dye tracing been connected to the springs near Dungory in Kinvarra and also to Cahermore Turlough.

As described in the assessment of the Coole-Garyland SAC (Section 4.5.14) the Owendalulleegh River was impacted during the peat slide. The slide material travelled downstream into the lower reaches of the river, eventually reaching Lough Cutra, approximately 22 km downstream. The bulk of the escaped material settled out in the 4km^2 lake area of Lough Cutra. The finer buoyant material is likely to have over time possibly during successive floods been carried through Lough Cutra in the Beagh/Gort River and the suspended solids discharged through the various downstream turloughs at Castletown, Kiltartan, Coole-Garryland, Caherglassaun, Cahermore and eventually into Galway Bay via submarine springs and shoreline springs at Kinvarra. The minor increase in suspended solids involved, combined with its short duration means that the impact of the slide on this site was likely to have been negligible.

It is considered that the Project has not had a significant effect on this SAC following the peat slide. Given the distance between the Project and the SAC it is considered that there is no potential for the continued operation or decommissioning phases of the Project to have any effect on the SAC.

4.5.19 Inner Galway Bay SPA (004031)

The Inner Galway Bay SPA overlaps with Galway Bay SAC. The site is a Special Protection Area (SPA) under the E.U. Birds Directive, of special conservation interest for the following species: Black-throated Diver, Great Northern Diver, Cormorant, Grey Heron, Light-bellied Brent Goose, Wigeon, Teal, Redbreasted Merganser, Ringed Plover, Golden Plover, Lapwing, Dunlin, Bar-tailed Godwit, Curlew, Redshank, Turnstone, Black-headed Gull, Common Gull, Sandwich Tern and Common Tern. 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.

The Gort River disappears underground at Castletown and is shown to have underground connection with Kiltartan, Coole, Caherglassaun and Cahermore. The Coole-Garryland Turlough has potential groundwater connections with Caherglassaun Turlough and possibly direct to Galway Bay in the Kinvarra area and possibly Cahermore Turlough. Caherglassaun has through dye tracing been connected to the springs near Dungory in Kinvarra and also to Cahermore Turlough.

As described in the assessment of the Coole-Garyland SAC (Section 4.5.14) the Owendalulleegh River was impacted during the peat slide. The slide material travelled downstream into the lower reaches of the river, eventually reaching Lough Cutra, approximately 22 km downstream. The bulk of the escaped material settled out in the 4km^2 lake area of Lough Cutra. The finer buoyant material is likely to have over time possibly during successive floods been carried through Lough Cutra in the Beagh/Gort River and the suspended solids discharged through the various downstream turloughs at Castletown, Kiltartan, Coole-Garryland, Caherglassaun, Cahermore and eventually into Galway Bay via submarine springs and shoreline springs at Kinvarra. The minor

increase in suspended solids involved, combined with its short duration means that the impact of the slide on this site was likely to have been negligible.

It is considered that the Project has not had a significant effect on this SPA following the peat slide. Given the distance between the Project and the SPA it is considered that there is no potential for the continued operation or decommissioning phases of the Project to have any effect on the SPA.

4.5.20 Barroughter Bog SAC (000231)

Barroughter Bog is a relatively small raised bog, situated on the shores of Lough Derg in Co. Galway, a few kilometres east of Woodford, and bounded in the north by the Cappagh River, which is downstream of the Duniry River which drains a tiny portion of the footprint of the wind farm to the east of the site. Two sites were surveyed for water quality in the Duniry catchment, which includes a short length of access track and just two turbines and associated peat repositories. This area of the site required no additional drainage and just a minor amount of tree felling as part of the construction phase. For these reasons the Project would have had a negligible impact on water quality in the Duniry River during construction and operation of the wind farm, and the decommissioning phase is likely to have even less impact, even in the absence of mitigation. This conclusion is borne out by the High Status (Q5 or Q4-5) that has being consistently recorded at EPA Station RS25D070200 DUNIRY - Bridge u/s Ballinasack Br every 3 years by the EPA from 1993 to 2017 (including in 2003 and 2006), while much farther down in the system at Cappagh Bridge (EPA Site RS25C030400 on the Cappagh River - Galway) conditions have been either Good (Q4) or Moderate (Q3-4) over the same period.

Barroughter Bog is over 22 km downstream of the wind farm and for the reasons given above it is considered not likely that the Project has had or will have any effect on this SAC based on the distance between the wind farm and the site and the nature of the qualifying feature.

4.5.21 Lough Derg, North-east Shore SAC (002241)

The Project is hydrologically linked to this site over a distance greater than 23 km. Given the distance from the wind farm site and the fact that the Duniry River drains a tiny portion of the footprint of the wind farm and there has been no significant impact on water quality in the Duniry River it can be concluded that the Project has not had nor is likely to have any effect on this SAC.

4.5.22 Pollagoona Bog SAC (002126)

A small section of the Derrybrien to Agannygal 110kV OHL corridor and Agannygal Substation drain to Lough Atorick which is within one of the sub-basins of the Bleach River (35.2km2 in area) which flows on into Lough Graney which in turn flows into the lower portion of Lough Derg at Scarriff Co. Clare, part of the River Shannon catchment.

Pollagoona Bog is a small blanket bog that shows some features of a raised bog and is located 300 m south-east of Lough Atorick. The bog is situated on a shallow saddle, on flat to gently sloping land surrounded by conifers at an altitude of 150 m. A stream (Pollagoona Mountain) which delineates the southern boundary of the site drains into Lough Atorick.

There is no impact pathway between the Project and this SAC. The Project has not had nor is likely to have any effect on this SAC.

4.5.23 Glendree Bog SAC (001912)

Glendree Bog SAC is designated for the Annex I habitat Blanket bogs (* if active bog) [7130]. This site is within the Bleach River catchment but is over 6 km upstream of the Graney River which flows out from Lough Graney.

There is no impact pathway between the Project and this SAC. The Project has not had nor is likely to have any effect on this SAC.

4.5.24 Loughatorick South Bog SAC (001912)

Lough Atorick South Bog SAC is designated for the Annex I habitat Blanket bogs (* if active bog) [7130]. This site is within the Bleach River catchment but is 9 km upstream of the Graney River which flows out of Lough Graney and ultimately discharges to the River Shannon.

There is no impact pathway between the Project and this SAC. The Project has not had nor is likely to have any effect on this SAC.

4.5.25 Lough Derg (Shannon) SPA (004058)

The Derrybrien to Agannygal 110kV OHL corridor drains mainly to the Owendalulleegh catchment but the lower 2.26 ha flow south to a small unnamed stream which eventually enters the north shore of Lough Atorick. This also receives the drainage from the Agannygal Substation at the southern end of the OHL corridor. Lough Atorick is within one of the sub-basins of the Bleach River (35.2 km^2 in area) which flows on into Lough Graney which in turn flows into the lower portion of Lough Derg at Scarriff Co. Clare, part of the River Shannon catchment.

At the southern end of the OHL corridor, draining to Lough Atorick, there was only a very small amount of tree felling required to prepare the site, including 2.26 ha on the OHL corridor and another 1.6 ha for the Agannygal Substation, amounting to 3.86 ha in total. This land, flowing via a nexus of small drains joins an unnamed 1st order stream (EPA Segment code: 25_1002, catchment area = 2 km^2) which flows more of less due south to the northern shore of Lough Atorick. By the time nutrients and or solids derived from the tree felling would have reached this stream they would likely have been much diminished due to biological uptake and sedimentation, so that no impact on the water quality would likely have been detectable as a result at sample site OHL 2 (see to Figure 2) on the small stream in question during the construction phase.

During the operation phase there would at most have been a requirement for some limited cutting back of tree regrowth along the lower 2.26 ha of the OHL line to maintain clearance. The trees are cut at the base which would have prevented the generation of nutrient and suspended solids run-off.

Finally, decommissioning will see all the above ground structures removed but the substation hardstand and associated access tracks will be retained. The substation foundations will be removed. There are four structures on this section of OHL and foundations will be left in-situ. The suspended solids potentially de-rived from these activities will in the main have dissipated in the small drains and between the site and Lough Atorick and any that reach this 95 ha water body will rapidly sediment out there. Any residual nutrients derived from the substation site will also be diluted and adsorbed biologically if they reach the lake. The outflow from Lough Atorick eventually reaches Lower Lough Derg at Scarriff by which time the catchment is 297 km^2. In a catchment of such a large area, land use alterations of the comparatively small scale as those associated with the Agannygal Substation and associated portion of OHL could have no impact on the Lough Derg Shannon SPA which is over 34 km downstream of the Project. This is supported by the survey results for a site in the middle reaches (on the Graney River at Aughadarreen Bridge, EPA Station RS25G040100) having mainly Good or High Status high status water quality (Q4-5 or Q4) from 1999-2017, while another in the very lower reaches in Scarriff (400m d/s Scarriff Bridge, EPA Station RS25G040400) had mainly Poor or Moderate Status in the same period (i.e. Q3 or Q3-4). Clearly, this reduction in quality toward the lower end of the catchment was entirely independent of what was occurring upstream of Lough Atorick in the same time interval.

The Project is also hydrologically link to this SPA via the Duniry River which drains a tiny portion of the wind farm footprint. Given the distance from the wind farm site and the fact that there has been no significant impact on water quality in the Duniry River it can be concluded that the Project has not had an effect on this SPA.

The Project has not had nor is likely to have any effect on the Special Conservation Interests of Lough Derg (Shannon) SPA or the habitats on which they rely on.

4.5.26 Derrycrag Wood Natura Reserve SAC (000261)

Derrycrag Wood Natura Reserve SAC is designated for the Annex I habitat Old sessile oak woods with Ilex and Blechnum in the British Isles [91A0]. This site is situated over 10 km from the Project at its nearest point and is within a different river catchment (Woodford River catchment) to the Project.

Based on the qualifying feature of this SAC it has been determined that there is no impact pathway between the Project and this site.

It can be concluded that the Project has not had nor is likely to have any effect on this SAC

4.5.27 Pollnaknockaun Wood Natura Reserve SAC (000319)

Pollnaknockaun Wood Natura Reserve SAC is designated for the Annex I habitat Old sessile oak woods with Ilex and Blechnum in the British Isles [91A0]. This site is situated over 11 km from the Project at its nearest point and is within a different river catchment (Woodford River catchment) to the Project.

Based on the qualifying feature of this SAC it has been determined that there is no impact pathway between the Project and this site.

It can be concluded that the Project has not had nor is likely to have any effect on this SAC.

4.5.28 Rosturra Wood SAC (001313)

Rosturra Wood SAC is designated for the Annex I habitat Old sessile oak woods with Ilex and Blechnum in the British Isles [91A0]. This site is situated over 13.7 km from the Project at its nearest point and within different river catchments to the Project. The SAC comprises two separate areas approximately 200 m apart. One site is within the Woodford River catchment and the other within the Moannakeeba River catchment.

Based on the qualifying feature of this SAC it has been determined that there is no impact pathway between the Project and this site.

It can be concluded that the Project has not had nor is likely to have any effect on this SAC.

4.5.29 Cloonmoylan Bog SAC (000248)

Cloonmoylan Bog SAC is designated for the Annex I habitat Active raised bogs [7110]. This site is situated over 13.7 km from the Project at its nearest point and is within a different river catchment to the Project.

Based on the qualifying feature of this SAC it has been determined that there is no impact pathway between the Project and this site.

It can be concluded that the Project has not had nor is likely to have any effect on this SAC.

4.5.30 Ardrahan Grassland SAC (002244)

Ardrahan Grassland SAC is designated for the Annex I habitats Alpine and Boreal heaths [4060], Juniperus communis formations on heaths or calcareous grasslands [5130] and Limestone pavements [8240]. This site is situated over 14.6 km from the Project at its nearest point.

Based on the qualifying features of this SAC it has been determined that there is no impact pathway between the Project and this site.

It can be concluded that the Project has not had nor is likely to have any effect on this SAC.

4.6 Potential cumulative effects

In order to take account of in-combination or cumulative effects, plans and projects that are completed, approved but uncompleted, or proposed (but not yet approved) should be considered in this context (European Commission, 2018).

4.6.1 Overview

Based on consideration of the receiving environment existing/approved projects and activities have been identified for cumulative effects assessment.

The assessment of cumulative effects on the Slieve Aughty Mountains SPA is considered in Section 5.7.1 of the Natura Impact Statement. The assessment of cumulative effects on Lough Cutra SPA is considered below along with other SACs and SPAs with water-dependent Qualifying Interests or Special Conservation Interests that are located downstream of the Owendalulleegh River catchment. The findings of the assessment with respect to Lough Cutra SPA are summarised in Section 5.7.2 of the Natura Impact Statement.

The following projects/activities were considered as relevant for cumulative effects assessment.

- Turbary activities
- Wind Farms in Slieve Aughty Mountains
- Adjacent coniferous forestry plantations
- Planting in lieu of felling on wind farm site
- Overhead Transmission Lines
- Gort Regional Water Supply Scheme
- Flood Relief Schemes
- M18 Motorway Project
- Quarries/Sand extraction
- Works to Beagh Bridge

Turbary activities

An area of approximately 67 ha of drained turbary land occupies the eastern part of the wind farm site. Turbary lands also extend immediately beyond the site to the east covering an area of approximately 15 ha. There are 136 turbary plots within or immediately adjacent to the windfarm site, 22 are partially or fully outside the wind farm site boundary. Individual plot sites range in area between approximately 0.55 ha and 1.10 ha.

It is not known where the turbary rights were exercised prior to construction. However, the original Phase 1 EISs noted that old and new turf banks and drainage channels could be

found throughout the site, that the turbary was used by a small number of local people with turbary rights on the site but at the time (1997), turbary activity was low level.[7]

Up until 2012, the extent of turf cutting carried out mechanically is not known but based on observations from wind farm staff on site, turf cutting by hand was carried out on a number of plots, normally in late Spring/early Summer. Since 2012, the level of turbary activity within the site appears to have increased and is currently carried out by hand and mechanical means using an excavator and hopper. Mechanical peat extraction is currently being carried out in approximately 35 of the 136 plots and not all of these are cut each year. The mechanical turf cutting has been mainly carried out using a Difco Bogmiser hopper machine.

A certain amount of turf harvesting is undertaken annually. Some of the turbary activity is close to peat drains while others are more remote. The former is more likely to be the source of some peat solids run-off, although the amounts are likely to be variable depending on weather conditions and the intensity of harvesting in any given year. Monitoring as part of the current study has only occasionally been able to distinguish the impact of turbary from other catchment activities, such as forestry clear felling. These impacts have been discernible as a reduction in Q-rating to Moderate Status (Q3-4) in some of the small streams draining the southern side of the wind farm toward the Owendalulleegh River but not in the main channel. Turbary, therefore is not likely to have been exerting a cumulative impact on any of the downstream SACs and SPAs with water-dependent Qualifying Interests or Special Conservation Interests in any of the 3 catchments draining the wind farm during construction or operation as this has coincided with mainly High Status water quality on the main channel of the Boleyneendorrish, Owendalulleegh (except for 2003 following the peat slide) and Duniry Rivers, throughout this period.

In April 2020, a peat disturbance was noticed in the turbary area of the wind farm site. The exact date of the original occurrence of the disturbance is unknown. The disturbance was located in the southern portion of Turbary Plot No 160 which is located south of the central turbary access track in an area between turbines T34, T37 and T38. The area of peat disturbed is approximately 0.25 ha. The peat disturbance mass was heavily saturated with water.

Following inspection by geotechnical specialists, it was concluded that no wind farm related activity could have contributed to the peat disturbance and that it was likely to have been caused by a combination of:

- Concentrated groundwater pressures in the peat within the turbary plot
- Undercutting for the drain along the toe of the slope
- Loading due to the more recent use of mechanical harvesting in the peat involving large hoppers

[7] EIS submitted with GCC Reg. Ref. 97/3470 / ABP Reg. Ref. PL.07.106290 – 'the Phase 1 EIS'

Further details in relation to this incident are provided in Chapter 10 of the rEIAR–(Soils, Geology and Land). The peat disturbance did not give rise to any discharge of materials to watercourses. This event has not had a cumulative effect with the wind farm project.

The potential for ongoing impacts from a peat slide due to turbary

A peat stability risk assessment (refer to Chapter 10 Soils, Geology and Land) was carried out in the area of turbary in and immediately adjacent to the wind farm, which concluded that without mitigation the chances of peat failure occurring in the turbary plots ranged from Possible to Likely to Possible to Very Likely depending on the plots involved. The corresponding peat stability impacts were estimated to range from High and Significant, and Medium to High and Moderately Significant. Given that the active turbary plots are only cut seasonally once a year in late spring/early summer, the frequency of the stability impact is Occasional and because peat extraction within any turbary plot only takes a few days, the duration of the impact is described as Brief to Temporary. If the failure involved was on the same scale as the one which occurred in April 2020 then cumulative impacts on the aquatic habitats in SC7(a) tributary (see Figure 5) of the Owendalulleegh River would be Slight, Negative and Temporary in duration. However, if a major failure occurred, at the level of the 2003 peat slide then the cumulative impacts would be Profound or Very Significant, Negative and potentially Short-term to Medium term in duration, impacting water quality and fisheries in the Owendalulleegh via the SC7(a) tributary which is the watercourse draining the turbary area.

Following the risk assessment, a series of significant mitigation measures (refer to Chapter 10 Section 10.4.5.2.4) was drawn up for future mechanical peat extraction in the turbary plots in order to *reduce the likelihood of a peat failure and the cumulative effect of the activities on the stability of the peat in the Project area to an acceptable level over the remaining operational life of the wind farm and during decommissioning*. The assessment concluded that once these mitigation measures were implemented, the likelihood of a peat failure occurring dropped to Low.

In the absence of mitigation for turbary activities on the wind farm site a peat slide could potentially occur, however it is considered unlikely that this would result in significant effects on Lough Cutra SAC or SPA or any of the SACs and SPAs with water-dependent Qualifying Interests or Special Conservation Interests downstream of Lough Cutra. This is based on the Qualifying Features and Special Conservation Interests of these sites and the findings of the impact assessment of the peat slide which occurred in 2003.

With the implementation of mitigation measures for turbary activities the risk of a peat slide is considered to be low. However, even in the absence of mitigation the cumulative impacts associated with turbary activities on the wind farm site are considered not likely to result in significant effects on any European site(s).

Wind Farms in Slieve Aughty Mountains

The Sonnagh Wind Farm

This wind farm is a small development of 9 turbines situated on high ground immediately east of Lough Belsrah about 3.4 km north west of the Derrybrien Wind Farm. Part of the site drains into the upper tributaries of the Boleyneendorrish River at a point upstream of B3 and EPA B1 (RS29B040100, Ford west of Pollaboy) (Refer to Figure 2) the latter coinciding with B5 in the current study. Biological water quality results at both sites have recorded High Status (Q4-5 or Q5). The EPA B1 site results returning High Status results consistently for over 2 decades. Therefore, there has been no cumulative impact from this project on aquatic habitats during construction, or operation of the windfarm, certainly not farther downstream on the Boleyneendorrish. The same will be the case during decommissioning of the Derrybrien Wind Farm, given the minimalist approach that is being taken in that process. This will be the case with or without mitigation given the large distances between these operations and the nearest SACs or SPAs with water-dependent Qualifying Interests or Special Conservation Interests respectively that are located downstream.

Keelderry Wind Farm

The site of this proposed wind farm is situated 3.5 km west of the Derrybrien Wind Farm. The project was abandoned in 2007 after the access tracks to the turbine sites were completed. The site drains to a small catchment due west of SC9 (Refer to Figure 5) which joins the main channel of the Owendalulleegh immediately upstream from EPA O3 RS29O010800 (Ford east of Chevy Chase Cottage). The latter, had always returned a High Status value except in 2003 after the peat slide at Derrybrien. The road construction at Keelderry did not take place until 2007 and therefore there was no cumulative impact with this project during construction of the Derrybrien Wind Farm that could have affected Lough Cutra or any of the SACs or SPAs with water-dependent Qualifying Interests or Special Conservation Interests respectively that are located downstream of Lough Cutra given the distances involved coupled with the very limited extent of the Keelderry development. As the latter was abandoned in 2007, operation phase and decommissioning phase cumulative impacts effectively do not arise.

Adjacent coniferous forestry plantation

Commercial planted coniferous forestry occupies much of the land area of the upper catchments of the Owendalulleegh, Boleyneendorrish and Duniry Rivers. These very extensive areas are drained by a network of small streams which lead down into the valleys of the three rivers and form their main channels. These latter channels have been monitored for generally 30 or more years by the EPA while the upper channels have not been monitored by virtue of their small size. Every year large tracts of these plantations are clearfelled and/or replanted. Despite this however, water quality in the main channels of all three river systems has generally remained High Status (Q4-5 or Q5) indicating that forestry management does not appear to be negatively affecting water quality in the main channels, even at upper channel sites close to where the afforested side tributaries join

the main channels. An exception to this was on the Duniry where the Q-rating dropped from High to Good between 2003 and 2006. However, the next site downstream remained High Status from 1993 to 2017 indicating that there was no cumulative impact from forestry plantation and the Derrybrien windfarm detectable in the Lough Derg SAC during construction or operation of the wind farm and that will therefore also be the situation when the wind farm is decommissioned given the minimal disturbance likely to arise during that activity, the very small area of the windfarm draining to the Duniry and the very large distance between it and Lough Derg. There was also major drop in quality in the Owendalulleegh in 2003 but that was due to the peat slide, not forestry management. Monitoring work as part of the current study has in some instances attributed reductions in water quality in the smaller upland tributaries to ongoing forestry management activities, but these effects have generally not been detectable in the main channels. These patterns in water quality monitoring results strongly suggest that forestry management, while locally impactful in some instances in the smaller watercourses immediately draining the plantations, have not negatively impacted the larger watercourses farther downstream on any of the three main river catchments and therefore no cumulative negative impacts are likely to have occurred during the construction and operation phases of the windfarm and none are anticipated to occur during the decommissioning of the site, even in the absence of mitigation. In the case of the Agannygal Substation and southern end of the OHL, where a total of just 3.38 ha of forestry was felled during construction in an otherwise very large area of forestry in the catchment of Lough Atorick into which these lands drain, cumulative impact from forestry felling would have been imperceptible on the receiving waters of Lower Lough Derg given the very large distance between Anannygal in the upper catchment and Lough Derg. This would also have been the case during the operation phase of the project any will also be the case at the decommissioning stage, with or without mitigation.

Planting in lieu of felling on wind farm site

Coillte planted forestry in Counties Roscommon and Tipperary in order to compensate for the forestry felled on the Derrybrien Wind Farm site. These comprised six planting areas, three in Co. Roscommon in the Upper River Shannon Catchment and three in Co. Tipperary in the Lower Shannon Catchment (see Figures 9 and 10). Those areas in the Upper Shannon Catchment are not situated in any European sites, nor are they close enough to any designated sites downstream to have an effect on one. The Co. Tipperary sites are either in or very close to the Lower River Shannon SAC (code: 002165) and all three sites are located within the now designated Slievefelim to Silvermines Mountains SPA (code: 004165) (notice of designation was in 2007). As the Slievefelim to Silvermines Mountains SPA is designated for hen harrier the assessment of cumulative effects on this site is discussed under the assessment of cumulative effects on the Slieve Aughty Mountains SPA, also designated for hen harrier, in Section 5.7.1.

All of the Co. Roscommon plantings are on or adjoining 1st order streams and two flow into channels that have been extensively drained/straightened downstream (Oldtown and Brackloon). Moreover, one of the plantings, Ardcocoran, is almost 3.8 km from the 1st order channel that it most likely eventually drains to. The drains around that plot seem to blind-end after short distances and it is difficult to be certain of the direction of eventual

flow but based on contours on the OSI Discovery series maps and EPA online mapping, it seems to be into Lough Gara in Co. Sligo. All three plantings are on mineral soils so the risk of phosphorus leaching as a result of planting is likely to have been low. Moreover, the flat terrain also reduced the risk of solids erosion. Overall impact from these works is assessed as having been imperceptible or slight in terms of water quality and imperceptible in terms of fisheries.

Two of the three Co. Tipperary plantings (Folimahonmore and Coonmore) are either bordering (Folimahonmore) or partly overlapping with the Lower River Shannon SAC boundary (Coonmore), while the Knocknabansha plot is 2.4 km upstream of the SAC boundary. The Lower River Shannon SAC is designated for the Annex II species freshwater pearl mussel (*Margaritifera margaritifera*), sea lamprey (*Petromyzon marinus*), river lamprey (*Lampetra fluviatilis*), brook lamprey (*Lampetra planeri*), otter (*Lutra lutra*) and Atlantic salmon (*Salmo salar*). Of these, the pearl mussel does not occur in the Bilboa and it is less likely that either river lamprey or sea lamprey occur that far up the system or are scarce there due to barriers to migration farther downstream. Salmon are the most plentiful Annex II species in the main channel of the Bilboa adjoining the Coonmore forestry plots, with brook lamprey also likely to occur. Salmon are almost certainly absent from the 1st order stream adjoining the other two plots, but brook lamprey could be present.

Knocknabansha and Folimahanmore plantings are adjoining or bordering 1st order streams, while the Coonmore planting (both plots) are bordering a 4th order river (the Bilboa) one set back 10-15 m from the edge the other with a 35 m broadleaf edge. One of the Coonmore plots (the larger one) has 20% of its area over blanket peat, which would have resulted in increased leaching of soluble phosphorus if fertilisation occurred during planting time. However, the fact that any drainage arising would have entered a 4th order channel, means that it would have had minimal impact on the ecology of that channel, which was High Status at the time. The first order stream bordering Folimahonmore plot flowed a further 0.25 km to join a second order stream which flowed a further 0.31 km to reach the main 4th order channel of the Bilboa, 0.7 km upstream of the smaller and more upstream Coonmore plot. It would have had no impact on the main channel of the Bilboa and no more than imperceptible to slight impacts on the water quality of the two lower order streams given that there was only a low risk of phosphorus leaching during the planting, as the soils are mineral. The Knocknabansha planting is over 90% mineral soil and 10% blanket peat. The 1st order stream within the site was Poor Status (Q3) before the planting and the adjoining 1st order stream was Moderate Quality (Q3-4), so any impact arising would be expected to have been slight at worst and more likely would have been masked by the existing impaired quality. It would have had no impact on the SAC, a further 2.2 km downstream.

Neither set of plantings can have any cumulative impacts on the Derrybrien Wind Farm project. The Roscommon sites are more than 128 km upstream of the northern end of the Lough Derg (Shannon) SPA (004058) and 135 km upstream of where the Duniry River reaches North East Shore Lough Derg SAC (002241), as well as 185 km upstream of where the Bleach River eventually joins the Lower Shannon in Lough Derg. The Co. Tipperary sites in the Bilboa River catchment discharge to the Lower River Shannon via the Mulkear River which at that point is more than 35 km downstream of where the Bleach

River (Lough Atorick catchment) eventually joins Lough Derg near Scarriff and 53km downstream of where the Duniry River eventually joins the Lough Derg NE Shore SAC, and 19 km downstream of the Lough Derg (Shannon) SPA (004058). Thus, while all the sites are connected eventually to the River Shannon catchment, they are all too far from each other to possibly have a cumulative effect.

Overhead Lines

Moneypoint – Oldstreet 400 kV Line

This line was constructed prior to the Derrybrien Project so that no cumulative impact could have occurred during construction. The ground below the line had to be lowered between structure 28A and 29 to facilitate the stringing of the Derrybrien – Agannygal 110kV OHL which required localised earth movements. This is addressed in the Impacts Section (see OHL & Agannygal Substation and associated works). The line will be refurbished in 2020 and 2021 when the structures will be repaired and repainted. The concrete shear blocks, which are the above-ground concrete structures holding the feet of the pylons, will be re-capped, the structure foundations will not be touched. The two structures nearest the OHL corridor are 120 m and 280 m respectively away from the small stream that drains to the Owendalulleegh River from the central part of the OHL corridor. Moreover, they are readily accessible from nearby forest tracks which should minimise the potential for ground damage causes by tracking of works vehicles. Overall, the likelihood is that this operation will have negligible impacts on surface waters and no cumulative impacts with the Derrybrien Project.

The potential for cumulative impacts on the Slieve Aughty Mountains SPA owing to collision risk with OHLs is discussed in Section 5.7. The Derrybrien to Agannygal 110kV OHL is not considered a risk to the Special Conservation Interests from any other SPA and these species have not been recorded in the Project area during surveys between 2004 – 2020. Therefore there can be no cumulative impacts between the Project and the Moneypoint – Oldstreet 400 kV OHL.

Ennis – Shannonbridge 110 kV Overhead Line

The Ennis – Shannonbridge 110 kV OHL was installed in 1952 with some further structures installed in 1968. Refurbishment of one circuit on this line, Ennis – Agannygal, is scheduled for 2023/2024. The refurbishment works have no perceptible cumulative impact with respect to hydrology or hydrogeology.

These works will occur during the operation phase of the Agannygal Substation of the project within the Bleach/Lough Atorick catchment and given the absence of any activities in the sub-station likely to have a discernible impact on receiving waters during the operation phase, combined with the extensive area of the overall catchment and the very long intervening distance to the Lower Lough Derg SPA, no cumulative impact is anticipated to affect that site. As the works on the Ennis-Shannonbridge OHL will be completed beforehand, the cumulative impact of the decommissioning of the substation is not relevant in this instance.

The potential for cumulative impacts on the Slieve Aughty Mountains SPA owing to collision risk with OHLs is discussed in Section 5.7. The Derrybrien to Agannygal 110kV OHL is not considered a risk to the Special Conservation Interests from any other SPA and these species have not been recorded in the Project area during surveys between 2004 – 2020. Therefore there can be no cumulative impacts between the Project and the Ennis – Shannonbridge 110 kV Overhead Line.

Gort Regional Water Supply Scheme

The water supply from Gort is derived from a combination of both groundwater supplies and surface water sources, which at the time of the peat slide were in the ratio of approximately 3:7 groundwater to surface water. The surface water supply came from the Cannahowna River which emerges from a subterranean cavern (Polldouagh) on the west side of Gort. The Cannahowna River is a continuation of the Beagh River, Lough Cutra and the Owendalulleegh River. In the period after the peat slide the colour of the treated water in the supply increased, although the supply periodically registered very high colour levels at that time of year in any case. Galway County Council also reported an increase in the frequency of the back-wash cycle for the rapid sand filters in the treatment plant which was probably due to an increase in suspended solids in the surface water source caused by the peat slide. This persisted at the time for several weeks. However, at no time was the supply interrupted. The raw water sources currently supplying the town remain essentially the same as in 2003.

Flood Relief Schemes

The Galway Bay South East River Basin Flood Risk Management Plan (FRMP) has included structural measures for communities at significant flood risk identified through the CFRAM Programme. It also includes for ongoing maintenance of existing Flood Relief Schemes such as Gort and those already at the design and construction phase such as in the Gort Lowlands. It should be noted that impacts on local runoff waters from the wind farm project are imperceptible by the time they reach the Gort lowlands area at Ballylee, Ballyloughlin, Turlough, Kiltartan area and Lough Coole flood area and therefore have no potential for cumulative impacts on any of the SACs or SPAs with water-dependent Qualifying Interests or Special Conservation Interests respectively that are located downstream of the wind farm.

Local OPW Flood Relief Scheme Gort

In 1997, the OPW completed a local flood relief scheme in Gort to combat potential serious winter flooding events. The potential flooding impacts of the Derrybrien Wind Farm Project are assessed as not extending far enough downstream to impact on flood-prone areas such as Gort. Therefore, there is no cumulative impact arising with respect to hydrology and hydrogeology on any of the SACs or SPAs with water-dependent Qualifying Interests or Special Conservation Interests respectively that are located downstream of the wind farm.

Local Flood Relief Works at Kiltartan

Permanent remedial works were planned and constructed at Kiltartan in 2011-2012 by Galway County Council to combat potential serious winter flooding events. The potential flooding impacts of the Derrybrien Wind Farm Project are assessed as not extending far enough downstream to impact on flood-prone areas such as Kiltartan. Therefore, there is no cumulative impact arising with respect to hydrology and hydrogeology.

Flood Relief Works at Kinvarra

Temporary flood relief works were undertaken at Kinvarra during the long winter floods of winter 2015-2016. The potential flooding impacts of the Derrybrien Wind Farm Project are assessed as not extending far enough downstream to impact on flood-prone areas. Therefore, there is no cumulative impact arising with respect to hydrology and hydrogeology.

Given that these flood relief works did not take place until 2015-2016 there would have been no cumulative impact from these works and the ongoing operation of the wind farm at that time, given the very long intervening hydrological pathways between both projects.

All flood relief schemes have been undertaken since the construction phase of the wind farm, so the latter could not have had a cumulative impact with any of these. Furthermore, as the operation phase of the wind farm has coincided with mainly High Status water quality on the main channel of the Boleyneendorrish and Owendalulleegh Rivers, no cumulative impacts could have occurred between it and the subsequent flood relief scheme works at any of the SACs or SPAs with water-dependent Qualifying Interests or Special Conservation Interests respectively that are located downstream of Lough Cutra. This will also be the case during the decommissioning phase of the wind farm, even without mitigation, by virtue of the minimal ground disturbances envisaged for that phase of the works, and the very significant distances involved in the hydrological pathways between the wind farm and the European sites in question.

Proposed Gort Lowlands Flood Relief Scheme

The proposed Gort Lowlands Flood Relief Scheme is examining options of providing flood overflow pathways from several turloughs (Lough Coole to Caherglassaun to Cahermore and an overland spill to the Galway Bay at Dungory Castle at Kinvarra). This is currently at preliminary engineering and feasibility stage and will be the subject of a planning permission stage assuming that a feasible scheme can be achieved. Flood relief solutions for the Gort Lowlands are being progressed by the Office of Public Works (OPW) and Galway County Council to protect vulnerable properties, farms, communities and roads in the Gort Lowlands area. The preferred flood relief option is to reduce turlough levels to identified target levels through engineering overland spill channels between successive turloughs until eventually reaching the sea at Dungory Kinvarra.

While the effect of the wind farm drainage is to increase peak surface water flow rates in the vicinity of the wind farm, this effect diminishes rapidly downstream in the larger river catchments such that by the time flood flows reach Lough Cutra and the Ballylee Thoor floodplain area, the increased runoff rate is not significant in respect to flooding and flood risk. As such, it is understood based on the likely proposals that the flood relief scheme

shall have no perceptible cumulative impact with the wind farm with respect to hydrology or hydrogeology on any of the SACs or SPAs with water-dependent Qualifying Interests or Special Conservation Interests respectively that are located downstream of Lough Cutra.

Quarries/Sand extraction

Sand Extraction at Cloghvoley

Cloghvoley quarry is situated 4.5 km to the south-east of the wind farm and was granted planning permission in May 2008 after the wind farm was already commissioned, so there could have been no cumulative impact between it and the wind farm during construction. The quarry is within the catchment of the very upper reaches of the main channel of the Owendalulleegh River about 4 km upstream of Site O7C on the main channel of the Owendalulleegh (see Figure 2). However, there is no direct stream or drain connection between the quarry and the river. Even in the low likelihood of some solids contamination in overflow water from the quarry during times of very heavy rainfall, the significant distance between it and the nearest point in the Owendalulleegh which receives drainage from the wind farm (i.e. at the base of SC6, 2.5 km downstream), would strongly suggest that there has been no cumulative impact between the two projects on any SACs or SPAs with water-dependent Qualifying Interests or Special Conservation Interests downstream of Lough Cutra or Lough Cutra itself during the operation phase of the wind farm, by virtue of the significant intervening hydrological pathways. This is also expected to be the case during decommissioning of the wind farm, even without mitigation of the latter, for the same reasons.

Coillte Quarry

The Coillte quarry is situated just east of the junction between the R353 and the Black Road, to the south-east of the Derrybrien Wind Farm site. It is a relatively small, 1.8 ha aggregate quarry, with an extraction area of 1.3 ha, the aggregate being used for forest road repairs. The area where the quarry is situated shows no surface drainage channels on the 6in:1mile map for the area nor is there any indication from aerial photos of the area. The downslope over-ground distance between the quarry and the nearest stream, SC7(a) between sites O3 and O6A (see Figures 2 and 5), is just over 500m through forestry and damp grassland/blanket peat. Given that the material being quarried was predominantly coarse, the likelihood of any suspended solids from the site reaching any of the wind farm drainage streams is considered to have been extremely low. For that reason, it is considered extremely unlikely that there would have been any cumulative impacts between the quarry and the wind farm either during the construction or operation phases of the wind farm and therefore no cumulative impact on any of the SACs or SPAs with water-dependent Qualifying Interests or Special Conservation Interests downstream. As the quarry is now exhausted, the issue of cumulative impacts during the decommissioning phase of the wind farm no longer arises.

Ballinakill Quarry

Ballinakill Quarry is within the drainage area of the Ballinlough Stream (River Waterbody Code: IE_SH_25B150300) draining ultimately to Lough Derg in the River Shannon catchment. The most downstream EPA Q-value monitoring site on the Ballinlough Stream (Bridge u/s Cappagh River, RS25B150500) has returned a High Status value (Q4-5) on each sampling occasion from 1999 to 2017 inclusive, so there is no evidence that there has been a cumulative impact between the quarry and the wind farm with regard to water quality and habitats within the Lough Derg, North-east Shore SAC or Lough Derg (Shannon) SPA at any stage, nor is there any chance that there will be during the decommissioning stage of the wind farm given the tiny portion of the wind farm within the overall catchment of the Kilcrow River. The latter is the final channel into which the Duniry River and the Ballinlough Stream flow before it enters Lough Derg in the north western corner of the lake.

M18 Motorway Project

The M18 motorway project was planned and constructed after the Derrybrien Wind Farm Project was developed and so there could not have been any cumulative impact between the projects during the construction phase of the wind farm. Furthermore, as the operation phase of the wind farm has coincided with mainly High Status water quality on the main channel of the Boleyneendorrish and Owendalulleegh Rivers, no cumulative impacts could have occurred between it and the subsequent motorway scheme at any of the SACs or SPAs with water-dependent Qualifying Interests or Special Conservation Interests downstream of Lough Cutra. This will also be the case during the decommissioning phase of the wind farm, even without mitigation, by virtue of the minimal ground disturbances envisaged for that phase of the works, and the very great intervening hydrological pathways between the wind farm and the European sites downstream.

Beagh Bridge

The privately owned four-span Beagh Bridge at the outlet of Lough Cutra underwent a structural assessment by ESB International (ESBI) in August 2004. This followed on from the temporary erection of straw filter barriers on the upstream face of the bridge in the aftermath of the peat slide to capture and filter any suspended sediment that may have transported from the peat slide area. Evidence of damage and deterioration to two of the three intermediate piers was highlighted although it was deemed by ESBI engineers at the time that the peat slide most likely could not have caused or contributed to this damage. ESBI recommended in their assessment report that all river flow be diverted away from these piers. The recommendations were addressed in January 2005 and left the pier foundations in what was deemed by ESBI as being in better condition than it was prior to the initial assessment.

Given the nature and scale of the remedial works at Beagh Bridge and the fact that they were undertaken in 2005, the potential for cumulative effects with the wind farm project is considered not likely to have occurred. As a consequence of the distance between Beagh

Bridge and the European sites downstream the potential for significant cumulative effects is not likely to have occurred.

4.7 Screening Assessment Conclusion

This screening assessment was completed based on best available scientific data and in line with the relevant European Commission and national guidelines to determine the significance of effects, if any, on the relevant European site(s) which have occurred or which are occurring or which can reasonably be expected to occur because of the Derrybrien Wind Farm project.

This screening process has examined the details of the Project and has considered the potential impacts and significance of effects on 30 European Sites identified within the Zone of Influence of the Project. Based on the findings of the screening assessment, it has been determined that the Project has not had nor is likely to have, either alone or in-combination with other plans and projects, significant effects on 28 out of the 30 European sites assessed.

As the Project is entirely within the Slieve Aughty Mountains SPA, the assessment has identified the potential for significant effects to have occurred on the habitats and associated birds within the SPA at the time of construction (prior to SPA designation) and during the operation phase up to 2020. The assessment has also identified the potential for significant effects on the Slieve Aughty Mountains SPA arising from the continued operation and decommissioning of the Project, individually or in combination with other plans or projects, in the absence of mitigation.

The assessment has identified the potential for significant effects to have occurred on Lough Cutra SPA, as a result of the peat slide which occurred during the construction phase of the Project. The potential for significant effects during the continued operation and decommissioning phases of the Project, in the absence of mitigation, requires further assessment.

Therefore, it is considered that an Appropriate Assessment under the Habitats Directive is required for the Derrybrien Wind Farm Project

5 Natura Impact Statement

The Appropriate Assessment Screening in Section 4 of this report, identified two European sites as having the potential to have been or to be significantly affected by the Project, namely the Slieve Aughty Mountains SPA and Lough Cutra SPA.

The remedial Natura Impact Statement presents the information required by the competent authority to undertake an Appropriate Assessment.

The purpose of the Appropriate Assessment is to assess the implications of the Project, either alone or in-combination with other projects or plans, on the integrity of European sites in view of the site's conservation objectives.

5.1 Effects on site integrity defined by the conservation objectives

This section of the report sets out the effects of the Derrybrien Wind Farm Project (either alone or in combination with other projects or plans) on the integrity of the Slieve Aughty Mountains SPA and Lough Cutra SPA with respect to the conservation objectives for both sites. The focus is on demonstrating, with supporting evidence, that the Project has not and will not adversely affect the integrity of these European sites.

The integrity of a European site is defined as the coherence of the site's ecological structure and function, across its whole area, or the habitats, complex of habitats and/or populations of species for which the site is or will be classified.

5.2 Description of European Sites

5.2.1 Slieve Aughty Mountains SPA

5.2.1.1 Status of hen harrier within the Slieve Aughty Mountains SPA

Hen harrier breeding territories within 5 km radius of wind farm

It is noted that hen harriers have not been recorded nesting within the wind farm site since monitoring of the wind farm commenced in 2004 nor were there any previous known attempts dating to at least the late 1990s (latter based on information supplied by NPWS).

Since the start of the monitoring surveys for breeding territories in 2004, up to 14 breeding territories have been identified within an approximate 5 km radius of the wind farm. Most of these would have been traditional territories dating to at least the late 1990s. However, in any one year occupancy will vary, with some territories showing no evidence of occupancy or perhaps being abandoned early in the season. Also, within each territory the exact location of the nest site will often vary between years.

There follows a summary of the number of territories occupied in various years since 2004 within a 5 km radius of the wind farm. Data from the respective National Hen Harrier Surveys for 2005 and 2010 are also given to supplement the years when monitoring did

not take place at the wind farm. Two categories of breeding are given – confirmed (where nesting actually took place though breeding may not have been successful, i.e. young not fledged) and possible (where territory was apparently occupied early in season only).

	2004	**2005**	**2006**	**2007**	**2009**	**2010**	**2011**	**2015**	**2018**
Confirmed	9	14	11	12	11	8	6	2	2
Possible	1	-	2	2	2	4	4	4	3
Total	**10**	**14**	**13**	**14**	**13**	**12**	**10**	**6**	**5**

Since monitoring commenced in 2004, there have been two regular territories within a 1-2 km distance of the Derrybrien Wind Farm site. In 2011, the only successful nesting (i.e. young birds fledged) by the 10 pairs within the 5 km radius of the wind farm was from one of these territories, and one was still occupied in both the 2015 and 2018 surveys (though no young were known to be produced).

The monitoring of hen harrier territories within the 5 km radius of the wind farm shows that the number of confirmed nesting attempts was fairly constant between 2004 and 2011 but there then followed a decline, with a total of six and five occupied territories in 2015 and 2016 respectively (and with only 2 confirmed nesting attempts in each year). Between 2011 and 2018, the total number of pairs (confirmed and possible) dropped from 10 to 5.

Factors potentially affecting hen harrier breeding population within the Slieve Aughty Mountains

The population decline since about 2011 as recorded in the 5 km radius of the wind farm is reflected in the Slieve Aughty Mountains SPA as a whole (see Table 3):

Table 3. Comparative population data from the national hen harrier surveys in 1998-2000, 2005, 2010 and 2015 for the Slieve Aughty Mountains SPA (after Ruddock *et al.* 2012 and 2016). Figures are total estimated pairs.

1998-2000	**2005**	**2010**	**2015**	**% change 2005 - 2015**
10-21	24-27	16-24	8-14	-48.1%

Note: 1998-2000 survey effort was less than in subsequent surveys.

A detailed study of hen harriers in three areas (Slieve Aughty Mountains, Ballyhoura Mountains & West Clare hills) by researchers from University College Cork showed population declines in all three areas between 2007 and 2011 and also that the numbers of young fledged at successful hen harrier nests was quite low compared to other populations (Irwin *et al.* 2011).

The cause(s) of the marked population decline and low productivity within the Slieve Aughty Mountains SPA, and indeed in areas such as the Ballyhoura Mountains and the West Clare hills and several other SPAs, remain largely unknown but are expected to be

due to a number of reasons, possibly acting in combination, including the following (after Ruddock *et al.* 2016):

- Habitat change (largely forest management affecting prey availability)
- Predation
- Persecution
- Access and recreation (walking paths, cycling tracks etc)
- Non-intensive grazing
- Wind energy & Utility and service lines

Habitat change

Open moorland (heath/bog) is the natural nesting habitat for hen harriers in Britain and Ireland (Watson 1977). Since the middle of the last century, commercial forest expansion across traditional bog and heath habitats in the upland of Ireland and the UK has been associated with Hen Harrier population declines in these areas (Bibby & Etheridge 1993, Ruddock *et al.* 2016). However, the population in Ireland has readily adapted to nesting within young conifer plantation, as highlighted by Norriss *et al.* (2002) in the first National Hen Harrier Survey. Indeed, Wilson *et al.* (2009) have shown pre-thicket conifer plantations to be the most frequently used nesting site throughout Ireland. This trend is particularly prevalent in the Slieve Aughty Mountains and in the 2015 national survey, all confirmed nesting pairs were in conifer plantation (Ruddock *et al.* 2016). Foraging activity, however, continues to indicate a preference for open habitats (bog-heath-grassland) though pre-thicket second plantation is also used extensively.

It can be assumed that over time the proportions of the main landuses within the Slieve Aughty Mountains SPA will remain fairly constant, which is roughly as follows: forestry 50%, bog/heath 30%, grassland 20% (NPWS, 2015).

Within the forestry component, however, there is continuous change as trees mature over the (average) 40 year cycle, are clearfelled and then replanted. As only the pre-thicket or open canopy phase of the forest cycle (usually forest not more than 10-12 years of age) provides useful nesting and foraging habitat for hen harriers, it follows that the status of the age cohorts of the forest in any one area at a given time is likely to have an important effect on the local hen harrier population. This trend was shown quite well in the 2005 National Hen Harrier Survey when a marked increase was recorded in the Hen Harrier population in the Ballyhoura Mountains since the 1998-2000 survey (Barton *et al.* 2006). The authors of the survey report considered that the increase in the amount of pre-thicket second rotation forest was a main reason for the increase in the number of birds.

In the 2010 National Hen Harrier Survey, Ruddock *et al.* (2012) wrote (page 55 of report) as follows: *'Forest maturation may be partly responsible for regional decreases in breeding hen harriers, as a shift in age structure of plantations was recorded between the two surveys with a general increase in older classes of suitable forest breeding habitats'*. In discussing significant population declines in three of the six SPAs designated for hen harrier, they noted further (page 57 of report): "*There has been a decrease in the forest age-classes suitable for hen harrier nesting and a decline in afforestation across all the*

SPAs which may have affected distribution. Afforestation in all SPA areas appears to have dramatically increased during 2006, immediately prior to SPA designation in 2007 and has since declined annually. The quality of open habitats for hen harriers may need to be improved in order to compensate for decreased availability of young forest habitats due to the changing age profile of forest plantations in these areas."

In discussing the decline in the population in the Slieve Aughty Mountains SPA between the 2010 and 2015 national surveys, Ruddock *et al.* (2016) wrote that surveyors observed that forest maturation is likely to have reduced the availability of suitable habitat since the previous survey and they suggest that this may have led to a redistribution of some breeding pairs from the Slieve Aughty Mountains to areas south of the SPA as some increases were recorded in the Slievefelim – Silvermines Mountains complex. From analyses carried out on forest age structure within all six SPAs selected for hen harriers in Ireland, Ruddock *et al.* (2016) predicts that the extent of usable forest habitat (i.e. open canopy up to c.12 years) for nesting and foraging purposes will decline over the next 10 years.

In addition to habitat loss, forest management activities, including new forest road construction and felling works, can have considerable impacts on breeding birds of prey. In an analysis of anthropogenic activities recorded during the 2015 National Hen Harrier Survey that could potentially impact on breeding Hen Harriers, the most frequently recorded pressure recorded was forest management and use (13% of occurrences) followed by the category 'paths, tracks & forest roads' (11%) (Caravaggi *et al.* 2020a).

Predation

Compared to open habitats, the increase and maturation of commercial forest plantations has led to an increase in potential predators of hen harrier nests due to the provision of cover and breeding sites. Avian predators include hooded crow, raven, magpie and more recently jay, while mammalian predators include fox, pine marten, mink and rat. O'Donoghue (2010) attributed 55% of all nest failures in south and west Ireland in 2007 and 2009 to predation events. In the 2015 National Hen Harrier Survey, Ruddock *et al.* (2016) identified the main predators as fox, pine marten, hooded crow and mink.

While there is little direct evidence of predation in the Slieve Aughty Mountains SPA, other than a nest being predated by a fox in 2008 (recorded by nest camera), all the key predators are widespread throughout the SPA as well as in the Derrybrien area. Indeed, populations of species such as pine marten and fox have increased in the past decade or so.

Persecution

Persecution or illegal killing of hen harriers has been recorded in some parts of the country (including Kerry and west Clare) (Ruddock *et al.* 2016). While there has been no evidence of such events in the Slieve Aughty Mountains, this does not necessarily rule out the possibility of persecution occurring.

Access and Recreation

Ruddock *et al.* (2016) identified disturbance to hen harriers from human presence as being widespread throughout the species range and probably responsible for nest abandonment in some cases. This category included dedicated walking and cycling

tracks, quad bikes, as well as local paths. Disturbance can occur particularly when users leave the dedicated routes.

In the 2015 National Hen Harrier Survey, surveyors in the Slieve Aughty Mountains identified access tracks and cycling tracks, including use of non-paved forest roads, as a pressure on the hen harrier population.

Non-intensive grazing

Appropriate grazing levels to optimize habitat conditions for hen harrier can be difficult to achieve and will vary in any one area over time. While under-grazing may facilitate development of tall stands of heather suitable for nesting, the absence or near-absence of grazing may lead to scrub encroachment which may not be suitable for either nesting or foraging. Similarly, over-grazing can lead to unsuitable conditions for both nesting and foraging.

While Ruddock *et al.* (2016) does not identify grazing levels as an issue in the Slieve Aughty Mountains, they do note uncontrolled burning (which may be related to local grazing) as a pressure on the hen harrier population.

Wind energy & Utility and service lines

For the Stacks Mountains complex in Kerry and Cork, Ruddock *et al.* (2016) cited wind energy production as one of the most frequently recorded pressures on the hen harrier population. The effects of the presence of wind farms are considered mainly through loss of suitable habitat and disturbance to breeding during the construction phase. For the Slieve Aughty Mountains SPA, they note that there are 77 turbines located within the SPA boundary and no others within 500 m of the boundary. Wind energy was not reported as a main pressure on the hen harrier population within the SPA.

In respect of power lines, for the Slieve Aughty Mountains SPA, Ruddock *et al.* write the following:

> "*There appeared to be a positive association, although this was not statistically tested, and supported by behavioural observations, that habitat management (i.e. clearance) for power line infrastructure may provide corridors for movement and foraging by hen harriers within the forested landscape. The use of such corridors could prove useful to increasing connectivity with suitable nesting and foraging areas and particularly linking forested areas with open habitats which are shown to be used more frequently in Ireland."*

5.2.1.2 Status of breeding merlin in wind farm project area

Merlin is a scarce breeding bird within the Slieve Aughty Mountains, with the Site Synopsis for the Slieve Aughty Mountains SPA (NPWS, 2015) noting that "*The population size is not well known but is likely to exceed 5 pairs*"

There were no sightings of merlin within the wind farm project area during the various breeding bird surveys between 2004 and 2018. A single sighting was made in the hinterland area several kilometers from the wind farm on 10th May 2011 during a search for hen harrier territories which probably indicated local breeding.

As merlin is a difficult species to survey due to its discrete breeding behaviour (Lusby *et al.* 2011), there is some chance that one or more pairs could breed in the hinterland of the wind farm and remain unnoticed. However, it is undoubtedly a rare breeding bird within the Slieve Aughty Mountains.

5.2.2 Lough Cutra SPA

5.2.2.1 Status of breeding cormorant colony within the Lough Cutra SPA

Lough Cutra SPA is located approximately 10 km south west of the Project and approximately 20 km from the wind farm hydrologically. Lough Cutra is a large oligo/mesotrophic freshwater lake lying on limestone but with much sediment washed down from the sandstone hills above. The Owendalulleegh River is the main in-flowing river. Woodland occurs around much of the lakeshore. While much of this is planted, wet woodland with willows (*Salix spp*.) and Alder (*Alnus glutinosa*) is also represented. The lake has a number of islands, some of which are wooded (NPWS, 2009).

Historical data for Lough Cutra show that it was once a long-established breeding site for Cormorant (166 pairs in 1985), with birds recorded breeding on Parsons Island and appearing to commute to the coast for feeding (NPWS, 2009). However, declines were reported in 1996 (34 pairs) and a survey of the colony on 2004 (Inis Environmental Services, 2004b) found that the cormorants were no longer breeding at the lake and that limited, or no breeding activity had been recorded for a number of years (as per NPWS consultation).

Monitoring conducted in 2010 as part of a study undertaken by Tierney *et al.* (2011) revealed that the colony at Lough Cutra had been recently abandoned. More recent counts undertaken in May 2017 showed that cormorants were present at the site, but no breeding activities were recorded (Data provided by NPWS in 2018).

5.3 Describe the elements of the project or plan (alone or in combination with other projects or plans) that are likely to give rise to significant effects on the environment

The potential impacts associated with the construction, operation and decommissioning of the Project and the peat slide and associated works which occurred in 2003 are identified in this section. The impacts identified below are those which are likely to have occurred, which are occurring or which can reasonably be expected to occur based on the nature and scale of the Project and of the Special Conservation Interests of the Slieve Aughty Mountains SPA and Lough Cutra SPA.

5.3.1 Slieve Aughty Mountains SPA

The elements of the project identified as having the potential to affect the Slieve Aughty Mountains SPA are as follows:

Potential impacts due to construction activities

- Loss of habitat (including subsequent alteration / change of habitat)
- Disturbance of birds due to presence of personnel/machinery

Potential impacts due to peat slide and associated activities

- Loss of habitat (including subsequent alteration/change of habitat)
- Mortality of individual birds
- Disturbance of birds due to presence of personnel/machinery.

Potential impacts due to operation and maintenance activities

- Collision risk to birds associated with operating turbines.
- Collision risk from overhead powerline
- Displacement of birds due to operation of turbines.
- Impacts on reproductive output in relation to wind turbine proximity.
- Barrier effects
- Disturbance to species associated with maintenance activities on site, e.g. removal of self-sown conifers, road and drain maintenance.

Potential impacts during decommissioning

- Disturbance/displacement of birds associated with dismantling of above ground components of wind farm (24 month duration).

5.3.2 Lough Cutra SPA

The elements of the Project identified as having the potential to affect Lough Cutra SPA are as follows:

Potential impacts due to construction activities

- Pollution of surface waters and impact on fisheries owing to an increase in runoff of inorganic and peat solids, combined with increased nutrients from clearfelling.

Potential impacts due to peat slide and associated activities

- Pollution of surface waters and impact on fisheries owing to siltation with peat solids.

Potential impacts due to operation and maintenance activities

- Collision risk to birds associated with operating turbines.
- Pollution of receiving waters with siltation due to maintenance activities.

Potential impacts during decommissioning

- Pollution of receiving waters with siltation due to machinery on site associated with dismantling of wind farm components and offsite barrages.

5.4 Set out the Conservation Objectives of the Site

5.4.1 Slieve Aughty Mountains SPA

Generic conservation objectives for the Slieve Aughty Mountains SPA are available on NPWS website https://www.npws.ie/protected-sites/spa/004168 (Citation: NPWS 2020, Conservation objectives for Slieve Aughty Mountains SPA [004168]. Generic Version 7.0. Department of Culture, Heritage and the Gaeltacht).

The overall aim of the Habitats Directive is to maintain or restore the favourable conservation status of habitats and species of community interest.

The maintenance of habitats and species within Natura 2000 sites at favourable conservation condition will contribute to the overall maintenance of favourable conservation status of those habitats and species at a national level.

The favourable conservation status of a species is achieved 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.

Objective: To maintain or restore the favourable conservation status of the bird species listed as Special Conservation Interests for this SPA:

- Hen Harrier (*Circus cyaneus)* [A082]
- Merlin (*Falco columbarius)* [A084]

5.4.2 Lough Cutra SPA

Generic conservation objectives for Lough Cutra SPA are available on NPWS website https://www.npws.ie/protected-sites/spa/004056 (Citation: NPWS (2018) Conservation objectives for Lough Cutra SPA [004056]. Generic Version 6.0. Department of Culture, Heritage and the Gaeltacht.).

The overall aim of the Habitats Directive is to maintain or restore the favourable conservation status of habitats and species of community interest.

The maintenance of habitats and species within Natura 2000 sites at favourable conservation condition will contribute to the overall maintenance of favourable conservation status of those habitats and species at a national level.

The favourable conservation status of a species is achieved 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.

Objective: To maintain or restore the favourable conservation status of the bird species listed as Special Conservation Interests for this SPA:

- Cormorant (*Phalacrocorax carbo*) [A017]

5.5 Describe how the project has or will affect key habitats and key species

5.5.1 Slieve Aughty Mountains SPA

5.5.1.1 Construction phase impacts, 2003 – March 2006

Construction works on site commenced in June 2003 with tree felling operations which were undertaken by a contractor on behalf of Coillte. Civil engineering works commenced in July 2003 with road construction and excavations at turbine locations. The works were stopped on 16th October 2003 due to a peat slide on site (the impact of this on birds is considered in section 5.5.1.2). Construction works re-commenced in June 2004, including work on the Derrybrien to Agannygal 110kV OHL and Agannygal Substation, and were complete by March 2006. The entire construction phase of the project was undertaken prior to the designation of the SPA in 2007.

The principal impacts on birds which occurred or had the potential to have occurred during the construction of the Project were:

- Loss of habitats (including. subsequent alteration/change of habitat),
- Disturbance to birds (noise, human presence etc.)

The assessment is focused on the hen harrier, as this species occurs in the wind farm area and is considered by McGuinness *et al.* (2015) to be highly sensitive to wind farm developments. However, the issues considered could also apply to merlin, though the species has not been recorded within the wind farm and there are no known breeding territories within the 5 km hinterland (though a territory may well occur).

Loss of habitat

Wind farm site

At the time of wind farm construction, the main habitats on the Derrybrien Wind Farm site were conifer plantation and cutover (blanket) bog. The conifer plantations were planted between 1963 and 1996 on areas dominated by blanket bog. At the time of construction, the plantations were largely in the closed canopy state though the trees planted in the 1993 to 1996 period (located in the south-southwestern section of the site and measuring approximately 42 ha in total) still had open canopy in 2003. The cutover bog, which at the time comprised areas of active turbary, is located within the eastern section of the site.

Conifer plantation forest is an non-native habitat and is of low value for birds. As noted by Caravaggi *et al.* (2020b), commercial forest expansion across traditional open heath and blanket bog hen harrier habitats in the uplands of Ireland and the UK has been associated with population declines in these areas. Furthermore, in an upland landscape, conifer plantation presents a threat to adjoining unplanted bog and heath habitats from

spread of self-seeded conifer trees. While the pre-thicket phase is useful for supporting a range of small bird species (passerines) and also provides useful foraging and nesting habitat for hen harrier, it is a transient habitat that loses its value from about 10-12 years of age onwards.

The removal of approximately 222 ha of conifer forest (total of approximately 263 ha) as a habitat for birds due to the construction works is a positive impact of long-term duration because of the non-native status of the habitat. With the clearance of conifer plantation and without replanting, bird species more typical of blanket bog (the natural habitat of the area) have had an opportunity to become re-established on the regenerating open habitats outside of the construction footprint. This is considered to have had a significant positive effect for the local bird populations including meadow pipit (Red-listed), skylark (Amber-listed) and hen harrier (Annex I species).

At the time of construction, the plantations were largely in the closed canopy state though the trees planted in the 1993 to 1996 period (located in the south-southwestern section of the site and measuring approximately 42 ha in total) were still in the open canopy phase in 2003 and would likely have provided suitable habitat for foraging hen harriers for perhaps another 5 years. While the loss at the time of this 42 ha is a negative impact, the significance of the effect on birds is considered slight and of short-term duration. It is noted that the subsequent creation of open habitat across the 42 ha would have been more valuable for birds such as hen harrier in the medium to long term as the area developed into regenerating bog/heath and scrub after several years (as shown by vegetation surveys), whereas the trees upon attaining closed canopy status would have been of little or no use for hen harriers.

Within the 222 ha of plantation forest which was cleared, the construction footprint, including turbine bases, hardstands, roads and the Derrybrien Substation, measured 13.6 ha. While built surfaces are not of significant value to birds, it is noted that species such as meadow pipit and skylark and occasionally red grouse, will utilize the road surfaces and hardstand areas, and especially the margins which adjoin the regenerating areas, for feeding and perching/resting purposes. On warm days, birds may also use the hard surfaces for dust bathing. When hunting, hen harriers will often follow linear features including embankments, tracks and road margins and therefore the wind farm roads/tracks can be considered of some value to foraging hen harriers. Of the 13.6 ha of conifer plantation that was removed to facilitate the wind farm infrastructure, the majority (11 ha) was closed canopy forest planted between the 1960s and 1980s. Without the wind farm development, it is expected that this would have been clear-felled and replanted at some stage up to the 2020s. The replanted pre-thicket forest phase would have provided potential foraging habitat for hen harrier from the age of approximately 3 years to 10-12 years (depending on growth rate). It is noted that the felling and replanting of the 11 ha would have taken place at different times across the wind farm and the later plantings (1980s) would have remained as closed canopy forest into the 2020s. While the loss of up to 11 ha of future pre-thicket second rotation forest is considered as a negative impact, the effect is considered slight and of medium-term duration (i.e. potentially available to harriers for up to 10 years before canopy closes).

The construction works in the cutover bog in the eastern section of the site resulted in the loss of an estimated 0.7 ha of cutover bog (the tracks through the bog were already in

place for forestry purposes). While mostly in a cutover state, the bog is well vegetated and apparently supported (at time of construction) species typical of upland bog habitats such as skylark, snipe and meadow pipit. While this is a negative impact, the area of loss is minor in the context of the overall amount of cutover bog within the wind farm site (i.e. amounting to less than 1% of the area of cutover bog habitat). Overall, the loss of 0.7 ha of cutover bog as a habitat for birds is rated as a long-term negative impact of slight significance

Overhead line corridor and Agannygal Substation

The OHL linking the wind farm to the Agannygal Substation extends for approximately 7.8 km along a corridor of up to 45 m width. The OHL comprises 43 structures, including 34 double wood pole structures, 2 end masts (1 within Derrybrien Substation), 6 angle masts and 1 intermediate mast. There are two additional masts within Agannygal Substation associated with the connection to the National Grid on the Ennis-Shannonbridge 110kV line.

Much of the line corridor was within commercial conifer plantation and required the removal of approximately 33.1 ha of forest. Only a small fraction of this was built on (i.e. polesets and angle masts) with the majority of the corridor allowed to regenerate to a mix of habitats including low scrub, wet grassland and regenerating bog vegetation. As with the main site, it is considered that the removal of the conifer plantation from along the overhead line corridor and without replanting is a positive long-term impact as conifer plantation is alien to the landscape and of low value for birds. This is considered to have had a significant positive effect for local bird populations, including hen harrier.

The Agannygal Substation includes a control room in a palisade fenced compound. The base platform measures 72 m x 52 m (3,744 m^2). At time of construction, the location for the substation was closed canopy conifer plantation. A total of 1.6 ha of forest was cleared to facilitate the substation construction. Without the wind farm development, the conifer plantation would have been clear-felled and replanted at some stage up to the 2020s. The replanted pre-thicket forest phase would have provided potential foraging habitat for hen harrier from the age of approximately 3 years to 10-12 years (depending on growth rate). Considering the amount of conifer forest within the Slieve Aughty Mountains SPA (c.50% of total area) the loss of approximately 1.6 ha of future pre-thicket forest at the substation site is a minor negative impact of medium-term duration, with, at most, a slight effect on birds including hen harrier.

Disturbance to birds

Construction works can cause disturbance to birds within surrounding areas. This arises from noise and the physical presence of humans, machinery etc. Potential disturbance is of most concern for breeding birds as nests could be deserted or at the least left unattended for prolonged periods and subject then to predation. Foraging birds, including hen harriers, may be displaced from suitable habitats during the period of construction. In a review of potential displacement effects on birds at twelve wind farm sites in Britain, Pearce-Higgins *et al.* (2012) reported that observed negative effects of wind farms on bird species occur principally as a result of disturbance by high levels of activity during the construction phase rather than the operation phase.

While there is no evidence to suggest that hen harriers were nesting within the wind farm site or its immediate environs at the time of construction, it can reasonably be expected that foraging hen harriers could have been displaced from suitable foraging habitats within the site during the construction works. Such an effect would be potentially significant but of temporary duration.

5.5.1.2 Peat slide impacts

The peat slide which occurred in October 2003 affected an area in the southern part of the wind farm and extended to Flaggy Bridge on the R353. Emergency works which were carried out immediately after the slide involved the construction of barrages to contain the displaced peat and debris. The terrestrial habitat affected was conifer plantation, both pre-thicket and closed canopy phases. Following the slide, the area comprised bare peat and exposed mineral soil with isolated vegetated islands which continued to support individual conifer trees and typical bog-heath species. The total affected area was estimated at 25 ha.

Survey of the peat slide area in 2011 showed almost full recovery of vegetation and habitat structure throughout the area (P. Crushell & B. Madden personal observations). The area was mapped as a mosaic of heath and scrub, with a well-developed herb and shrub layer dominated by ling heather (*Calluna vulgaris*) and purple moor-grass (*Molinia caerulea*). Soft rush (*Juncus effusus*) was common where mineral soil predominated. The tree layer supported scattered pine and spruce of varying ages, many of which appeared to be self-sown since the peat occurred. Willow was also common.

The impacts on birds as a results of the peat slide are considered to be the following:

Mortality

As the slide occurred in October, it would not have impacted any nests. Adult birds present in the area would not have been affected due to their mobility and capacity to move away from the area.

Habitat loss

The area of the slide included both closed canopy and pre-thicket phase forest. The closed canopy forest is of low value to foraging hen harriers. As already noted, conifer forest is a non-native habitat and the impact due to its removal without replanting is positive and of long-term duration, with a significant positive effect for birds including hen harrier

The pre-thicket phase forest, which occurred in the slide area within and below the wind farm, would have been suitable for foraging by hen harriers for perhaps a further five years before the canopy would have closed. While the loss of pre-thicket forest is a negative impact, the significance of the effect is slight and of short-term duration. Also, the removal of the forest plantation resulted in the development of open habitat of considerable more value to hen harrier and other bird species in the short to long-term.

Habitat regeneration

Regeneration of the peat slide area to a mix of scrub and heath, with occasional conifer trees still standing and self-seeded trees becoming established provides excellent habitat for birds including hen harriers. The revegetation of the peat repository areas at the barrages was mainly rushes – this provides low quality habitat for birds. The effect for birds including hen harrier by the development of suitable vegetation in the slide area after a short number of years is a significant positive effect of long-term duration.

5.5.1.3 Operation phase impacts (2006 – Mid-2020)

The principal potential impacts on birds within the SPA as a result of the operation of the Project are:

- collision,
- displacement,
- impacts on reproductive output in relation to wind turbine proximity,
- barrier effects,
- development of habitats

In addition, maintenance works include maintenance and periodic upgrade of access tracks and drains, the cutting back of self-sown tree growth in previously felled areas, and substation inspections and maintenance.

Potential collision impact

Collision risk posed to bird species is one of the main environmental concerns associated with wind energy developments (Drewitt & Langston 2006, Band *et al.* 2007, Drewitt & Langston 2008). However, bird species differ widely in their susceptibility to collision mortality. Essentially, birds are at risk of collision only when their flight path overlaps with the rotor blade sweep area of a turbine, and birds whose flight heights coincide with the height of turbine rotor blade sweep are most at risk. Previous studies have reported low flight heights for hen harriers (Whitfield & Madders 2006, Madden & Porter 2007, Ruddock *et al.* 2012), with low proportions (5-15%) of observations at rotor sweep height (Garvin et al 2011). In general, when hen harriers are engaged in hunting behaviour they are outside of the area of greatest risk of collision with wind turbines. However, courtship displays such as sky dancing occur at heights of up to 100 m or more, overlapping with the rotor sweep of most modern wind turbines.

In a study of flight behaviour of adult and juvenile hen harriers at various wind farms in Ireland, Wilson *et al.* (2015) found that adult hen harriers spent most of their time (82.8%) flying below the reach of turbine blades. The study also showed that the time spent flying at heights with risk of collision (25m – 125m) was similar between wind farms and control sites, which suggests that hen harriers do not modify their flight height in areas where wind turbines have been installed. Of particular interest is that the study showed that

recently fledged hen harriers (< 5 weeks) spent almost all of their time (99.1%) below 25 m and thus not within the collision risk zone.

It is important to note that there appears to be very few documented cases of hen harrier collision mortality from turbines in the literature (Johnson *et al.* 2001, Smallwood & Thelander 2004, Whitfield & Madders 2006, Scott & McHaffie 2008). At the Altamont Pass Wind Resource Area in the United States, which is the largest concentration of wind turbines anywhere in the world and is located on a busy bird migration route, only seven collisions by northern harriers (the US equivalent of the hen harrier) were documented over a 17 year period between 1989 and 2007 (Smallwood & Karas 2008).

At the Derrybrien Wind Farm, there have been no documented collisions during the various surveys since 2006, though it is noted that carcass search was not part of the routine monitoring. During the hen harrier summer surveys at Derrybrien between 2006 and 2018, hen harriers were observed within the wind farm site for a total of 2,457 seconds. The time spent by birds flying within the rotor sweep of the turbines was 637 seconds or 28.2% of the total, with the remainder (71.8%) of the time below 25 m height (and much of that below 10 m height). While the time spent within the rotor sweep area is somewhat higher than the figure of 18.2% given by Wilson *et al.* (2015), it is still relatively low and reflects the typical low flying behaviour of the hen harrier. Collision with overhead power lines is a well-documented cause of bird mortality (Bevanger 1998, Ferrer & Janss 1999, Jenkins *et al.* 2010, SNH 2016b). Species at most risk are large birds such as eagles, vultures, storks, herons, swans and geese. While the birds may be able to maneuver around large objects such as turbines or masts, their eyesight is rather poor at detecting thin horizontal objects ahead of them. In a review of 16 investigations of bird collision with power lines globally, Bevanger (1998) recorded collisions among hawks, vultures, eagles and falcons but did not list harriers. However, in a review of collision casualties with overhead lines for all bird species based on recovery data from the long-term BTO Ringing Scheme, Rose and Baillie (1989) recorded over 100 recoveries for hen harrier. The hit wire index (i.e. system to standardise the recovery samples) for hen harrier was particularly high relative to body size. They noted that hen harrier inhabits open moorland areas and may hunt at heights which make them particularly vulnerable to collisions with OHLs.

For the Derrybrien to Agannygal 110kV OHL (which does not have bird flight diverters, the risk may be highest in the stretch at Knockavana where there is a traditional hen harrier breeding territory. However, nesting was confirmed at this territory in each of the survey years 2006 to 2011 and by 2018 (when no birds were present) it was considered that the local habitat was no longer suitable for breeding due to conifer maturation.

Taking into account the findings from the various surveys at Derrybrien since 2006 (commencement of operation), the detailed study of hen harrier flight behaviour at Irish wind farms by Wilson et al (2015), and also the studies from the international literature, it can be demonstrated that hen harriers are at low risk of collision with wind turbines as a result of their typically low flight height. However, in the absence of mitigation, the risk of collision with the OHL is considered a potential negative impact, the effect of which could be significant.

Potential displacement impact

Displacement of birds from otherwise suitable habitat as a result of the presence of wind turbines has been reported as a potential indirect impact of wind turbines (Drewitt & Langston 2006, de Lucas *et al.* 2007, Pearce-Higgins *et al.* 2009). The displacement occurs as a result of behavioural responses that prevent or decrease the use of an area for activities such as nesting or foraging. However, the results of studies on potential displacement have varied widely and in an overall review of the literature Madders & Whitfield (2006) concluded that displacement effects of wind turbines on raptors, and hen harrier in particular, are negligible for the most part. In a review of potential displacement effects on birds at twelve wind farm sites in Britain, Pearce-Higgins *et al.* (2009) reported an avoidance area of 250 m from turbines for hen harrier. In a further review (but not including hen harrier), Pearce–Higgins *et al.* (2012) reported that observed negative effects of wind farms on birds occur principally as a result of disturbance by high levels of activity during the construction phase. Various studies have also reported hen harriers breeding within a few hundred metres of turbines (Whitfield & Madders 2006).

Wilson *et al.* (2015) studied the movement of adult hen harriers at wind farm and control sites in Ireland using GPS tags and data collected during vantage point watches. The study aimed to determine whether habitat use by foraging hen harriers differed at wind farm and control sites. The study found that at wind farm sites hen harriers favoured open habitats over afforested areas. Hen harriers at control sites foraged preferentially over peatland and young forest plantations, while those at wind farm sites foraged preferentially over natural and semi-natural open habitats (i.e. scrub, rough grassland) and to a lesser extent over peatland. While the authors noted that the selection of the somewhat different foraging habitats between the wind farm and control sites is difficult to explain, the study demonstrated that wind farms were actively used for foraging purposes.

At the Derrybrien Wind Farm, since 2006 hen harriers have been recorded both foraging and flying through the wind farm in all surveys (Biosphere Environmental Services 2006, 2007, 2009, 2011, 2015, also see Madden & Porter 2007). Birds were often seen flying close to wind turbines (<50 m) and on one occasion within 10 m of the base. The habitats within the wind farm, which comprise a mix of cutover blanket bog, regenerating bog/heath vegetation, scrub and stands of mature conifer, are considered as optimum for foraging by hen harriers. While breeding is not known to have been attempted within the wind farm, there are two traditional territories approximately 1 – 2 km distance from the wind farm and it can be assumed that most, or at least a significant proportion, of the sightings within the wind farm involve birds from these territories. Research on the spatial ecology of hen harriers has shown that foraging females spend most of their time within 1 km of the nest, while males hunt mostly within 2 km of the nest (Irwin *et al.* 2011, Arroyo *et al.* 2014).

While there is conflicting evidence from the literature on displacement of foraging hen harriers from close to wind turbines, there is overwhelming evidence that hen harriers have continued to forage within the Derrybrien Wind Farm since its operation in 2006. Taking this into account, as well as the results of research by Wilson *et al.* (2015) and reviews such as Madders & Whitfield (2006), it is considered that displacement of hen harriers from areas near turbines at Derrybrien has not had a significant effect. On the available evidence, it is considered that the operation phase of the Derrybrien Wind Farm

has not had a significant displacement effect on the hen harrier population of the Slieve Aughty Mountains SPA.

Impact on reproductive output in relation to wind turbine proximity

Wilson *et al.* (2015) studied the breeding performance of hen harriers in relation to wind farm sites across Ireland (also see Fernandez-Bellon *et al.* 2015). The results showed that there were no significant differences between the breeding outputs of hen harrier nests located at different distances from wind turbines. However, non-statistically significant lower nest success rates and productivity were observed within 1 km of wind turbines. Of the nine nests monitored in the 0-1 km band during the study, 33.3% were successful, while nest success in all other distance bands was 56.0% (n = 75). It was noted that hen harrier nest success rates vary considerably throughout their range and are influenced by many external factors. No trend was observed in fledged brood size with increasing distance from wind farms in their study, suggesting that potential impact of wind turbines on hen harrier breeding output is mediated through nest success rather than clutch or brood size.

At the Derrybrien Wind Farm, since 2006 hen harriers have been recorded nesting within a 1-2 km distance of the wind farm boundary, with one or two of territories occupied in each year of survey. In all of the survey years, breeding was confirmed at one of the two territories, and in 2009 and 2011 both territories were occupied (possible and confirmed categories).

While there have been no breeding attempts or known historic territories within the 0-1 km distance band of the wind farm, there is no evidence to suggest that the wind farm has had any impacts on the reproductive output of the two regular hen harrier territories within a 1-2 km distance band.

Barrier effect due to turbines

The potential impact of lines of wind turbines creating a barrier effect to passing birds is mostly relevant to locations where migratory species pass regularly. Rees (2012) cites eight published studies of flight behaviour which reported changes in flight lines for swans or geese initially seen heading towards turbines, at distances ranging from a few hundred metres to 5 km (the larger distances were by birds on migration); 50-100% of individuals/groups avoided entering the area between turbines, but in some cases the sample sizes were small. Commenting on studies to assess the barrier effect, Rees writes "*Avoidance of turbines should be related to whether or not flights were initially in line with the wind farm, rather than in relation to all bird movements in the area, as including the latter artificially boosts sample sizes used for calculating avoidance rates*."

As the Derrybrien Wind Farm Project area is not used by migrating birds of prey, the issue of a possible barrier effect created by the turbines is not considered relevant to the current assessment.

Development of habitats in felled areas

As already noted, the removal of much of the plantation forest on site (c.222 ha) without replanting has allowed the subsequent development of habitats that are suitable for a range of bird species including species typical of unplanted upland areas (such as meadow pipit and red grouse). While the regenerating bog/heath vegetation is prone to invasion by self-seeded conifers, the operation of the wind farm requires the removal of such conifers when they reach a height of approximately 4 m – this will maintain the developing open habitats for the remainder of the wind farm operation life. The replacement of non-native conifer plantation with open habitats is a positive impact of long-term duration for birds including hen harrier, resulting in a significant positive effect.

Maintenance activities during operation phase

The main maintenance activities undertaken on site are the maintenance and periodic upgrading of access tracks and drains, the cutting back of self-seeded tree growth in previously felled areas (including along OHL corridor), and substation inspection and maintenance.

Maintenance and upgrading of access tracks within the wind farm is an occasional activity. Such works, which are assessed in advance for potential environmental impacts (including the issue of peat stability), are relatively minor and localised within the site and largely confined to the original road footprint. Also, routine works such as this would usually be carried out outside of the bird nesting season. It is considered that track maintenance and upgrading works would not have any measurable effect on the foraging potential of the site for the local hen harrier population and would not affect the breeding of birds in the hinterland of the wind farm site.

Since the clearing of conifer plantations within the wind farm site and along the overhead line corridor between 2003 and 2005, self-seeded conifer trees, mostly lodgepole pine, have become established throughout the site. These trees have now reached 4 m or more in height and in places the trees are encroaching along the access tracks. A programme to remove most of these trees over a 3-year period commenced in autumn 2018. The works in each year are carried out outside of the bird breeding season and so will not cause disturbance to nesting birds. Overall it is considered that the removal of the trees is a positive impact of long-term duration for birds such as hen harrier which naturally forage over open habitats such as bog, heath and low scrub.

Of particular relevance is the harvesting and replanting of the forest area immediately to the southwest of the wind farm (46.2 ha) by Coillte between 2016 and 2018 to optimise productivity of the wind farm. This area had been scheduled for felling as part of Coillte's routine tree felling programme. This area will provide suitable second rotation foraging habitat for hen harriers from about 2020 onwards to at least 2030 – birds foraging here and in other replanted areas around the wind farm would be expected to also use the habitats within the wind farm.

Maintenance works at the wind farm substation and the Agannygal Substation would not be expected to have any impacts on local bird populations or species such as hen harrier

which nest in the hinterland of the wind farm as they are confined to the substation compounds.

Impact on winter bird species

While hen harrier was observed in the hinterland of the wind farm in October 2019 and at times could roost locally during the winter period (though no roosts were located during winters surveys in 2011/12 or 2019/20), it is not expected that the feeding or roosting behaviour of this species in autumn or winter (if present) would be affected by the presence of the wind farm. Similarly, the wind farm project would not be expected to impact upon merlin which may occur in the hinterland during the winter period (one recorded *c*.2.5 km from the wind farm in October 2019).

5.5.1.4 Operation phase impacts, 2020 to end of operation

It is envisaged that the wind farm will operate until circa 2040. During that period, the site will be maintained as it has been since operation, with repairs to roads and other infrastructure as required. Self-seeded conifer trees will be controlled as necessary within the wind farm site and along the OHL corridor so that the vegetation is expected to remain as open habitat dominated by bog, heath and scrub communities.

The bird communities are expected to remain similar to that since post construction surveys commenced in 2006 subject to natural fluctuations in some species which can be expected over a 20 year period (for instance, severe winters can dramatically affect populations of species such as stonechat, wren and meadow pipit – see Madden and Lovatt 2016). The occurrence of sightings of hen harrier within the wind farm will be dependent on the size of the overall population in the Slieve Aughty Mountains. Should the decline in the overall Slieve Aughty Mountains hen harrier population since the 2010 period continue, less sightings would be expected in the vicinity of the wind farm.

Based on the current best available data for nesting hen harrier it is not considered likely that future maintenance works would result in the displacement of hen harrier from suitable habitats. However, as breeding distribution could potentially change between now and future maintenance works, a survey for territorial hen harriers within and around the wind farm project (to at least a 2 km radius from the wind farm boundary) will be required prior to future maintenance works.

The area of the peat slide outside of the wind farm is expected to become more dominated by self-seeded conifers and hence less suitable for supporting birds including hen harrier.

On the basis of the findings from the various bird surveys since 2006 and from the literature review that has been carried out for the present report, it can be reasonably expected that the continuing operations at the Derrybrien Wind Farm project (including the OHL fitted with bird flight diverters – refer to section 5.8.1) will not have a significant effect on the local hen harrier population in respect of risk of collision with turbines or displacement from suitable habitats.

5.5.1.5 Decommissioning

The wind farm decommissioning process will involve the removal of all of the above ground elements of the wind farm. The turbine bases, crane pads, access tracks, trackside drainage and borrow pits are to be left in situ. The Derrybrien to Agannygal 110kV OHL and the Agannygal Substation will also be removed, with polesets and masts cut to base. The duration of the decommissioning phase is expected to be approximately 24 months.

At any one time, works are expected to be localised to a small number of locations on site. It is reasonable to expect that the disturbance factor to birds will be low and hen harriers nesting at traditional sites in the hinterland of the wind farm would not be expected to be disturbed by the works as the nearest site (presently) is at least at a distance of more than 1 km from the wind farm site. Ruddock & Whitfield (2007) cited a distance of up to 1 km for disturbance to hen harriers from human related activities, such as construction. Based on current best available data for hen harrier in the vicinity of the wind farm it is considered that the decommissioning of the Project will not have any negative impacts on breeding and/or wintering birds. However, as breeding distribution could potentially change between now and the date of decommissioning a survey for territorial hen harriers within and around the wind farm project area (to at least a 2 km radius distance) will be required prior to future works.

5.5.2 Lough Cutra SPA

The peat slide which occurred on the south-central section of the wind farm in October 2003, impacted water quality and fisheries in the Owendalulleegh River, a tributary of Lough Cutra. The slide material travelled downstream into the lower reaches of the Owendalulleegh River, eventually reaching Lough Cutra, approximately 22 km downstream.

A survey undertaken in July 2004 (Inis Environmental Services, 2004b) to assess the impact of the peat slide on the ecology of Lough Cutra, found that the cormorants were no longer breeding at the lake and that limited, or no breeding activity had been recorded for a number of years (as per NPWS consultation). The abandonment of the Lough Cutra site does not necessarily indicate that the conservation status of the species is unfavourable. A further survey of lakes in the general area of south Galway / North Clare found a large colony of breeding cormorants had established itself on Illaunmore at Muckanagh Lough, ten kilometres south west of Lough Cutra. It was believed that these birds had relocated to this area from Lough Cutra (Inis Environmental Services, 2004b).

The peat slide did not affect the breeding colony of cormorants at Lough Cutra as the colony was abandoned at the time of the slide and had been for a number of years predating the event. The peat slide did however affect water quality in the Owendalulleegh River and had a profound impact on fisheries in the upper reaches of the river, with material from the slide also impacting Lough Cutra. The slide therefore had the potential to adversely affect the food source of the Special Conservation Interest of Lough Cutra and the integrity (i.e. structure and function) of the SPA. The likely effects of the project on the integrity of Lough Cutra are discussed in section 5.6.2.

5.6 Describe how the integrity of the site is likely to have been or to be affected by the Project

5.6.1 Slieve Aughty Mountains SPA

National surveys of breeding hen harriers have shown that the overall hen harrier population of the Slieve Aughty Mountains SPA has declined markedly between 2005 and 2015 (Ruddock *et al.* 2016). This decline is in line with population trends between 2005 and 2015 for three of the other five SPAs selected for hen harrier, with increases registered at only two of the sites, as follows:

SPA	**% Change 2005-15**
Slieve Aughty Mountains SPA	-48.1%
Stack's to Mullaghareirk Mts, West Limerick Hill & Mount Eagle SPA	-37.7%
Mullaghanish to Musheramore Mountains SPA	-80.0%
Slieve Beagh SPA	-25.0%
Slievefelim to Silvermines Mountains SPA	100%
Slieve Bloom Mountains SPA	62.5%

As discussed in section 5.2.1.1, analysis of data from the 2015 survey suggests that the long-term decline may be due to a number of reasons, with the categories 'forest management and use' and 'paths, tracks & forest roads' being the most frequently recorded anthropogenic pressures recorded across all the survey areas in the country (Caravaggi *et al.* 2020a). The authors write "*Hen Harriers cannot use closed canopy forests for breeding or foraging, therefore the maturation of the existing forest estate threatens to deprive Hen Harriers of already scarce breeding habitat, while further increases in forest cover could also lead to increased habitat fragmentation and subsequently reduce the capacity of the landscape to support breeding pairs*."

Of note is that Ruddock *et al.* (2016) suggest that the increase in the hen harrier population of the Slievefelim to Silvermine Mountains could reflect movement of birds from the Slieve Aughty Mountains.

While it is accepted that wind energy development could have implications for breeding hen harriers in Ireland, Ruddock *et al.* (2016) did not report it as a main pressure on the hen harrier population within the Slieve Aughty Mountains SPA.

Interestingly, despite the substantial hen harrier population decline within the SPA from 2011 onwards, it is noted that the only successful nesting (i.e. young birds fledged) by the 10 pairs within the 5 km radius of Derrybrien Wind Farm was from one of the territories located within a 1-2 km distance of the wind farm, and this territory was still occupied in both the 2015 and 2018 surveys (though no young were known to be produced).

The effects on birds as a result of the Derrybrien Wind Farm Project are summarized as follows:

- Loss of approximately 42 ha of pre-thicket conifer plantation suitable for foraging at the construction stage is considered a negative impact of slight significance, of short-term duration.

- Loss of approximately 13.6 ha of commercial conifer plantation for construction footprint (including Agannygal Substation 1.6 ha) which would have provided suitable hen harrier foraging habitat when clear felled and replanted for a period of up to 10 years (in absence of wind farm development) is considered a negative impact of slight significance, of medium-term duration.

- Loss of approximately 0.7 ha of cutover bog for construction footprint – is considered a negative impact of slight significance, of long-term duration.

- Potential disturbance to foraging hen harriers during construction works – is considered as significant but of temporary duration.

- Potential collision by hen harriers with the Derrybrien to Agannygal 110kV line – is considered a potential negative impact which could be of significance.

- Regeneration across the wind farm site and along the Derrybrien to Agannygal 110kV OHL corridor of a mix of bog and scrub vegetation (as shown by vegetation survey) where conifer plantation had been cleared to facilitate the project. This has provided approximately 255 ha of suitable foraging habitat for hen harriers and will be maintained for the life time of the project. This is considered as a significant positive effect of long-term duration.

The overall permanent loss of habitat as a result of the project is approximately 15.2 ha of commercial conifer plantation which could have been used by hen harriers for foraging purposes whilst in pre-thicket stage, as well as approximately 0.7 ha of cutaway bog which would provide continuous foraging potential for the birds.

However, as the design of the project required the clearance of 255 ha of conifer plantation without replanting, this resulted in the development of suitable foraging habitat which has attracted foraging hen harriers (as shown by bird monitoring between 2006 and 2018). The project has therefore resulted in a net gain of approximately 241 ha of suitable hen harrier habitat which will be maintained for the duration of the project. A further benefit of the clearance of trees from the OHL corridor is that (as suggested by Ruddock *et al.* 2016) the corridor may facilitate the movement of harriers within a heavily afforested landscape and thus provide connectivity between suitable habitats.

While there is no evidence to indicate that the Derrybrien - Agannygal 110kV OHL has resulted in any collision casualties, it is acknowledged that such lines pose a risk of collision to large birds of prey such as hen harriers and hence this is considered a potential negative impact which could be of significance.

Martin & Shaw (2010) have conducted research into avian visual fields related to power line collision and note the following key findings:

- Relative to humans, birds have small blind spots. However, these blind spots can render a bird blind in the direction of travel, if the head or eye is moved in a certain way;
- Birds have small binocular fields. Binocular vision is important for distance perception;
- Birds' highest visual acuity and colour vision is in their lateral visual field, birds' frontal vision may be tuned for detecting movement rather than spatial detail;
- Birds in flight in open habitats may 'predict' that there are no obstacles in front of them;
- Birds may detect obstacles such as pylons and pole sets, and fly towards them with the intention of veering away at the last minute (direction and time to contact measurements are derived from this behaviour) only to collide with the undetected cables.

It is considered that mitigation to minimise the risk of collision for birds will be required (refer to section 5.8.1).

For the remainder of the wind farm operation period, routine maintenance works associated with the operation of the project will be required as necessary. Activities such as road maintenance and clearing of self-seeded conifers will be carried out subject to mitigation as required and would not be expected to have adverse impacts on hen harriers nesting or foraging in the hinterland. Similarly, decommissioning works would be carried out subject to appropriate mitigation and monitoring (refer to section 5.8.1).

It is considered that the evidence presented in this report has demonstrated that the Derrybrien Wind Farm project, both the construction phase and operation phase 2006-2020, as well as the continued operation of the wind farm to the decommissioning phase, has not had and will not have a significant effect on the integrity of the SPA. While some negative impacts or potential impacts on the habitat of the hen harrier have been identified, it is also noted that there is a net gain of suitable habitat for hen harriers as a result of the project. The identified potential impact of collision with overhead lines will be mitigated for the remainder of the project.

In respect of the conservation objectives for the SPA site, there is no evidence to indicate that the wind farm project has had an effect on:

(i) the population dynamics of the Special Conservation Interests, i.e. Hen harrier and merlin,

(ii) the natural range of the Special Conservation Interests within the SPA site, and

(iii) and '*a sufficiently large habitat to maintain its populations on a long-term basis*' – in fact the wind farm project has contributed to maintaining and increasing the amount of available suitable habitat for hen harrier within the SPA.

5.6.2 Lough Cutra SPA

Impact of peat slide on fisheries

A study undertaken in 1996 of breeding sites within the South Galway area noted that the cormorants on Parsons Island on Lough Cutra were still carrying twigs to the nests but no bird was observed to feed on the lake. The author noted that the birds were likely to fly to the coast to feed (Biosphere Environmental Services, 1997). An earlier study by West *et al.* (1975) found that the cormorants were feeding on eel at the site - "*Only one small sample was obtained from this lake-colony. It contained three eels which were probably from the lake where many of the parent birds were seen fishing*".

There are records of eel being surveyed in Lough Cutra in 1974, 1975 and in 1984 (Moriarty 1975, 1986) but the densities of other fish present, namely pike, roach, perch and trout have never been surveyed. The main fisheries interest in the lake currently is as a pike fishery but other species including perch and brown trout are also occasionally taken in this private fishery. In their second report (Anon, 2004) on the peat slide of October 2003 the Shannon Regional Fisheries Board (now Inland Fisheries Ireland) highlighted the large scale of the fish mortalities in the Owendalulleegh River, including species of cyprinid fish in the lower reaches of the river however they do not refer to any fish mortalities in Lough Cutra. Indeed, according to Mr Michael Fitzsimons Chief Environmental and Fisheries Officer (at the time) at the Shannon Regional Fisheries Board there were no reports of fish mortalities on the lake at the time and they observed no floating fish on the lake when fisheries personnel were on the lake in a boat in the immediate aftermath of the peat slide.

Invertebrate kick samples undertaken by the EPA just 17 days after the main peat slide (EPA 2004) noted only a modest decline in biological water quality (Q4-5 to Q4) at the lowest monitoring site on the Owendalulleegh River, situated just 1.6 km upstream of Lough Cutra, and the following day on the Beagh River at the outlet from the lake, there was no decline in the water quality compared to that recorded at the same site in the two previous surveys in 1997 and 2000, i.e. Q4 (Good Status). The relatively large size of the lake (approximately 385ha) would have facilitated the sedimentation of the peat silt washed into the lake from the Owendalulleegh, much of which would be expected to have deposited in the area around the inflow. While this deposited silt may have smothered benthic invertebrates within the sediment in this area, that impact is likely to have been very localised and temporary in terms of duration. Moreover, the timing of the slide, effectively at the beginning of the winter season, coincided with the annual period when biological activity and productivity on the lake would have been low, which would have also reduced any potential impacts. Taken together these observations indicate that the bulk of the impact from the peat slide occurred in the 22 km of river channel between the peat slide and Lough Cutra and that the impact on fisheries in the lake was not likely to have been significant.

Cormorants eat a very wide range of fish and their diet composition differs from location to location depending on the dominant species mix at a given site. They will also vary their diet at the same site over the course of a year if the relative dominance of the fish present also changes seasonally. Each of the species present in Lough Cutra are known to be eaten by cormorant and it is very unlikely that the diet of birds at the lake was ever

confined exclusively to eels. Moreover, eels are one of the most resistant fish to deteriorations in water quality and because it does not spawn in freshwaters, eel is less vulnerable to water quality challenges than several other freshwater species for that reason.

Recovery of the fish population

The impact on fisheries in the main channel of the Owendalulleegh River can be classified as Profound to Significant (depending on location in catchment), negative and of short-term duration and taken at least 3 – 5 years to fully recover.

Based on the information above, the evidence shows that the impact on the fish population within Lough Cutra was at worst slight, negative and of temporary to short-term duration, especially considering the sheer size of the water body as a whole (385 ha). Any impact in terms of direct fish mortalities that would have occurred is likely to have been localised to the immediate inlet area of the Owendalulleegh River. Also supporting this assessment is suspended solids data from Galway County Council for water samples taken down along the Owendalulleegh on Saturday November 1st 2003 that showed a very strong decline in concentrations from Black Road Bridge downstream to the lower reaches of Kilafeen Bridge.

Any impacts on water quality in the Owendalulleegh as a result of construction activities involving clear-felling and installation of wind farm infrastructure would have been insignificant compared with the impacts to the river following the peat slide.

It is not possible to categorically measure the level of impacts on the fish population as little or no quantitative fish population data is available for Lough Cutra from before or immediately after the peat slide. However, the late seasonal occurrence of the event and the likelihood that impacts on benthic invertebrate biomass were probably minor in effect and that the following annual spring/summer coarse fish spawning season would not have been disrupted suggests that the impact on fisheries can be classified as neutral or slight negative and temporary to short-term in duration.

For these reasons and the fact that no fish mortalities were noted at the time in Lough Cutra, the integrity of Lough Cutra SPA is not likely to have been adversely affected by the peat slide or any aspect of the Project. The conditions at the site have remained favourable for cormorant. Moreover, it is noted that few cormorants would have been present on the lake at the time of the slide in October and November as breeding birds would have departed to wintering grounds by then. In winter bird surveys at Lough Cutra in 1995/96 and 1996/97, it was noted that "*The Cormorants which breed at the lake do not winter in any numbers*". Winter surveys of Cormorants at Lough Cutra from November 1995 to March 1996 recorded the following (data from: BioSphere Environmental Services, 1997):

Nov	Dec	Jan	Feb	Mar
0	1	10	20	20

Further counts in September and October 1996 and January 1997 recorded respective totals of 0, 0 and 2 birds.

Operational and Decommissioning Phases

Cormorants have not been recorded within the wind farm area during surveys from 2004 to 2020. Given the upland nature of the wind farm site it is unlikely that this species would fly through the wind farm site with any regularity.

As the conservation objective for this site is to maintain or restore the favourable conservation of the Special Conservation Interest of the site it is important to address any impacts which may affect cormorants using this site in the future.

The only potential for the wind farm to impact the cormorants at Lough Cutra would be via sediment from the wind farm site impacting fish in the Owendalulleegh River system which feeds into Lough Cutra. The stretch of river between Lough Cutra and the wind farm site is over 22 km in length. The maintenance works which involve tree cutting and clearing of drains are not regular activities and are minor in scale.

The decommissioning strategy for the Project has been designed so that only above ground wind farm and OHL infrastructure will be removed in order to reduce the requirement for ground excavation and potential siltation. The foundations of the Derrybrien and Agannygal Substations will be removed but hardstands will remain in place. Decommissioning of barrages 3 and 4 located in an upper tributary of the Owendalulleegh River will involve the removal of the boulders that form the main structure of the barrages and to also remove the finer silt material which has accumulated behind the structures. Mitigation measures (see Section 5.8.2.2) will be implemented to ensure this material is not released into the river as it could potentially, at worst, result in a fish kill. In the absence of mitigation this impact is likely to affect only the first approximately 1 to 2 km downstream of the barrage sites. This would not have a significant effect on the SPA.

Effective and proven mitigation measures have been in place at Derrybrien Wind Farm since operation began and will remain in place for the remaining operational and decommissioning phases of the Project to reduce the likelihood of peat instability during wind farm activities to a low or negligible level, and thus preventing a release of peat solids to the aquatic environment. However, even in the absence of these measures it is considered that the Project, along or in-combination with other projects and activities, will not adversely effect the integrity of Lough Cutra SPA during the continued operation and decommissioning phases.

5.7 Cumulative effects

5.7.1 Slieve Aughty Mountains SPA

The following projects and activities within the have been included for assessment of cumulative effects on the Slieve Aughty Mountains SPA.

Cumulative impacts which have occurred

In addition to the Derrybrien Wind Farm alone, consideration is given to possible cumulative impacts on the hen harrier population within the Slieve Aughty Mountains SPA, when other projects in the vicinity are considered, namely:

- Other wind farms
- Overhead power lines
- Forestry activities
- Turbary/peat extraction
- Planting in lieu of felling on wind farm site

Other wind farms

The Sonnagh Old Wind Farm is the only other wind farm within the Slieve Aughty Mountains SPA. This wind farm is located approximately 3 km to the northwest of Derrybrien. It comprises nine Vesta turbines each of 0.85 MW capacity and was commissioned in 2004. This wind farm was constructed within a conifer plantation. The EIS (Corr na Gaoithe Teo, 2000) for the Sonnagh project did not record hen harriers nesting within the site though foraging birds were recorded in the hinterland area (within 1 km). Monitoring for hen harriers has not been required at the Sonnagh Old Wind Farm since the commissioning of the project.

It is concluded that there is no evidence to suggest that there is a cumulative impact on birds, and hen harrier in particular, by the operation of the two wind farms in the area.

Overhead power lines

In addition to the OHL connecting Derrybrien Wind Farm to the Agannygal Substation, there are three further OHLs within the SPA (excluding medium and low voltage OHLs on the distribution system), as follows:

- 38kV OHL which runs from Sonnagh Old Wind Farm northwards towards Loughrea. Some minor maintenance works are due to take place on this line in 2020. These works, which are subject to AA Screening, will take into account the sensitivities of the area in respect of SPA designation, with all required works taking place after August 15th when hen harriers, if present, would have completed breeding.
- Ennis to Shannonbridge 110kV OHL which runs across the central part of the SPA and includes the Agannygal Substation. This OHL has been in place since the 1970s. There are no upgrade or maintenance works planned on this line for the foreseeable future.
- Moneypoint-Oldstreet 400kV OHL which runs across the central part of the SPA. Refurbishment works commenced on this project in February 2020 and are due to finish in 2021. Work will require vegetation clearance for access to towers but without any tower replacements. As part of this project is within an SPA an NIS was prepared as part of the planning application for the Project. Significant effects have been ruled out in the NIS with the implementation of mitigation measures.

Hen harrier, as well as merlin, could be expected to utilise the OHL corridors at times for hunting or for moving between areas. Indeed, as already noted, in respect of the OHL within the Slieve Aughty Mountains SPA, Ruddock *et al.* (2016) wrote the following:

> *"There appeared to be a positive association, although this was not statistically tested, and supported by behavioural observations, that habitat management (i.e. clearance) for power line infrastructure may provide corridors for movement and foraging by hen harriers within the forested landscape. The use of such corridors could prove useful to increasing connectivity with suitable nesting and foraging areas and particularly linking forested areas with open habitats which are shown to be used more frequently in Ireland."*

As already discussed, collision with unmarked OHLs is a well-documented cause of bird mortality. For hen harrier, the 38kV and 110kV lines within the SPA would pose the most risk as these are within the usual flight height range of the birds. For merlin, the risk of collision with power lines is low due to the flight height of the species which is invariably close to ground level.

It is considered that the Derrybrien to Agannygal 110kV OHL contributes with the other OHLs present to a source of collision risk for birds including hen harrier. While there is no evidence to indicate that there have been bird casualties as a result of the overhead lines within the SPA site, on a conservative basis the effect of this potential cumulative impact (in absence of mitigation) is rated as of moderate significance.

Forestry activities

As already referred to in Section 5.2.1.1, the age structure of the commercial forestry plantations in the hinterland of the wind farm is an important factor in the amount of habitat available to hen harriers in any one period. The importance of forestry as an influencing factor on the size of the hen harrier population in the Slieve Aughty Mountains SPA (as well as other SPAs selected for hen harrier) was highlighted by Ruddock *et al.* (2012 & 2016). Since monitoring for hen harrier at Derrybrien commenced in 2004, there have been marked changes in the age structure of the forest plantations in the surrounding areas. Since 2016, large areas along the wind farm entrance road have been clear felled and replanted by Coillte and will provide suitable foraging habitat for hen harriers in the coming years.

As the conifer forest on the Derrybrien Wind Farm site has been largely removed and not replanted, from the perspective of value for foraging purposes the wind farm site now represents an area of habitat stability where foraging potential is available continuously for the lifetime of the project (unlike the situation with commercial plantations which become progressively unsuitable for hen harrier over time as plantations mature). It is concluded that the Derrybrien Wind Farm Project is not contributing to an in-combination negative impact with forestry within the Slieve Aughty Mountains SPA.

Turbary/peat extraction

An area of approximately 67 ha of drained turbary land occupies the eastern part of the wind farm site. Turbary lands also extend immediately beyond the wind farm site to the east covering an area of approximately 15 ha. There are 136 turbary plots within or immediately adjacent to the windfarm site, 22 are partially or fully outside the wind farm

site boundary. Individual plot sites range in area between approximately 0.55 ha and 1.10 ha.

It is difficult to know precisely how much peat was and is extracted in any given year. In 1998 prior to the project construction, it is understood that the turf cutting activities on the turbary lands within the wind farm site were low level. Over the intervening period until circa 2012, turf cutting by hand was carried out on a small number of plots, normally in late Spring/early Summer. The level of turbary activity within the site appears to have increased in recent years and is currently carried out by hand and mechanical means using an excavator and hopper. Mechanical peat extraction is currently being carried out in approximately 35 of the 136 plots and not all of these are cut each year.

Caravaggi *et al.* (2020a) considered the significance of anthropogenic pressures within the breeding range of hen harriers in Ireland. The data analysed had been collected by surveyors during the 2015 National Hen Harrier Survey. While the mechanical removal of peat was not recorded as a pressure in survey areas with confirmed hen harrier territories, it accounted for 11% of 'pressure occurrences' in survey squares where there were no hen harrier territories (but potential foraging habitat). They note that pressures such as peat extraction or illegal burning may not occur until after egg laying and, hence, can impact on parental care and, ultimately breeding success. Such activities can essentially sterilise breeding habitat in the longer-term. Ruddock *et al.* (2016) had noted that at Slieve Beagh SPA the pressures observed were primarily degradation of habitat through extensive, mechanised turf-cutting.

While turf cutting by hand at the Derrybrien site had not resulted in a significant loss of habitat or a high level of disturbance, the recent mechanised cutting is of some significance in respect of both loss of foraging habitat and potential disturbance to foraging birds. It is concluded that mechanised peat cutting at Derrybrien, which is unrelated to the wind farm project, is contributing to an in-combination impact within the SPA. While the actual effect of peat cutting on the Special Conservation Interests of the SPA is not known (Ruddock *et al.* 2016), there may be some localised effects on breeding territories. However, it can be concluded that the operation of the Derrybrien Wind Farm project is not contributing to an adverse in-combination effect when considered with turbary and peat extraction activities within the SPA.

Planting in lieu of felling on wind farm site

Felling Licence FL3983 issued in 2003 granted permission by the Minister under Section 40 of the 1946 Forestry Act to fell or uproot trees at Derrybrien as part of the wind farm development. The felling was to take place on lands owned by Coillte, comprising 263 ha of lodgepole pine and Sitka spruce. The Licence also required that where the felling or uprooting took place the Licensee (the Landowner) must within 12 months after the date on which the authority conferred by the licence ceases to be exercisable or any extended period granted by the Minister, plant 119.3 ha, comprising 55% Sitka spruce, 30% Diverse Conifers and 15% Broad leaved species, in the townlands indicated in the Schedule to the Felling Licence.

Data provided by Coillte indicate that 119 ha of trees were planted in a total area of 150.81 ha at locations in Counties Tipperary and Roscommon between 2003 and 2008. Of

relevance to the present assessment is that parts of the planted lands selected by Coillte were located within the now designated Slievefelim to Silvermines Mountains SPA (code: 004165) (notice of designation was in 2007).

However, within the SPA the selected plots located within the townlands of Foilmahonmore (8.16 ha) and Knocknabansha (51.6 ha) had been already planted for a Christmas tree crop and thus there was no change in habitat, i.e. land already classified as conifer plantation (WD4, after Fossitt 2000) at time of planting. A single plot at Coonmore (24.43 ha) was grassland (presumably wet grassland) prior to the planting of conifers in 2003.

For the Coonmore plot, the impact of the planting from the perspective of usage by hen harrier was a change in habitat from open grassland to afforestation. While the planted Coonmore plot still provided suitable habitat for hen harrier, this was only for a number of years until the canopy closed (probably by c.2015) after which the plantation would be of little value to hen harrier until clear felled and replanted (issue of afforestation already discussed in this report). In contrast, open habitats such as rough grassland provide permanently available habitat for the birds. The Site Synopsis (NPWS, 2015) for the Slievefelim to Silvermines Mountains SPA notes that approximately 50% of the land area is afforested, with roughly a quarter of the land bog and heath and the remainder grassland used mainly for hill farming. With the total area of the SPA at 20,922 ha, the extent of afforestation at the time of designation would have been approximately 10,460 ha (which included the 24.43 ha at Coonmore), with approximately 5,230 ha of rough grassland. The impact by the planting at Coonmore was the removal of 0.46% of the total grassland component that would have been included within the SPA had the planting not occurred (i.e. grassland included within the SPA would have amounted to 5,254 ha approximately if the planting had not occurred).

In the context of the now designated Slievefelim to Silvermines Mountains SPA, the significance of the effect of the impact by the replacement of 24.43 ha of open grassland habitat (potentially available to hen harrier for foraging all the time) with plantation forest (potentially available to hen harrier for foraging and nesting for roughly 10 years out of a 40 year cycle) is considered as slight negative.

It is noted that in the period 2005 to 2015, the Slievefelim to Silvermines Mountains SPA is one of only two of the six designated SPAs for hen harrier where the population has increased (Ruddock *et al.* 2016). The numbers of hen harrier territories (probable & confirmed) recorded in the SPA during the three national surveys are as follows:

- 2005 5 territories
- 2010 7 territories
- 2015 10 territories

While a change in habitat (24.43 ha) from grassland to conifer plantation occurred as a result of planting in lieu of felling on the wind farm (rated as a slight adverse effect) prior to the designation of the Slievefelim to Silvermines Mountains SPA, it is considered that

the Derrybrien project has not contributed to any adverse in-combination effect on the hen harrier population of Slievefelim to Silvermines Mountains SPA.

Cumulative impacts which are likely to occur

For the future operation of the Derrybrien Wind Farm, cumulative impacts as already discussed are likely to remain unless further wind farms and/or power lines are built.

5.7.2 Lough Cutra SPA

The following projects and activities were identified as having the potential to impact water quality in the Owendalulleegh River catchment and potentially contribute with the Project to effects on Lough Cutra SPA. The assessment of the cumulative impacts of these project and activities with the Derrybrien Project is presented in Section 4.6. The findings of the assessment relating to Lough Cutra SPA are summarized below.

- Turbary activities
- Keelderry Wind Farm
- Adjacent coniferous forestry plantations
- Quarries/Sand extraction

A peat stability risk assessment (refer to Chapter 10 Soils, Geology and Land) of turbary activities (not related to the wind farm project) on and adjacent to the wind farm site concluded that the likelihood of these activities alone, in the absence of mitigation, resulting in a peat failure in the turbary plots ranged from Possible to Likely to Possible to Very Likely depending on the plots involved. This is due in part to an increase in turbary activity since 2012 and the loading of peat due to the more recent use of mechanical harvesting involving large hoppers.

Activities associated with the continued operation of the wind farm and decommissioning therefore have the potential to act cumulatively with the turbary activities with regard to peat instability.

Following the risk assessment, a series of significant mitigation measures (refer to Chapter 10 Section 10.4.5.2.4) were drawn up for future mechanical peat extraction in the turbary plots in order to *reduce the likelihood of a peat failure and the cumulative effect of the activities on the stability of the peat in the Project area to an acceptable level over the remaining operational life of the wind farm and during decommissioning*. The assessment concluded that once these mitigation measures were implemented, the likelihood of a peat failure occurring dropped to Low.

In the absence of mitigation for turbary activities on the wind farm site a peat slide could potentially occur, however it is considered unlikely that this would result in significant effects on Lough Cutra SAC or SPA or any of the SACs and SPAs with water-dependent Qualifying Interests or Special Conservation Interests downstream of Lough Cutra. This is based on the nature of the Qualifying Features and Special Conservation Interests of

these sites and the findings of the impact assessment of the peat slide which occurred in 2003.

Cormorants have not been recorded in the Project area during bird surveys from 2004 to 2020 and given the upland nature of the area are considered not likely to occur with any regularity. In the past cormorants from Lough Cutra were recorded traveling to the coast to feed. The risk of collision with the Derrybrien to Agannygal 110kV OHL is considered negligible and therefore not likely act cumulatively with the other OHLs in the area.

The cumulative effects assessment found that none of the projects/activities listed above have resulted in cumulative effects on Lough Cutra SPA with the Derrybrien Project and will not during the continued operation and decommissioning of the Project.

5.8 Mitigation measures

This section outlines measures which have been implemented on the Project to date and which will be implemented during the continued operation and decommissioning of the Project to avoid or reduce the potential for adverse effects on European sites.

5.8.1 Slieve Aughty Mountains SPA

Monitoring of the hen harrier population in the vicinity of the Project has been on-going since 2004. This has allowed for maintenance activities during the operational phase of the wind farm to be undertaken without causing disturbance to nesting birds in the area surrounding the wind farm. This monitoring will continue for the lifetime of the project to ensure that mitigation of future works is based on the most up-to-date information.

5.8.1.1 Overhead power line

This assessment has identified the Derrybrien to Agannygal 110kV OHL as a potential collision risk to birds including hen harrier.

Line marking can reduce collision mortality quite effectively and for some species by 50-94% (see reviews by Frost 2008, Jenkins *et al.* 2010, Prinsen *et al.* 2011, SNH 2016b). Markers are simply physical devices to make the line visible to approaching birds. There are various types available but the basic requirement is to increase the visible thickness of the line by at least 20 cm for a length of at least 10-20 cm. The markers are usually installed on the shield wire(s) but can be placed on the conductors if the shield wire(s) is absent. Markers on lines should be installed as close together as feasible and at least every 5-10 m along the line. The markers should be in contrasting colours for maximum visibility in different weather and light conditions. Movement of the device is likely to be important. Line markers will also need maintenance and replacement as necessary and the line should be checked at least once a year (preferably in late winter prior to the arrival of breeding birds to the uplands).

As a mitigation measure to minimise the risk of collision, bird flight diverters will be placed at appropriate spacing along the entire length of the Derrybrien to Agannygal 110kV OHL.

5.8.1.2 Maintenance works / Decommissioning

Prior to any future maintenance works or decommissioning works as part of the Project, a survey for territorial hen harriers within and around the wind farm project (to at least a 2 km radius from Project boundary) will take place as the breeding distribution is likely to have changed somewhat. Should a pair be found nesting within the Project boundary or within a distance of 2 km from the Project boundary, seasonal restrictions on works may be required (depending on location of works, local topography etc.) to minimise risk of disturbance.

Routine maintenance works, other than those associated with individual turbine maintenance and works within the substations, will be undertaken outside of the bird nesting season (1st March-31st August) in compliance with the Wildlife Acts 1976 & 2000.

5.8.1.3 Monitoring

As the wind farm is within the Slieve Aughty Mountains SPA, the monitoring programme for hen harriers will continue at intervals (suggested 3 year intervals) for the remainder of the wind farm operation. This will provide useful long-term data on the potential effects of wind farms on sensitive bird species (it is noted that there are few, if any, comparative long-term studies in Ireland) and will provide up-to-date baseline information on the distribution of breeding territories to ensure future maintenance activities have no potential to cause disturbance.

5.8.2 Lough Cutra SPA

5.8.2.1 Measures to maintain peat stability

Effective and proven risk mitigation measures are in place at Derrybrien Wind Farm to reduce the likelihood of a peat failure and potential impacts to water quality to a low or negligible level. Chapter 10 – Soils, Geology and Land sets out detailed mitigation measures which are currently implemented during the operation of the wind farm and which will be implemented during the decommissioning stage of the wind farm. The measures are of a nature routinely adopted on similar sites on upland blanket bogs across Ireland and the UK .

Mitigation measures range from preventing cranes from stopping on floating roads, to ensuring that all lifting operations are undertaken from hardstanding areas in order to avoid unnecessary loads on floating roads.

As part of the decommissioning phase access routes to structures on the OHL have been identified based on geotechnical evaluation (see Figures 7.1 and 7.2).

Mitigation required for turbary activities

The following is a summary of the mitigation measures that are recommended in Chapter 10 Soil, Geology and Land which specifically relate to turbary peat harvesting and which are recommended to be implemented by the turbary rights holders:

• No peat harvesting should be carried out by saw cutting in any of the turbary plots;

• No mechanical peat harvesting should be carried out in the turbary plots where the likelihood of a peat failure without appropriate mitigation measures is interpreted as Very Possible to Likely (L=4.0 to 5.0). Manual turf cutting can be carried out but should be done during the drier months between May and September;

• Limitations on the type and size of equipment that can be used for mechanical peat harvesting in the turbary plots is recommended where there is a risk of peat instability.

• The operational control measures recommended should be implemented by the turbary plot owner and their turf cutting contractor to manage the stability of peat excavations and to prevent excessive damage to the integrity of the vegetated surface of the peat;

• No mechanical peat harvesting should be carried out in the turbary area during the decommissioning stage of the wind farm project.

• Communication will be established between the turbary plot owners, turf cutting contractors and the wind farm site manager for Gort Wind Farms Ltd. to allow the turbary rights holders to give notice of peat harvesting activities and to report any peat instability on the site

5.8.2.2 Measures to protect water quality

Construction phase

Across the wind farm site in general, silt traps in the form of in-stream sumps and straw bales were installed in existing drains where there was potential for pollution of watercourses from runoff from works. The fact that the site as a whole is relatively flat or gently sloping helped facilitate the effectiveness of these control measures.

Peat slide

Emergency measures were undertaken to address impacts arising from the peat slide in 2003. These emergency measures, which mainly involved the installation of barrages and creation of repositories for peat debris, largely related to the safeguarding of downstream water quality and reducing the risk of further peat slides.

Operation and decommissioning phases

In order to minimise potential impacts on the aquatic environment, the following water quality protection measures will be undertaken in relation to the wind farm project operational phase maintenance and end-of-life decommissioning and in relation to the removal of post-slide remedial structures namely Barrages 3 and 4.

The following list describes general mitigation measures to be employed during on-going maintenance on-site and during decommissioning works.

- Maintenance works on the wind farm site such as tree cut-back, access road upgrade and maintenance, and drain cleaning will be undertaken regularly rather than be allowed to accumulate and thereby require more widespread and intensive interventions.

- All on-site maintenance including tree felling, access road repair, and drain cleaning work will be detailed in advance, ideally on an annual basis and the plan sent for assessment to a trained aquatic ecologist before any works are started. This would help to identify any potential for ground damage and silt and nutrient runoff which could then be targeted for mitigation.
- All works will be scheduled to take place between late spring and late summer and timed to coincide with dry weather. All such work will be preceded by a survey for breeding hen harriers and would progress only conditional to the absence of potential for impacts to breeding birds.
- All heavy machinery will travel on access roads and hard stand areas only. Any machinery required to track across the vegetated areas of the site will have wide tracks in order to prevent ground damage or otherwise travel on bog mats or equivalent.
- All material removed from drains will be side cast in such a way as to ensure that subsequent rainfall doesn't wash sediment back into the drainage system. This may mean that in very wet or steep areas that material is removed from such areas and placed in borrow pits or suitable hollows where it can safely dry out and become revegetated.
- Temporary silt fences will be placed on the downstream end of drain stretches earmarked for cleaning in order to intercept dislodged silt. These will remain in place for some time after the cleaning is finished, and any silt accumulated behind the traps will be regularly removed and spread on open vegetated ground before the silt trap is removed during dry weather or if the conditions do not allow removed off site for safe disposal.
- During the decommissioning phase the contractors shall nominate a pollution control officer who will report to the site manager and the client for the duration of the works. They will be responsible for (i) preventing any unnecessary ground damage and (ii) installing silt control measures on all of the drains leaving the site in order to prevent solids or other contaminants reaching off-site drainage channels. They will be responsible for maintaining these measures on a continuous basis as required, particularly before, during and after heavy rainfall. They will also be required to identify any developing pollution risks e.g. related to borrow pit use, vehicle re-fuelling or temporary fuel storage measures and possible oil leaks during the decommissioning of the sub-station buildings as well as initiation control measures to prevent the escape of hydrocarbons into the soil from the site.

Decommissioning of Barrages 3 and 4 and Overhead Line Structures

Detailed mitigation measures to ensure the protection of water quality and fisheries within the Owendalulleegh River during the decommissioning of Barrages 3 and 4 and structures along the OHL are as follows:

- During the removal of Barrages 3 and 4, a pump-over system will be used to minimise the escape of suspended solids into the watercourse downstream of Site O4 in SC7(b). In order to minimise such an effect, the work will only be undertaken during a period of dry weather between May and September using a pump-over

method. This entails damming the channel immediately upstream of the works using sandbags and then pumping the clean water down below the barrage until all the retained material upstream has be removed and the channel re-profiled to its original pre-slide form and gradient. This will minimise the solids escapement during the initial phase of the removal. If it is possible to maintain the pump-over during the removal of the large boulders, then this should be attempted also. However, boulder removal is less likely to give rise to much in the way of solids, so the pump-over can be dispensed with if necessary for this phase.

- Access to Barrage 3 should be simple as the ground is fairly hard, whereas, the route to Barrage 4 is longer and the ground softer and bog mats will be necessary to prevent ground damage due to the passage of heavy vehicles. The silt material and boulders removed from the barrages will be loaded onto separate dumper trucks and transported off-site to a suitable location.
- During the removal of structures along the OHL corridor, all decommissioning traffic will only follow the proposed stoned access tracks indicated on Figures 7.1 and 7.2 until they reach the entrance points to the OHL corridor itself. Along the corridor itself every effort will be made to plot a course between structures that avoids direct crossing of all minor or larger drains and streams in order to minimise solids loss. Where crossings cannot be avoided, bog mats or other suitable bridging methods will be used to protect the drains in question. Planning for this will require that each stretch will initially be traversed on foot or with a 4x4 to identify drains. It is important to note that all the pole sets and masts will be cut at the base, i.e. they will require no excavation and any that will take place at masts will be very limited.
- For each of the line stretches accessible via the 6 proposed access tracks, silt control measures will be used in all minor drains likely to act as conduits for solids-contaminated water arising as a result of vehicular-associated ground damage, thereby preventing them from reaching any of the larger watercourses along the route of the OHL. This will be more important during wet weather, which if possible will be avoided.
- For access to structures AM 24 and poles sets 23 and 25, at the Owendalulleegh fording point by Site O7C, in the absence of alternative advice from Inland Fisheries Ireland, the fish rescue and protection options outlined here will be implemented in order to prevent or minimise fish mortalities at the fording place: (1) The operation will be planned so that the minimum number of vehicles required will be used and the lowest possible frequency of over-and-back crossings will take place. (2) As narrow a crossing corridor as possible will be used that will still accommodate the largest vehicle needed for the decommissioning and all traffic will stick to this line. This will be facilitated by (a) demarcating the lane with red and white marker tape which will be maintained as necessary throughout and (b) only one vehicle at a time to will be allowed to cross and at a very slow speed. This approach will reduce to the absolute minimum the level of fish mortality due to crossing activities'
- Suitable sized bog mats or steel plates will be placed over the small stream that will be crossed at two points between Poleset 28A and Poleset 31.

- For the main crossing of the Owendalulleegh for access to AM 24, etc. IFI will be consulted in advance about the most appropriate crossing method. In terms of average density, we know that this crossing point holds about 0.3 trout and 0.1 stone loach per m^2 which would suggest that about 5-6 trout and about 2 stone loach, on average, might be present in a 3.5m wide corridor at a point where the river is about 5m across. These figures could be higher however if there was frequent over-and-back trafficking. It is unlikely that all fish that happened to be present at the time would be killed if the vehicles crossed slowly. However, to reduce the risk to the absolute minimum one could also electrofish the crossing corridor in advance in the following manner. Place fish stop-nets 1m upstream and 1m downstream of the crossing lane and in advance of the vehicles crossing, preferably all at the one time, electrofish out all the fish between the nets and carry them in bins of water a couple of hundred meters downstream and release them back into the channel. Let the stop nets in place until all the vehicles have crossed. If the larger vehicles could remain on site for the duration and only smaller vehicles such as 4x4s allowed to cross in the interim, that would reduce the likelihood of more fish mortalities which would be further minimised if someone walked across the river in waders just in from of a very slow moving vehicle. This would have the effect of scattering any small fish within the path to be displaced away from the vehicle advancing behind. Clearly, this approach would not be practicable if the job required very frequent back-and-forth trafficking, in which case a more structural approach might be required e.g. the installation of a baily bridge.

5.9 Consideration of findings

The rNIS has considered the likely significant effects of the Derrybrien Wind Farm Project, if any; that have occurred, that are occurring or can reasonably be expected to occur in the future; that would adversely affect the integrity of any European site(s).

Two European sites were identified at screening stage as having the potential to have been or to be significantly affected as a result of the Project.

The assessment undertaken in the rNIS has been informed by project-specific field surveys and specialist reporting with reference to the ecological communities and habitats potentially affected by the Project, in order to provide a scientific basis for evaluations.

The removal of conifer planation as part of the project construction has created approximately 255 ha of suitable open upland foraging habitat for hen harrier in the Slieve Aughty Mountains SPA. As plantation forest maturation has been quoted as being partly responsible for the regional decreases in breeding hen harriers, the alteration of mature forestry to open habitat has the potential to have significant positive effects on the hen harrier population within the Slieve Aughty Mountains SPA. The assessment has shown that there is no evidence that the construction phase of the Project and the operational phase to date, have adversely affected the integrity of the SPA. With the implementation of mitigation measures it is anticipated that the Project will not result in any future direct, indirect or cumulative adverse effects on the Slieve Aughty Mountains SPA during the continued operation and decommissioning of the wind farm and associated infrastructure.

The effects of the Project, in particular the peat slide, on Lough Cutra SPA were assessed and the findings were that the Project did not adversely affect the integrity of the site. The continued operation and decommissioning of the Project will also not affect the integrity of the SPA.

It is therefore concluded, that the Project with the implementation of the prescribed mitigation measures will not give rise to significant impacts, either individually or in combination with other plans and projects, in a manner which adversely affects the integrity of any European site(s).

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DERRYBRIEN WIND FARM

DERRYBRIEN, SLIEVE AUGHTY MOUNTAINS, CO. GALWAY

BAT ASSESSMENT

February 2012

DRAFT REPORT

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DERRYBRIEN WIND FARM

DERRYBRIEN, SLIEVE AUGHTY MOUNTAINS, CO. GALWAY

BAT ASSESSMENT

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DERRYBRIEN WIND FARM

DERRYBRIEN, SLIEVE AUGHTY MOUNTAINS, CO. GALWAY

BAT ASSESSMENT

1. INTRODUCTION

1.1. Background

Faith Wilson Ecological Consultant and licensed bat specialist was commissioned by ESB International Consulting Engineers to carry out a study in relation to bats at the Derrybrien Windfarm, Slieve Aughty Mountains, Co. Galway. The Derrybrien Windfarm Project was acquired from Saorgus by ESB with full planning permission in 2003. There were no detailed bat surveys conducted as part of the planning process for the proposed wind farm at Derrybrien as part of the original Environmental Impact Assessment.

A peat slip occurred during construction in Oct 2003 during which peat/forestry debris was mobilised. After the peat slip remediation measures were put in place. These comprised barrages/boulder dams (4 of which remain) and some rerouting of drains. Following the peat slide in 2003 some surveys of the lesser horseshoe bats at Lough Cutra were conducted (Williams, 2004a & 2004b) to try and determine if the peat slide had any adverse impacts on the local populations.

The Department of Environment Community and Local Government have advised that a substitute consent application will have to be made for Derrybrien Windfarm and the remedial measures associated with 2003 peat slip. The objective of this report is to establish the impact of the peat slide and the existing wind farm on bats.

1.2. Legislation

Note regarding the Substitute Consent Process

The Planning and Development (Amendment) Act 2010 provides for a substitute consent process, in exceptional circumstances only, to allow for retrospective planning permission for development requiring EIA, or appropriate assessment under the Habitats Directive.

The Act provides that where a planning authority becomes aware that a final judgement of a court in the state or the EU Court of Justice has been made that a planning permission was in breach of the law, invalid or otherwise defective in a material respect it will require that an

application for substitute consent is made to An Bord Pleanala to be accompanied by a remedial EIS and Natura Impact Statement.

The contents of a remedial EIS are as follows:

- A statement of significant effects, if any, on the environment, which have occurred or which can reasonably be expected to occur because of the development
- Details of any appropriate measures undertaken or proposed to remedy any significant adverse effects on the environment and the period of time within which any proposed remedial measures shall be carried out.

The contents of the remedial Natura Impact Statement are as follows:

- A statement of the significant effects, if any, on the environment, which have occurred or which are occurring or which can reasonably be expected to occur because of the development
- Details of any appropriate remedial measures undertaken or proposed to remedy any significant adverse effects on the environment and the period of time within which any proposed remedial measures shall be carried out
- Where the applicant wishes, a statement of imperative reasons of overriding public interest associated with the development or any compensatory measures being proposed by the applicant.

Legislation in relation to Bats

Wildlife Act 1976

In the Republic, under Schedule 5, of the Wildlife Act 1976, all bats, and their roosts, are protected by law. It is unlawful to disturb either without the appropriate licence. The Act was amended in 2000.

Bern and Bonn Convention

Ireland has also ratified two international wildlife laws pertaining to bats. These are known as the 'Bern' and 'Bonn' Conventions.

The Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention 1982), in relation to bats, exists to conserve all species and their habitats.

The Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention 1979, enacted 1983) was instigated to protect migrant species across all European boundaries.

EU Habitats and Species Directive

The EC Directive on the Conservation of Natural habitats and of Wild Fauna and Flora (Habitats Directive 1992), seeks to protect rare species, including bats, and their habitats and requires that appropriate monitoring of populations is undertaken. All bat species are protected under Annex IV of the EU Habitats Directive, while the lesser horseshoe bat (*Rhinolophus hipposideros*) is listed under Annex II. Member states are required to designate Special Areas of Conservation for all species listed under Annex II in order to protect them.

The current status and legal protection of the known bat species occurring in Ireland is given in **Table 1** below.

Table 1: Legal status and protection of the Irish bat fauna

Common and scientific name	Wildlife Act 1976 & Wildlife (Amendment) Act 2000	Irish Red List status	Habitats Directive	Bern & Bonn Conventions
Common pipistrelle *Pipistrellus pipistrellus*	Yes	Least Concern	Annex IV	Appendix II
Soprano pipistrelle *Pipistrellus pygmaeus*	Yes	Least Concern	Annex IV	Appendix II
Nathusius' pipistrelle *Pipistrellus nathusii*	Yes	Not referenced	Annex IV	Appendix II
Leisler's bat *Nyctalus leisleri*	Yes	Near Threatened	Annex IV	Appendix II
Brown long-eared bat *Plecotus auritus*	Yes	Least Concern	Annex IV	Appendix II
Lesser horseshoe bat *Rhinolophus hipposideros*	Yes	Least Concern	Annex II Annex IV	Appendix II
Daubenton's bat *Myotis daubentonii*	Yes	Least Concern	Annex IV	Appendix II
Natterer's bat *Myotis nattereri*	Yes	Least Concern	Annex IV	Appendix II
Whiskered bat *Myotis mystacinus*	Yes	Least Concern	Annex IV	Appendix II
Brandt's bat *Myotis brandtii*	Yes	Data Deficient	Annex IV	Appendix II

NB: Destruction, alteration or evacuation of a known bat roost is a notifiable action under current legislation and a derogation licence has to be obtained from the National Parks and Wildlife Service before works can commence.

2. METHODOLOGY

2.1. Desk Review

A review of the previous bat surveys conducted at Lough Cutra Castle by Williams (2004a & 2004b) following the peat slide was undertaken by Faith Wilson BSc CEnv MIEEM.

2.2. Consultations

A review of known bat roosts and bat activity within 10km of the windfarm was conducted using the Bat Conservation Ireland database. Monitoring data for the Lesser Horseshoe Roost at Lough Cutra Castle was provided by National Parks and Wildlife Service. Other bat specialists including members of Bat Conservation Ireland and the local Conservation Rangers from the National Parks and Wildlife Service (Raymond Stephens and Jacinta Murphy) were contacted regarding any surveys or detector work that they had carried out in the area.

2.3. Detector Survey

A bat activity survey across the operational wind farm and in the wider landscape was conducted using bat detectors. The surveys were conducted by Faith Wilson and Chris Peppiatt (both licensed bat specialists) on the 5th November 2011. During the survey each turbine was visited and bat activity was recorded using a variety of bat detectors (Heterodyne Bat Detector: Pettersson D100; Time Expansion Bat Detector: Pettersson D240; Frequency Division Bat Detector: Bat Box Duet). Time was spent at each turbine location during the survey and the networks of tracks between each turbine were also driven slowly with the bat box mounted on the window of each vehicle pointing upwards to record any bat passes. Bats were identified by their ultrasonic calls coupled with behavioural and flight observations.

2.4. Roost Survey

Initially it was proposed to resurvey the Lough Cutra Castle Lesser Horseshoe Roost as part of this study but following discussions with local National Parks and Wildlife Service staff this proposal was revised. The roost at Lough Cutra has had some recent works conducted to it and the roost is now counted by NPWS staff on a monthly basis. In order to reduce potential disturbance to the bats from additional counts it was agreed that this data would be made available to the study from NPWS and is presented below.

2.5. Survey constraints

Given the lack of baseline bat survey data for the wind farm site it is not possible to present the results of this study in a comparative way. However detailed roost information for the Lesser Horseshoe roost at Lough Cutra Castle is available from NPWS which will enable an indication of the fortunes of the roost to be examined.

Although the detector survey was carried out towards the end of the active bat season bats are currently still active and were recorded on both the wind farm site and at lower elevations.

3. RESULTS

3.1. Site Designations in the area for bats:

The closest designated Special Area of Conservation to the Derrybrien windfarm which lists lesser horseshoe bat as a qualifying interest is the Lough Cutra SAC (Site Code: 000299). This site is located approximately 12km to the south-west of the windfarm. The site synopsis for the site is presented in **Appendix 1**.

3.2. Rare and protected bat species known from the area

The wind farm is within the known range of the lesser horseshoe bat (*Rhinolophus hipposideros*) – this species is restricted in it's distribution to the west of Ireland and is found in Counties Mayo, Galway, Clare, Limerick, Kerry and Cork (Kelleher, 2004). This species is given additional protection under Annex II of the EU Habitats which requires member states to designate Special Areas of Conservation for the species.

There are a number of known lesser horseshoe roosts, all of which are located to the west of the wind farm as summarised below in **Table 2**. Two of these are located within 10km to the south-west of the site. Lough Cutra Castle, Gort which is located c.12km to the south-west of the site is also included in this table as the peat slide from Derrybrien entered the Owendallulleegh River ultimately entering Lough Cutra and there were concerns that the population of lesser horseshoe bats that roost there and form par t of the qualifying interest for the site may have been impacted.

Table 2. Known lesser horseshoe bat roosts within a 10km radius of the wind farm

Grid Ref	Name	Source	Species	Comment
R 47 98	Lough Cutra Castle, Gort, Co. Galway	NPWS Lesser Horseshoe Bat Database	*Rhinolophus hipposideros*	c.12km south west of the site

Grid Ref	Name	Source	Species	Comment
M 48 06	Thor Ballylee, Gort, Co. Galway	Bat Conservation Ireland Database	*Rhinolophus hipposideros*	c.9.3km to the west of the site
M 47 04	Cloonbeg, Gort, Co. Galway	Bat Conservation Ireland Database	*Rhinolophus hipposideros*	c.10km west of the site

The rare Nathusius' pipistrelle (*Pipistrellus nathusii*) was recorded from County Galway in 2007 (Bat Conservation Ireland database) but has not yet been recorded from Co. Clare.

All Irish species of bats are strictly protected under both the Wildlife Act (1976, amended 2000), the Bern and Bonn Convention and under Annex IV of the EU Habitats Directive.

3.3. Records of other bat roosts within a 10km radius of the wind farm.

There are no other known bat roosts within close proximity to the wind farm. There is a known roost of brown long-eared bats (*Plecotus auritus*) and soprano pipistrelle (*Pipistrellus pygmaeus*) and a second roost of brown long-eared bats and an unidentified *Myotis* sp. from a private residence and farm buildings at Ballynagar which is some 10km to the east of the wind farm.

Table 3. Previously known bat roosts within a 10km radius of the wind farm.

Grid Ref	Name	Source	Species	Comment
M 71 04	Private residence, Ballynagar, Co. Galway	Bat Conservation Ireland Database	*Plecotus auritus* *Pipistrellus pygmaeus*	10km east of the site
M 71 04	Farm Buildings, Ballynagar, Co. Galway	Bat Conservation Ireland Database	*Plecotus auritus* *Myotis sp.*	10km east of the site

3.4. Records of bat activity within a 10km radius of the wind farm.

Bats recorded from within a 10km radius of the wider study area are documented from a variety of data sources. These include reports prepared by licensed bat specialists and ecological consultants, records of activity recorded during Bat Conservation Ireland projects such as the BATLAS 2010 project and other records collated in the Bat Conservation Ireland Database.

The closest records of bats to the wind farm were made during the BATLAS 2010 Project recorded a good diversity of species from the general area. These include:

- Daubenton's bat (*Myotis daubentonii),* Leisler's bat (*Nyctalus leisleri*), soprano pipistrelle (*Pipistrellus pygmaeus*) and common pipistrelle (*Pipistrellus pipistrellus*) from Peterswell Turlough SAC which is located west of the N66,
- Leisler's bat (*Nyctalus leisleri*), soprano pipistrelle (*Pipistrellus pygmaeus*) and common pipistrelle (*Pipistrellus pipistrellus*) from Peterswell,
- An unidentified *Myotis* sp. and an unidentified bat from Kenny's Bridge, Farnaun,
- Leisler's bat (*Nyctalus leisleri*), soprano pipistrelle (*Pipistrellus pygmaeus*) and common pipistrelle (*Pipistrellus pipistrellus*) from Brockagh near Lough Atorick,
- An unidentified *Myotis* sp. and common pipistrelle (*Pipistrellus pipistrellus*) from Corlea Bridge on the Bleach River,
- Soprano pipistrelle (*Pipistrellus pygmaeus*) at Bleach Bridge on the east side of Lough Graney,
- Leisler's bat (*Nyctalus leisleri*) and common pipistrelle (*Pipistrellus pipistrellus*) from Speightspark on the west side of Lough Graney,
- Leisler's bat (*Nyctalus leisleri*) on the Clare Way,
- Soprano pipistrelle (*Pipistrellus pygmaeus*), an unidentified *Myotis* sp. and common pipistrelle (*Pipistrellus pipistrellus*) from Ballymanagh Crossroads,
- Daubenton's bat (*Myotis daubentonii),* soprano pipistrelle (*Pipistrellus pygmaeus*) and an unidentified *Myotis* sp. from Deerpark near Kilchreest,
- Soprano pipistrelle (*Pipistrellus pygmaeus*) from Clonoo East west of Loughrea,
- Soprano pipistrelle (*Pipistrellus pygmaeus*) from Leitrim More Castle.

The closest of these records was within 6km of the site. Other EIS studies in the area also recorded;

- soprano pipistrelle (*Pipistrellus pygmaeus*) at Ballynagar,
- common pipistrelle (*Pipistrellus pipistrellus*) at Ballaba.

The bat surveys conducted during 2004 by Howard Williams focused on bat activity in the Lough Cutra Castle Demesne. A spring survey conducted in March 2004 recorded 45 bats using the castle cellars for roosting purposes. In addition to the counts of lesser horseshoe bat the surveys also recorded:

- Soprano pipistrelle (*Pipistrellus pygmaeus*)
- Common pipistrelle (*P. pipistrellus*)
- Leisler's bat (*Nyctalus leisleri*)
- Natterer's bat (*Myotis nattereri*)

A summer survey was also conducted by Williams with counts in August and September 2004. This survey confirmed the presence of:

- Lesser horseshoe bat (*Rhinolophus hipposideros*)
- Soprano pipistrelle (*Pipistrellus pygmaeus*)
- Common pipistrelle (*P. pipistrellus*)
- Leisler's bat (*Nyctalus leisleri*)
- Natterer's bat (*Myotis nattereri*)
- Daubenton's bat (*Myotis daubentonii*)
- Whiskered bat (*Myotis mystacinus*)
- Brown long-eared bat (*Plecotus auritus*)

An estimate of 60 lesser horseshoe bats divided between the boiler house and the basement was made. A roost of Soprano pipistrelle and Natterer's bats was confirmed from a tower in the gate lodge in the estate (10 – 20 Natterers' bats and c.20 soprano pipistrelle).

3.5. Detector Survey

Weather conditions

Sunset 17:00 GMT, Cloud 5-10% at start (not much change during the approx. 3.5 hours), bright night with a waxing moon, wind light W (estimated Beaufort Scale 1), few flying insects seen. Temperatures – initial temperature was 8.5°C dropping to 5°C by the end of the survey.

Confirmed and potential roosts

No new roosts were confirmed during the detector survey but a number of buildings in the general area of the wind farm have potential both as maternity roosts and potential hibernation sites for bats. As these were private residences it was not possible to examine them in detail.

Areas of importance for foraging and commuting bats

The presence of bats using the wind farm for foraging purposes was confirmed during the detector survey of the site. Bat passes were recorded on two observations – a single pass of a distant unidentified bat was recorded near Turbine 40 with a similar observation of a single pass of an unidentified pipistrelle bat on the track between the junction of Turbines 56 and 57.

Details of the detector survey and the observations made are presented below in **Table 4** and coupled with the existing data held by Bat Conservation Ireland has allowed the status of bats in the study area to be determined (**Table 5**).

Table 4. Bat activity recorded using bat detectors within the wind farm site at Derrybrien with observations on features of interest to bats for foraging and commuting and assessment of potential collision risk with wind turbines.

Turbine Number	Easting	Northing	Time	Description	Observation	Distance from turbine base to adjoining vegetation likely to be used by bats (m)	Potential collision risk (H/M/L)
T1	157724	204779	19:19:00	Forestry on two sides, turbine is located in a corner	No bat activity recorded	29/35	H
T2	157942	204861	19:21:00	Forestry on two sides, turbine is located in a corner	No bat activity recorded	17/37	H
T3	157837	204545	19:17:00	Forestry on one side	No bat activity recorded	25	H
T4	158059	204646	19:27:00	Distant forestry	No bat activity recorded	93/122	M
T5	158247	204745	19:30:00	Almost encircled by forestry	No bat activity recorded	14/35	H
T6	157971	204362	19:14:00	Forestry on one side	No bat activity recorded	29	H
T7	158185	204433	19:37:00	Surrounded by wet grassland/clear fell	No bat activity recorded	131	M
T8	158427	204563	19:39:00	Some forestry adjoining	No bat activity recorded	35	H
T9	158573	204621	19:42:00	Some forestry adjoining	No bat activity recorded	50 – 70	M
T10	158793	204712	19:45:00	Surrounded by wet grassland/clearfell	No bat activity recorded	200	L
T11	158993	204794	19:49:00	Surrounded by wet grassland/clearfell	No bat activity recorded	225	L
T12	158083	204102	18:59:00	Forestry on one side	No bat activity recorded	45	H
T13	158298	204194	19:02:00	Surrounded by wet grassland/clearfell	No bat activity recorded	270	L
T14	158495	204317	19:04:00	Surrounded by wet grassland/clearfell	No bat activity recorded	290	L
T15	158685	204373	19:08:00	Surrounded by wet grassland/clearfell	No bat activity recorded	285	L

Turbine Number	Easting	Northing	Time	Description	Observation	Distance from turbine base to adjoining vegetation likely to be used by bats (m)	Potential collision risk (H/M/L)
T17	159116	204535	19:55:00	Low scattered conifers	No bat activity recorded	90	M
T18	158212	203857	18:57:00	Forestry on one side	No bat activity recorded	35	H
T19	158417	203937	18:53:00	Forestry on one side	No bat activity recorded	20	H
T20	158626	204045	18:50:00	Forestry on one side	No bat activity recorded	20	H
T21	158826	204148	18:46:00	Forestry on one side	No bat activity recorded	30	H
T22	159022	204237	18:42:00	Forestry on one side	No bat activity recorded	20	H
T23	159255	204307	18:38:00	Forestry on one side	No bat activity recorded	40	H
T24	159638	205083	20:14:00	Forestry at some distance to N and S	No bat activity recorded	130 - 140	L
T25	159739	204816	19:24:00	Forestry blocks to N and S	No bat activity recorded	40	H
T26	159905	204601	18:26:00	Forestry on two sides	No bat activity recorded	40 – 60	H
T27	159811	205250	21:07:00	Few small (to 5 metres) isolated self-sown saplings nearby, forestry 150-200 metres away to NE	No bat activity recorded	150 - 200	L
T28	159997	204938	19:37:00	Open – clearfell	No bat activity recorded	230	L
T29	160102	204702	18:35:00	Forestry to S	No bat activity recorded	30	H
T30	160034	205346	21:10:00	Forestry to N	No bat activity recorded	25	H
T31	160207	205042	19:50:00	Open	No bat activity recorded	135	L
T32	160281	204788	18:42:00	Forestry to S	No bat activity recorded	30	H
T33	160219	205422	21:14:00	Forestry to N, plus self-sown saplings nearby	No bat activity recorded	20	H
T34	160413	205125	19:58:00	Open	No bat activity recorded	280	L
T35	160459	204883	18:52:00	Forestry to S	No bat activity recorded	50	H
T36	160413	205505	21:17:00	Forestry to N	No bat activity recorded	20	H

Turbine Number	Easting	Northing	Time	Description	Observation	Distance from turbine base to adjoining vegetation likely to be used by bats (m)	Potential collision risk (H/M/L)
T37	160618	205216	20:05:00	Open	No bat activity recorded	260	L
T38	160636	204960	19:00:00	Forestry to S	No bat activity recorded	40	H
T39	160582	205579	21:20:00	Forestry to N, plus self-sown saplings nearby.	No bat activity recorded	25	H
T40	160789	205272	20:12:00	Open	21:18: one quick pass (seemed relatively distant) of unidentified Pipistrelle, not seen	230	L
T41	160801	205061	19:09:00	Forestry to S	No bat activity recorded	55	M
T42	160844	205609	21:25:00	Forestry to N, plus self-sown saplings nearby	No bat activity recorded	45	H
T43	160951	205159	20:38:00	Forestry to S	No bat activity recorded	140	L
T44	161041	205587	21:29:00	Forestry to N, plus self-sown saplings nearby	No bat activity recorded	45	H
T45	161146	205221	20:22:00	Open	No bat activity recorded	230	L
T46	161166	204961	20:31:00	Forestry to S	No bat activity recorded	90	M
T47	158301	205328	21:33:00	Forestry very close	No bat activity recorded	30	H
T48	158447	205411	21:36:00	Forestry on one side	No bat activity recorded	25	H
T49	158704	205512	21:40:00	Forestry on one side	No bat activity recorded	35	H
T50	158884	205610	21:47:00	Forestry on one side	No bat activity recorded	30	H
T51	159107	205713	21:51:00	Surrounded by wet grassland/clearfell, forestry to N	No bat activity recorded	60	M
T52	159301	205746	21:55:00	Surrounded by wet grassland/clearfell, forestry on both sides	No bat activity recorded	45 - 90	H

Turbine Number	Easting	Northing	Time	Description	Observation	Distance from turbine base to adjoining vegetation likely to be used by bats (m)	Potential collision risk (H/M/L)
T53	158482	205154	21:27:00	Forestry on one side, clearfell on the other	No bat activity recorded	35	H
T54	158655	205235	21:24:00	Forestry on both sides, 10 - 12m tall	No bat activity recorded	30	H
T55	158822	205317	21:21:00	Forestry close by	No bat activity recorded	30	H
T56	158985	205397	21:18:00	Surrounded by wet grassland/clearfell	Unidentified pipistrelle bat recorded between here and turbine 57, single pass only, foraging in amongst self sown conifers/scrub	90	M
T57	159249	205553	21:56:00	Forestry blocks all around	No bat activity recorded	57	M
T58	159447	205569	21:09:00	Some conifers adjoining on two sides	No bat activity recorded	60	M
T59	158565	204910	20:27:00	Surrounded by wet grassland/clearfell, forestry to S	No bat activity recorded	140	L
T60	158778	204988	20:30:00	Surrounded by wet grassland/clearfell, forestry to N	No bat activity recorded	45	H
T61	158961	205080	20:33:00	Surrounded by wet grassland/clearfell, forestry to W	No bat activity recorded	80	M
T62	159206	205247	20:37:00	Forestry on both sides N and S	No bat activity recorded	65	M
T63	159408	205269	20:40:00	Surrounded by wet grassland/clearfell and several blocks forestry	No bat activity recorded	50	H
T64	159588	205374	20:43:00	Surrounded by wet grassland/clearfell, forestry to S	No bat activity recorded	50	H
T65	159822	205461	21:37:00	Forestry to N and E	No bat activity recorded	40	H

Turbine Number	Easting	Northing	Time	Description	Observation	Distance from turbine base to adjoining vegetation likely to be used by bats (m)	Potential collision risk (H/M/L)
T66	159205	204891	20:19:00	Surrounded by wet grassland/clearfell	No bat activity recorded	125	L
T67	159395	204989	20:16:00	Forestry close by to S	No bat activity recorded	50	H
T68	159294	204643	17:20:00	Youngish forestry on one side	No bat activity recorded	10	H
T69	159521	204745	17:25:00	Forestry on both sides	No bat activity recorded	45	H
T70	159515	204408	18:36:00	Forestry on both sides	No bat activity recorded	30	H
T71	159711	204495	18:30:00	Forestry nearby on two sides	No bat activity recorded	25 – 30	H

Table 5. Adjudged status of Irish bat species within the study area.

Common name	Scientific name	Occurrence	Confirmed Roosts	Source
Common pipistrelle	*Pipistrellus pipistrellus*	Present – unidentified pipistrelle recorded in site	Yes	BCI database and field survey
Soprano pipistrelle	*Pipistrellus pygmaeus*	Likely – unidentified pipistrelle recorded	Yes	BCI database and field survey
Nathusius' pipistrelle	*Pipistrellus nathusii*	Potential – recorded from the county	No	BCI database
Leisler's	*Nyctalus leisleri*	Present	No	BCI database
Brown long-eared	*Plecotus auritus*	Present	Yes	BCI database
Lesser horseshoe	*Rhinolophus hipposideros*	Present	Yes	BCI database and field survey
Daubenton's	*Myotis daubentonii*	Present	No	BCI database
Natterer's	*Myotis nattereri*	Potential	No	BCI database
Whiskered	*Myotis mystacinus*	Potential	No	BCI database
Brandt's	*Myotis brandtii*	Potential – rare	No	BCI database

Bat activity was noted at lower elevations on leaving the site. At lower elevations two soprano pipistrelles and the other 4 unidentified pipistrelles were recorded on the minor road between the wind farm entrance and the R353. Five soprano pipistrelles were recorded on the minor road from the wind farm entrance to Killeenadeema.

3.6. Lesser horseshoe roost at Lough Cutra

The lesser horseshoe roost at Lough Cutra has been monitored over a number of years by National Parks and Wildlife Service staff and this data from the NPWS lesser horseshoe roost database is presented below in **Table 6**.

Table 6. NPWS counts conducted at the Lough Cutra roost.

Date	No. of bats present	Count Type	Droppings present	Bat Activity
21/07/1987	60		No	
14/01/1988	39		No	
17/01/2001	93		No	
19/04/2000	2		No	
Winter 1999/2000	49		No	
23/02/2006	84	Visual	Yes	Semi-active
13/06/2006	5		No	
23/01/2008	78	Visual	No	
20/08/2008	30	Heterodyne	No	
09/01/2009	97	Internal count	No	Torpid
17/06/2009	84	Internal count	No	Semi-active
03/07/2009	0	Internal count	No	
06/08/2009	1	Internal count	No	Semi-active
09/09/2009	31	Internal count	No	Semi-active
02/12/2009	139	Internal count	No	Semi-active
11/01/2010	142	Internal count	No	Torpid
12/02/2010	132	Internal count	No	Torpid

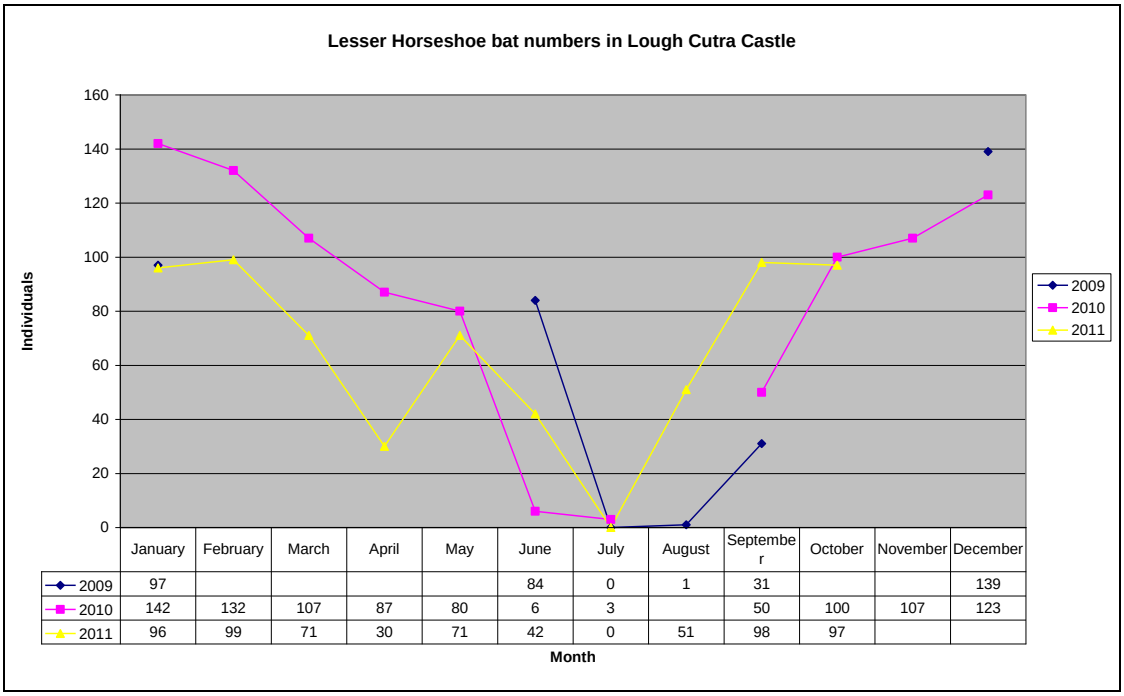
Since works to the roost took place in 2008 the roost has been monitored on a monthly basis by the local conservation staff. A summary of those counts is presented below in **Table 7**.

Table 7. Monthly monitoring counts of the roost conducted by NPWS staff following renovation works.

Month	2009	2010	2011
January	97	142	96
February		132	99
March		107	71
April		87	30
May		80	71
June	84	6	42
July	0	3	0
August	1		51
September	31	50	98
October		100	97
November		107	
December	139	123	
Average per year	***90***	***85***	***65***

These monthly counts are presented below in **Figure 1** and in general bat numbers at the roost have either increased or remained stable since the roost was first counted in 1987 when 60 bats were present indicating that the local population of lesser horseshoe bats are in favourable conservation status which is the same as the national population.

Figure 1. Lesser horseshoe bat numbers in Lough Cutra Castle 2009 – 2011.



	January	February	March	April	May	June	July	August	September	October	November	December
2009	97					84	0	1	31			139
2010	142	132	107	87	80	6	3		50	100	107	123
2011	96	99	71	30	71	42	0	51	98	97		

4. DISCUSSION AND IMPACT ASSESSMENT

4.1. Assessment of potential impacts of the peat slide in relation to bats

The peat slide which occurred in 2003, whilst causing a fish kill and degradation of water quality in the Owendalulleegh River is unlikely to have impacted on local bat populations in particular the lesser horseshoe bats in Lough Cutra Castle. The main habitats used by lesser horseshoe bats for foraging identified by NPWS (2007) include:

- Riparian
- Scrub woodland
- Deciduous woodland
- Mixed woodland
- Hazel woodland
- Lake
- Grassland
- Conifer plantation
- Limestone pavement
- Coastal
- Pasture
- Parkland
- Turlough
- Caves (sea and non-marine)
- Artificial underground habitats

Those habitats within the foraging range of the roost would have been unaffected by the peat slide at Derrybrien with the exception of Lough Cutra itself. The principal foraging habitat for lesser horseshoe bats has been shown through radio tracking studies to be woodlands with some use of pasture and wetlands, rarely foraging over open water (Biggane (2004a, 2004b, , Bontadina *et. al.* (2002)).

Given that the Lough Cutra Castle population has ultimately remained stable and in some years has increased there would appear to be no negative impacts on this population from the peat slide and subsequent pollution event.

4.2. Assessment of potential impacts of the operational wind farm in relation to bats

Bats and Windfarms

Over the past decade an increasing body of evidence has emerged to indicate that many operational wind farms are having a negative impact on bats. These include studies from Europe, Australia and North America, which has documented a number of cases where bat mortalities have been recorded. These fatalities are thought to have occurred due to collisions with wind turbines but recent research has found that many of the bats had suffered barotraumas[1] (Baerwald *et. al.* (2008)). The study found that 90% of bat fatalities involved internal haemorrhaging consistent with barotrauma, and that direct contact with turbine blades only accounted for about half of the fatalities.

Four main potential negative impacts on bats by wind farms have been identified (Bach & Rahmel 2004):

- Collision with turbine blades
- Loss of foraging habitat
- Blocking of commuting or migration routes
- Ultrasound emission by wind turbines

4.2.1. Collision with turbine blades

To date most bat mortalities that have been documented have occurred during late summer or early autumn (Brinkman 2004, Dürr and Bach 2004), particularly during the period mid-July to September, which has suggested that migratory bats may be at high risk. However, recent data from Germany show that significant numbers of bat collisions have occurred at some sites before mid July and that resident bats such as Pipistrelles, also appear to be affected (Brinkmann *et al*. 2006).

The foraging behaviour and habitat preferences of British bats has been well researched (see Altringham 2003; Walsh and Harris 1996a, b) and these observations would be expected to be replicated in Ireland given the species present and landscape similarities. At present however very little is known about bat activity within collision envelope heights and indeed activity levels of bats at elevated locations in Ireland which are typically selected for wind farm/turbine developments.

Guidance on this has been developed by Natural England in Bats and Onshore Wind Turbines: Interim Guidance (Natural England 2009). This document provides guidance on

[1] Barotrauma involves tissue damage to air-containing structures caused by rapid or excessive pressure change; pulmonary barotrauma is lung damage due to expansion of air in the lungs that is not accommodated by exhalation).

assessing the risk posed by wind turbines on various bat species by taking into account various factors including habitat preference and flight behaviour. An assessment of the risk of collision fatalities affecting bat populations was also conducted in this document. These assessments are presented below in **Tables 8** and **9**.

Table 8. Assessing risk posed by turbines by taking account of various factors including habitat preference and flight behaviour (Source: Natural England (2009))

Factor	Low Risk	Medium Risk	High Risk
Habitat preference	Bats preferring cluttered habitat	Bats able to exploit background cluttered space	Bats preferring to use open habitat
Echolocation characteristics	Short range High frequency Low intensity Detection distance ~15m	Intermediate – more plastic in their echolocation	Long range Low frequency High intensity Detection distance ~80m
Weight	Lightest	Medium	Heaviest
Wing shape	Low wing loading Low aspect ratio Broadest wings	Intermediate	High wing loading High aspect ratio Narrow wings
Flight speed	Slow	Intermediate	Fast
Flight behaviour and use of landscape	Manoeuvre well will travel in cluttered habitat Keeps close to vegetation Gaps may be avoided	Some flexibility	Less able to manoeuvre May avoid cluttered habitat Can get away from unsuitable habitat quickly Commute across open landscape
Hunting techniques	Hunt close to vegetation Exploit richer food sources in cluttered habitat Gleaners	Hunt in edge and gap habitat Aerial hawkers	Less able to exploit insect abundance in cluttered habitat Aerial hawker Feed in open
Migration	Local or regional movements	Regional migrant in some parts of range	Long-range migrant in some parts of range

Factor	Low Risk	Medium Risk	High Risk
Conclusion	*Myotis* (most species) Long eared-bats Horseshoe bats	Common pipistrelle Soprano pipistrelle *Serotine *Barbastelle	*Noctule Leisler's bat Nathusius' pipistrelle

* These bat species are not present in Ireland.

Table 9. Risk of Collision Fatalities Affecting Bat Populations, (Source: Natural England (2009), modified to only show Irish Bat Species).

Bat species	Scientific Name	Relative population size and status	Risk of collision^	Population Threat
Common pipistrelle	*Pipistrellus pipistrellus*	Common/Least Concern	Medium	Low
Soprano pipistrelle	*Pipistrellus pygmaeus*	Common/Least Concern	Medium	Low
Brown long eared bat	*Plecotus auritus*	Common/Least Concern	Low	Low
Daubenton's bat	*Myotis daubentonii*	Common/Least Concern	Low	Low
Natterer's Bat	*Myotis nattereri*	Fairly Common/Least Concern	Low	Low
Whiskered Bat	*Myotis mystacinus*	Locally distributed/Least Concern	Low	Low
Brandt's bat	*Myotis brandtii*	Data deficient	Low	Low
Leisler's Bat	*Nyctalus leisleri*	Common/ Near Threatened	High	High
Nathusius's Pipistrelle	*Pipistrellus nathusii*	Rare/Least Concern	High	High
Lesser Horseshoe	*Rhinolophus hipposideros*	Rare/Least Concern	Low	Low

** Based on Known Distribution and ranking in Irish Red Data Book – Terrestrial Mammals.
^ Risk of collision is based on what we currently know about bat behaviour.

There is currently insufficient information available on if and how bats migrate in the Irish/British environment. Leisler's, Nathusius pipistrelle and soprano pipistrelle bats can all migrate over considerable distances. Work conducted under the study team of Professor Altringham has also shown that bats may migrate over 60 miles to swarming sites during the autumn months (Rivers *et. al.* (2006)). However, it is not known if similar long-distance migrations take place in Ireland. Bats in Ireland may migrate only short distances (several kilometres) between summer roosts and winter hibernacula. However bats could still be at risk of collision and baro-trauma during such migrations depending upon the habitats and terrain present and the location of any wind turbines.

4.2.2. Habitat use by bats

In general bats tend to favour areas of broadleaf woodland and water in preference to areas such as open arable fields, improved grassland, and open moorland (Walsh and Harris 1996a, 1996b). Linear features through the landscape such as hedgerows, treelines, watercourses and woodland margins, are of importance for commuting and feeding bats, often providing ecological corridors for movement between isolated habitats. In general the direct loss of habitat associated with the erection of wind turbines and associated infrastructure, i.e. turbine foundations, access tracks and electrical sub-stations, is typically small although the wind farm itself may cover a large area of ground as at Derrybrien.

It is therefore unlikely that direct habitat loss at Derrybrien formed a significant issue for bats although on some sites this could be exacerbated if for example a small local pond used by Daubenton's was lost or works resulted in the drainage of wetland habitats.

The main potential impact in terms of habitat use by bats caused by a turbine/wind farm arises from fragmentation of habitats and the loss of or interference to commuting or migrating routes. These impacts may arise either directly through the removal of a section of hedgerow to facilitate an access track or general avoidance of the area. A study of Serotine bats in Germany found that the bats increasingly avoided a site on which a wind farm was located over a four year period, although they had previously used the area. Such avoidance may also be a species specific reaction as at the same location pipistrelle bats only altered their behaviour depending upon the position of the turbines (Bach (2002)).

Bat abundance has been positively related to the presence of woodland habitat (Walsh and Harris 1996a, 1996b), so it is perhaps not surprising that some researchers have found that bat mortalities appear to be higher in or near forests (Arnett *et al* 2004; Brinkman 2004). Research carried out in Germany has suggested that bats may be at greater risk of collision with wind turbines that have been sited in highly structured landscapes, such as forests (Brinkman 2004; Brinkman *et al* 2006).

4.2.3. Baroutrauma

Bats may also be killed by lung damage due to pressure changes around a rotating rotor blade ("barotrauma") and hence there is no necessity for bats to make contact with a rotor to be killed by its movement.

4.2.4. Disturbance due to ultrasound emission

At present it is unknown how bats react to the ultrasound emissions produced by wind turbines. In a number of cases it has been shown that bats do react to ultrasounds when the intensity/frequency is in the same range as their own sonar calls (Bach & Rahmel (2004)). However with the exception of a few single observations, the way bats react to turbine ultrasounds is completely unknown.

4.2.5. Other Considerations

Grid connections

The power lines connecting wind farms to the national grid can also have impacts on bats in the wider landscape through loss of hedgerows, severance of habitats, etc. but can also create new foraging habitat especially through dense conifer plantations in the landscape.

Site Lighting

Lighting may interfere with bat activity, as it not only can deter some species from foraging in an area but should areas around or near turbines be illuminated this could actually attract other species of bats to the area as they will come to forage on the insects which accumulate below the lights.

Bridge Upgrades

Local bridges which have roosting potential for bats often require strengthening works, pressure grouting, etc. in order to accommodate the construction traffic for the wind farm. This can result in the entombment of bats and loss of roosts.

4.2.6. Operational Impacts

The principal operational impacts on bats arising from operation of any wind farm, is a risk of collision. Recent collision studies conducted at German wind farm sites have shown a significant correlation between rates of collision and extensively forested sites; however, Brinkmann & Schauer-Weisshahn (2006) cautioned that the evaluation of each potential wind farm site on other factors besides forestation is needed. Current evidence largely, but not entirely, suggests that bat mortality in the USA appears to be highest in or near forests (especially forests along ridge tops), more moderate in open areas close to forest, and lowest in open grassland or farmland away from forests (Arnett 2005).

5. RECOMMENDATIONS AND MITIGATION OPTIONS

5.1. Detailed Bat Survey

No baseline surveys of bats were undertaken in advance of the construction of the wind farm at Derrybrien and there has been no monitoring of the operational impacts of the turbines on local populations. The presence of bats using the wind farm site at Derrybrien was confirmed during the recent detector survey on site.

Given the time of year in which this survey was conducted, which is approaching the hibernation period for bats, it is thought that this is an under-representation of the importance of the site for bats. It is therefore recommended that a detailed bat survey is conducted across the active bat season in line with the Bat Conservation Ireland Guidelines for bat surveys of Terrestrial Turbines and Wind Farms in Ireland.

Following this survey work the true significance and importance of the site for local bat populations can be assessed and suitable mitigation measures can then be designed and implemented as appropriate to ensure that the operating wind farm at Derrybrien is not negatively impacting these protected species. Potential mitigation measures are outlined below.

5.2. Collision risk mitigation

Vegetation buffer distance

One of the main mitigation measures recommended to reduce collision risk is that the layout of each turbine is buffered (from the blade tip) a minimum of 50m away from all linear habitat features (e.g. hedgerows, tree-lines, and woodland edges). This buffer distance conforms to the linear feature buffer recommended by Natural England (Mitchell-Jones & Carlin (2008)). This measure generally requires the removal of vegetation within this area to reduce its foraging suitability for bats and will also reduce turbulence for the turbines.

Clearance of such vegetation should take place during the winter months (November – February) which will also avoid the bird breeding season (March – August inclusive). The vegetation in these cleared areas will then need to be removed on an ongoing basis to reduce their attractiveness to bats.

As detailed above in **Table 4** a number of turbines are located in very close proximity to forestry edges (typically within 50m) and thus pose a risk to foraging and commuting bats. Vegetation (principally the conifer plantation) surrounding some of these turbines may need

to be cut back depending on bat activity levels in the area. These are summarised below in **Table10**.

Table 10. Buffer zones required for existing turbines at Derrybrien.

Turbine Number	Observation	Distance from adjoining vegetation likely to be used by bats (m)	Potential risk (H/M/L)	Expand buffer zone to vegetation to >50m
T1	No bat activity recorded	29/35	H	Y
T2	No bat activity recorded	17/37	H	Y
T3	No bat activity recorded	25	H	Y
T4	No bat activity recorded	93/122	M	N
T5	No bat activity recorded	14/35	H	Y
T6	No bat activity recorded	29	H	Y
T7	No bat activity recorded	131	M	N
T8	No bat activity recorded	35	H	Y
T9	No bat activity recorded	50 – 70	M	Y
T10	No bat activity recorded	200	L	N
T11	No bat activity recorded	225	L	N
T12	No bat activity recorded	45	H	Y
T13	No bat activity recorded	270	L	N
T14	No bat activity recorded	290	L	N
T15	No bat activity recorded	285	L	N
T17	No bat activity recorded	90	M	N
T18	No bat activity recorded	35	H	Y
T19	No bat activity recorded	20	H	Y
T20	No bat activity recorded	20	H	Y
T21	No bat activity recorded	30	H	Y
T22	No bat activity recorded	20	H	Y
T23	No bat activity recorded	40	H	Y
T24	No bat activity recorded	130 - 140	L	N
T25	No bat activity recorded	40	H	Y
T26	No bat activity recorded	40 – 60	H	Y
T27	No bat activity recorded	150 - 200	L	N
T28	No bat activity recorded	230	L	N
T29	No bat activity recorded	30	H	Y
T30	No bat activity recorded	25	H	Y
T31	No bat activity recorded	135	L	N
T32	No bat activity recorded	30	H	Y
T33	No bat activity recorded	20	H	Y
T34	No bat activity recorded	280	L	N
T35	No bat activity recorded	50	H	Y
T36	No bat activity recorded	20	H	Y
T37	No bat activity recorded	260	L	N
T38	No bat activity recorded	40	H	Y

Turbine Number	Observation	Distance from adjoining vegetation likely to be used by bats (m)	Potential risk (H/M/L)	Expand buffer zone to vegetation to >50m
T39	No bat activity recorded	25	H	Y
T40	21:18: one quick pass (seemed relatively distant) of unidentified Pipistrelle, not seen.	230	L	N
T41	No bat activity recorded	55	M	N
T42	No bat activity recorded	45	H	Y
T43	No bat activity recorded	140	L	N
T44	No bat activity recorded	45	H	Y
T45	No bat activity recorded	230	L	N
T46	No bat activity recorded	90	M	N
T47	No bat activity recorded	30	H	Y
T48	No bat activity recorded	25	H	Y
T49	No bat activity recorded	35	H	Y
T50	No bat activity recorded	30	H	Y
T51	No bat activity recorded	60	M	N
T52	No bat activity recorded	45 - 90	H	Y
T53	No bat activity recorded	35	H	Y
T54	No bat activity recorded	30	H	Y
T55	No bat activity recorded	30	H	Y
T56	Unidentified pipistrelle bat recorded between here and turbine 57, single pass only, foraging in amongst self sown conifers/scrub	90	M	N
T57	No bat activity recorded	57	M	N
T58	No bat activity recorded	60	M	N
T59	No bat activity recorded	140	L	N
T60	No bat activity recorded	45	H	Y
T61	No bat activity recorded	80	M	N
T62	No bat activity recorded	65	M	N
T63	No bat activity recorded	50	H	Y
T64	No bat activity recorded	50	H	Y
T65	No bat activity recorded	40	H	Y
T66	No bat activity recorded	125	L	N
T67	No bat activity recorded	50	H	Y
T68	No bat activity recorded	10	H	Y
T69	No bat activity recorded	45	H	Y
T70	No bat activity recorded	30	H	Y
T71	No bat activity recorded	25 – 30	H	Y

Operational curtailment

Should the creation of a buffer zone not have the required outcome and bat fatalities are still occurring another option is that of operational curtailment of turbines at low wind speeds as this is when bats are most likely to be foraging in close proximity to the turbines. Operational curtailment refers to selected, short-term periods when turbine rotor blades are intentionally kept from rotating. For bats, the most cost-effective type of operational curtailment appears to be a modest increase in cut-in speed, the lowest wind speed at which the rotor blades spin and generate electricity for the grid. Recent, cutting-edge research at wind farms in Canada, Germany, and the United States shows that increasing the cut-in speed from the usual 3.5–4.0 meters/second to about 6 m/s reduces bat mortality by 50–75 percent, while reducing power generation by only about 1 percent (Arnett, (2010)). This mitigation method has been proven to reduce bat kills from 53 to 87% on any given night, averaging 73%, at turbines that were partially curtailed during low-wind nights compared to those that were fully operational, (Arnett, pers. comm.) Such curtailment measures may only need to be applied to specific turbines within the wind farm where collision risk is high as opposed to across the board.

5.3. Monitoring

It is recommended that a year round bat detector activity survey and three year bat corpse monitoring study of the Derrybrien wind farm is designed and implemented to address if the wind farm is currently having an impact on bat mortality and to assess if the mitigation measures outlined above are working. This is in line with the guidelines issued by EUROBATS (Rodrigues, (2008)).

On completion of the study the results should be made available to the statutory agencies with the understanding that the results will be made available to any interested parties to assess the impacts of wind farms on Irish bat species and populations and to inform future Environmental Impact Studies, Ecological Assessment, and Appropriate Assessment work.

6. CONCLUSION

It is not thought that the peat slide at Derrybrien has had any adverse impacts on the population of lesser horseshoe bats at Lough Cutra Castle as the population there remains in favourable conservation status and is unlikely to have been impacted by this event.

At present it is unknown if the operation of the Derrybrien wind farm is having a negative impact on other species of bats as there has been no baseline surveys conducted during optimum conditions beyond a limited survey which was conducted in November 2011. This

is very late in the active bat season and does not present an accurate representation of how the site is being used by bats and the potential impacts of the wind farm.

It is therefore recommended that a year long bat detector activity survey and three year bat corpse monitoring study of the Derrybrien wind farm is designed and implemented to address if the wind farm is currently having an impact on bat mortality.

A number of possible mitigation measures have been detailed and such a survey will determine if these measures are either required, or once implemented, if they are working.

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8. APPENDIX 1. SITE SYNOPSIS FOR LOUGH CUTRA SAC.

SITE SYNOPSIS

SITE NAME: LOUGH CUTRA

SITE CODE: 000299

Lough Cutra is a large oligo/mesotrophic freshwater lake lying on limestone but with much sediment washed down from the sandstone hills above. This lake is situated about 4 km south-east of Gort, Co. Galway.

This site is a candidate SAC selected for alkaline fen, a habitat listed on Annex I of the EU Habitats Directive, and for Lesser Horseshoe Bat, a species listed on Annex II of the EU Habitats Directive. A series of connected woodlands on the western side of the lake has been included as foraging habitat for these bats.

The vegetation around the lake is diverse, with reedbeds confined to sheltered bays, marshes and fens on sandy and peaty ground and natural and planted woodlands. Shallow water communities include species such as Jointed Rush (*Juncus articulatus*), Bulbous Rush (*J. bulbosus*), Alternate Water-milfoil (*Myriophyllum alternifolium*), Water-plantain (*Alisma plantago-aquatica*), Floating Club-rush (*Scirpus fluitans*), Lesser Water-plantain (*Baldellia ranunculoides*), Water Lobelia (*Lobelia dortmanna*) and Shoreweed (*Littorella uniflora*). Winter flooded areas support marsh vegetation with Common Spike-rush (*Eleocharis palustris*), Common Marsh-bedstraw (*Galium palustre*), Purple-loosestrife (*Lythrum salicaria*), amongst others, and with notable species such as Lesser Meadow-rue (*Thalictrum minus*), Northern Bedstraw (*Galium boreale*) and Blue-eyed-grass (*Sisyrinchium bermudiana*). On wet peaty areas fen vegetation includes Black Bog-rush (*Schoenus nigricans*), Saw *Sedge (Cladium mariscus*) and a range of associated sedges (*Carex* spp.) and fen mosses.

Included in the site is a small (*c.* 3 ha.) turlough, very small areas of alkaline fen and occasional fields with affinities to *Molinia* meadow. A relatively large poor fen is present in the north of the site, adjoining the lake. The mouth of the Owendalulleegh River has formed an unusual delta where a good quality old willow (*Salix cinerea*)-dominated wet woodland has developed behind vegetated sand bars.

Woodland occurs around much of the lakeshore, as well as on a number of islands in the lake. Wet woodland on peat is dominated by Willow (*Salix cinerea*) and Alder (*Alnus glutinosa*). An old record of Irish Spurge (*Euphorbia hybernica*) probably comes from drier woodland which occurs in the Lough Cutra Demesne.

These woodlands provide feeding grounds for Lesser Horseshoe Bats. Between 1999 and 2001 up to 93 bats have been recorded in hibernation at Lough Cutra Castle and it is thought likely that a summer nursery roost also occurs here.

The lake is a regionally/locally important site for waterfowl. Monthly counts between November 1995 and March 1996, as part of an intensive study on flooding in the

catchment, gave the following numbers: Whooper Swan (18), Mallard (101), Teal (69), Tufted Duck (83) and Goldeneye (58). The latter also use the nearly Ballynakill Lough. The lake has a long-established breeding colony of cormorants, with 34 nests in 1996. Higher numbers (166 pairs, 1985) have been recorded in the past. Small numbers also winter on the lake. In recent years there have been no records of Greenland White-fronted Geese from the lake, although in the past flocks of 60-80 birds were regular and were considered to be birds from the Rahasane or Creganna population.

The lake is used for fishing and tourism. Precautions should be taken to ensure the lake and its surrounding area is protected from damaging operations such as application of artificial fertilisers, development close to the lakeshore, drainage and felling of woodland areas.

Lough Cutra is of conservation interest for the range of wetland habitat types it contains, particularly alkaline fen, a habitat listed on Annex I of the E.U. Habitats Directive. The presence of an internationally important colony of Lesser Horseshoe Bats, a species listed on Annex II of the Habitats Directive, and a regionally important population of Cormorants add further interest to the site.

19.2.2004

Summer assessment of the lesser horseshoe bat roost at Lough Cutra demesne

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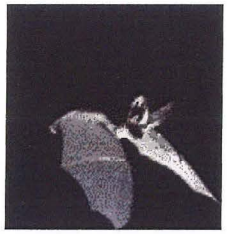
Inis Environmental Services, Edenvale, Ennis, County Clare.



September 2004

Introduction

A late winter assessment of the lesser horseshoe bat population of the Lough Cutra demesne was undertaken to identify the feeding activity of the bats and to confirm that the winter hibernaculum was still viable along the lake shore.

It became apparent from research on the bat fauna of the estate that no recent evidence was available relating to the summertime presence of the bats and that this was a major gap in the knowledge of the lesser horseshoe bats here.

The basis of this follow-up assessment is to examine the demesne for evidence of lesser horseshoe bats during the summer and if present to determine whether there is feeding associated with the lake.

Further to this, it is an aim of the study to examine all other bat activity upon the demesne and around the lake to provide evidence of any obvious disparity in bat feeding activity here in comparison with other water bodies and woodland examined formerly and in the current year by the author.

The presence of a number of bat species and of feeding activity especially close to the lake would assist in evaluating whether there is an unusually suppressed level of bat utilisation of the site.

This in turn would assist in interpreting whether there is reduced insect abundance of species of benefit to bat fauna associated with the land slide at Derrybrien.

This study deals only with the presence and activity of bats and does not address insect fauna directly.

Materials and Methods

Field equipment

QMC Mini3 ultrasonic heterodyne detector

Tranquility Transect Time expansion and heterodyne bat detector

Sony MiniDisc Recorder MZ-R700 and cable

Samsung Digimax 230 Digital Camera

Analysis equipment and editing software

Toshiba S2410-304 laptop computer

"Batsound" sound analysis software

Microsoft Picture It! Photo 7

An assessment to provide information on the summer bat fauna on the shores of Lough Cutra was carried out in August 2004. This is a period when bat activity is intense and bat numbers are high due to the recruitment of the year's offspring.

This is an ideal period to identify any severely negative effects upon the breeding success of bats in the immediate area of Lough Cutra.

A bat detector assessment of the Lough Cutra demesne was undertaken between August 8th and August 10th 2004. This involved a nighttime examination of all buildings upon the estate with special emphasis on the castle as this is the known site of the winter hibernaculum of the lesser horseshoe bat that is a central feature of the SAC.

Bat activity was monitored around the courtyard, stables, lodges and castle at a period when bats emerge from the roost (i.e. from approximately thirty minutes after sunset).

The farther shore of the lake was also examined for bat activity where access was possible to determine whether there was activity here also.

The whereabouts of the lesser horseshoe bat population in the summer period (i.e. the breeding site) was not known for several years prior to this study and one of the central investigations for this study was to determine if the bats were availing of the demesne throughout the year.

The castle was examined during the daytime and at night to check the basement, wine cellar, clock tower and all other accessible sites for evidence of or the presence of bats.

Residents and staff were questioned regarding any knowledge of bat roosts upon the estate.

Bat activity along the lakeshore and along paths through the woodland and forestry was assessed using bat detectors. All bats encountered were identified to species level and roosts were sought both by following the bats towards roosts and by examining buildings in the period prior to sunrise (a period of one and a half hours).

Roosts were not directly counted but an estimate of numbers of bats present was made for some of the roosts.

A final visit to count the lesser horseshoe bats present was undertaken on Saturday September 4th 2004.

Results

Species of bat present in Lough Cutra demesne

Lesser horseshoe bat	*Rhinolophus hipposideros*
Soprano pipistrelle	*Pipistrellus pygmaeus*
Common pipistrelle	*P. pipistrellus*
Leisler's bat	*Nyctalus leisleri*
Natterer's bat	*Myotis nattereri*
Daubenton's bat	*Myotis daubentoni*
Whiskered bat	*Myotis mystacinus*
Brown long-eared bat	*Plecotus auritus*

A spectrogram depicting ultrasonic signals of some of the species present upon the demesne is shown in Figure 1.

Lesser horseshoe bats were noted to be present upon the estate during the period of study. The bats were present in the boiler room up a chimney close to the boiler (see Figure 2). An attempt to count the bats at emergence time proved impossible as the bats repeatedly flew in and out of the windows, doorway and into the clock tower. It is probable that bats also emerged through a small gap surrounding the pipes where they entered from the clock tower (see Figure 3) as they were seen to return through this gap.

A visual examination of the chimney during daytime yielded an estimate of fifty bats approximately including a number of juvenile bats (offspring from this summer). At least fifteen young bats were present. A further eleven bats were present in the basement, one of the winter sites for this species. This brings an estimated total of sixty bats in summer. This population is most probably predominantly females and their young (a single offspring for each reproductive female that successfully bred).

A subsequent count on September 4th revealed that 46 lesser horseshoe bats were hanging up in the boiler house itself. None were in the chimney. The basement was not checked as it was too intrusive a procedure at this time for the residents.

Lesser horseshoe bats were noted feeding along the lakeshore in vegetation to the southeast and southwest of the castle and along an inlet of the lake to the southwest. Earlier studies in March 2004 also indicated that bats feed along the woodland paths and in the woods themselves. No lesser horseshoe bats were seen or heard feeding from two hours after emergence until a period one hour from return to the roost when bats were seen and heard along the northern side of the pheasantry and flying along vegetation lines towards the walled garden area prior to return.

Activity along the lakeshore and over the lake was most intense on the night of August 8th 2004. During observations in the area of the lake behind the castle, soprano pipistrelles, common pipistrelles, Daubenton's bats and Leisler's bats were all active at the same time over the lake.

Natterer's bats were heard and seen in the boiler room, emerging later than the lesser horseshoe bats and flying around outside the boiler room. Brown long-eared bats also flew in the same area of the boiler house in the area where the windows are absent (see the bottom of the tower as shown in Figure 3).

Natterer's bats were heard and seen returning before dawn towards a roost in the vicinity of the southern gate lodge (a café cum guest house). An examination of this building prior to sunrise on August 10th provided evidence that the lodge tower was the site of a Natterer's roost (of more than ten bats) and of a soprano pipistrelle roost (within the same tower, see Figure 4). Natterer's bats had returned to the roost before 5.35 am while some lesser horseshoe bats were still flying and perching in the boiler house at 6.00 am.

An approximate figure for Natterer's bats in the gate lodge would be between ten and twenty individuals. Bat squeaks were heard occasionally from the tower from bats that had already returned. Soprano pipistrelles were not counted as it was intended to note any other gate lodge with bats before bat activity ceased and observations at this gate lodge were interrupted prior to all bats having re-entered. It is likely that in excess of twenty soprano pipistrelles returned to this roost.

One soprano pipistrelle was seen to return to the northern gate close to sunrise (see Figure 5 (b)). This may have been the last of a number of bats and it is likely that there is a greater number present.

A bat was seen to emerge from the lodge late on the first night of observations. This was despite the tenant's assertion that bats had never been seen or heard in the lodge.

Soprano and common pipistrelle activity was present in and around the courtyard and stable yard and sustained social calls were heard here throughout the night.
Feeding was also noted in the stable yard by pipistrelles, Natterer's and by one whiskered bat. The majority of activity was of pipistrelles.

Pipistrelles were very active in the path leading from the southern gate lodge (on the Scariff Road) and were seen feeding in woodland around mature broadleaves (including a Spanish chestnut). Activity around this tree suggested that the bat was returning to a crevice in one branch but the bat did not land, either because it is not a roost or due to the disturbance caused by the observer. A Leisler's bat availed of a mature tree close to the courtyard as a mating roost and calls were audible (both to the unaided ear and to the bat detector) here for up to two hours on each night.

Leisler's bats were heard feeding over the lake, feeding over pasture and along woodland edge. No roosts of this species were found around the castle but this species may commute over a considerable distance and may also use trees more frequently than species like the pipistrelles.

Daubenton's bats could be seen and heard feeding directly over the lake surface. Activity levels were typical of a lake of the size and shelter of Lough Cutra. While watching bats, it was very clear that insects were abundant in the vicinity of the lake especially where there was vegetation to provide shelter towards the lakeshore.

Bat activity on the farther shores of the lake (to the east) was not observed over as long a period and thus only two species were noted here (pipistrelles).

There was an abundance of these species and it is unlikely that there was any difference in activity levels between the two shorelines examined. Bat activity (pipistrelle) was noted at a bridge over the River Owendalulleegh close to where it enters into Lough Cutra).

In summary, bat activity, diversity and abundance was high in the Lough Cutra estate and on Lough Cutra in August 2004.

Discussion

The Lough Cutra demesne provides a summer breeding site and winter hibernation site for lesser horseshoe bats and is thus one of the most significant sites for bats in Ireland. The actual number of the summer population of this species remains unclear due to the difficulty in counting the bats as they emerge or counting them within the roost without creating considerable disturbance. However, the number is likely to be greater than or equal to sixty bats (including offspring).

These bats benefit from the heat available in the boiler house during the summer period to rear their young and from the constant temperature of the basement and wine cellar to enter the deep winter torpor, termed hibernation. This is a highly desirable set of features within one site for a species of bat that has undergone worldwide decline up until very recently. Thus it would be of great concern if the feeding potential for this area were affected by the land slippage attributed to operations to establish a wind farm at Derrybrien.

The difficulty in identifying impacts upon the bats lies in the absence of previous data on the bats here in the summer period and on bat activity in the winter period.

What is clear from this study is that lesser horseshoe bats do avail of the site year-round, are present in 2004 and have bred successfully in 2004. This would imply that the bats have reached an appropriate body condition to allow pregnancy to occur and to progress to the birth of young and furthermore for young to advance to a stage when they can fly and feed for themselves.

Reproduction has thus not been prevented by any effects upon the lake by the accidental introduction of peat. It is unclear as to whether any diminution in reproductive success, population size (or mean body mass etc.) has taken place.

An earlier concern relating to the absence of Daubenton's bat was allayed by repeated observations of this species on the main body of the lake and on a small inlet southwest of the castle. As has been noted in the **Results** section, bat activity on the lake was especially noteworthy on the night of August 8th.

It is clear from this second short examination of the site that bats are abundant upon the demesne. It is probable that most of the species for which roosts have been identified have bred here. The lesser horseshoe bats had certainly bred.

Given that any waterborne peat entered into the lake at the opposite side via the River Owendalulleegh, it is improbable that there has been any significant impact upon the invertebrate fauna that would constitute the prey items of the bat species of the castle and lodges.

All of the indications from this examination would suggest that the bat fauna is in a healthy state in the area where the lesser horseshoe bats roost. The bats may feed over a wide area (as far away as 7 kilometres but more likely in the range of 3 to 5 kilometres). Feeding activity for the lesser horseshoe bats will encompass both the lakeshore and woodland interior and woodland paths.

One of the residents of the castle noted the presence of a barn owl (referred to as an "owl that screeched rather than hooted") in the clock tower in the days leading up to the study. The presence of this predator may provide an explanation for the lesser horseshoe bats' avoidance of the more exposed shoreline in favour of vegetation that would interfere both with their visibility to predators and with efforts catch them in flight.

It is concluded by the author that there is no measurable impact upon the bat fauna of Lough Cutra but that any effort to quantify potential impacts is hampered by lack of data for bats in the years prior to the land slippage.

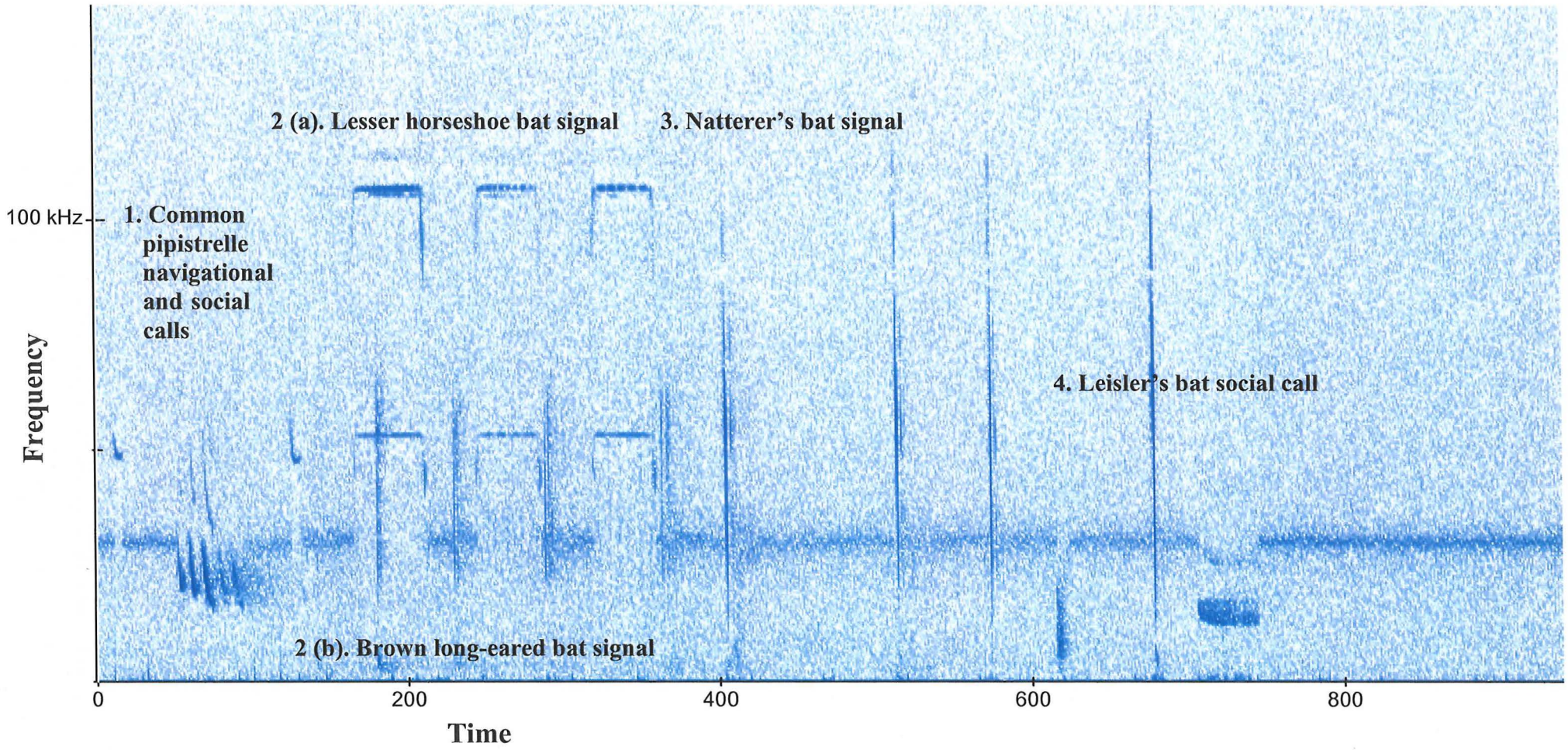


Figure 1: Spectrogram of some of the bat fauna of the Lough Cutra estate including common pipistrelle (1), lesser horseshoe bat and brown long-eared bat (2), Natterer's bat (3) and Leisler's bat (4).

Figure 2: Site of the lesser horseshoe bat maternity roost.
The bats are within the hot boiler room up the chimney. The bats fly in and out of the windows and door on emergence. The pile of droppings can be seen in the fireplace.

Figure 3: Exit and entry point used by bats in the boiler house.
At least one lesser horseshoe bat was seen to return through the hole around the pipe and two Natterer's bats exited through the aperture. The lesser horseshoe bat in the photo is one of two bats that flew around in the clock tower at emergence time.

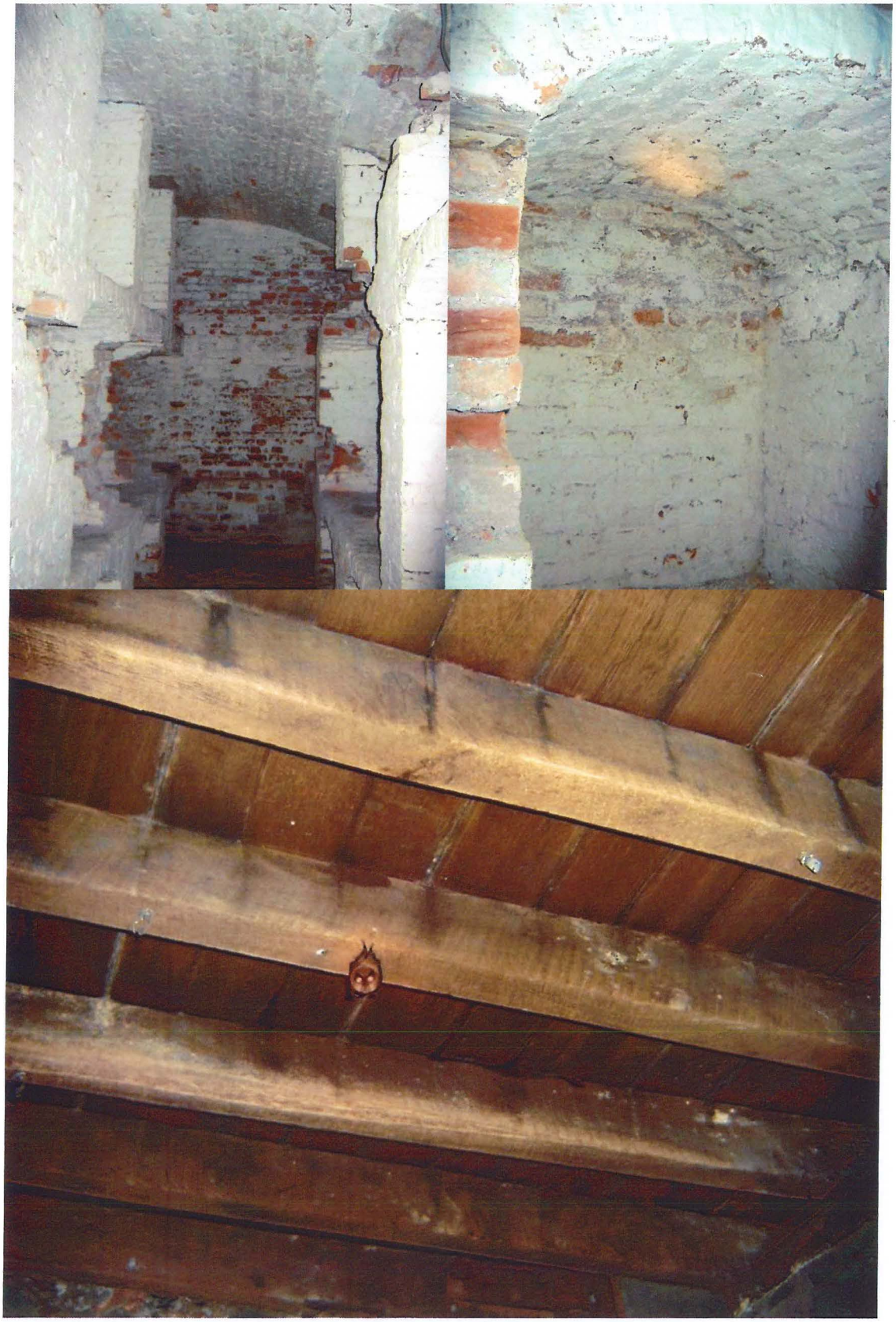


Figure 4: Wine cellar whereat lesser horseshoe bats roost in winter.
The lower picture shows the basement wherein bats roost both in winter and summer. A lesser horseshoe bat is shown in the centre of the picture.

Figure 5: Site of Natterer's bat roost (a) and soprano pipistrelle (a and b) roosts.
(a) is the gate lodge along the Scarriff Road and is open to guests.
(b) is the entrance gateway to the Lough Cutra demesne.
(c) Yard whereat soprano pipistrelles were active and emitting social calls.

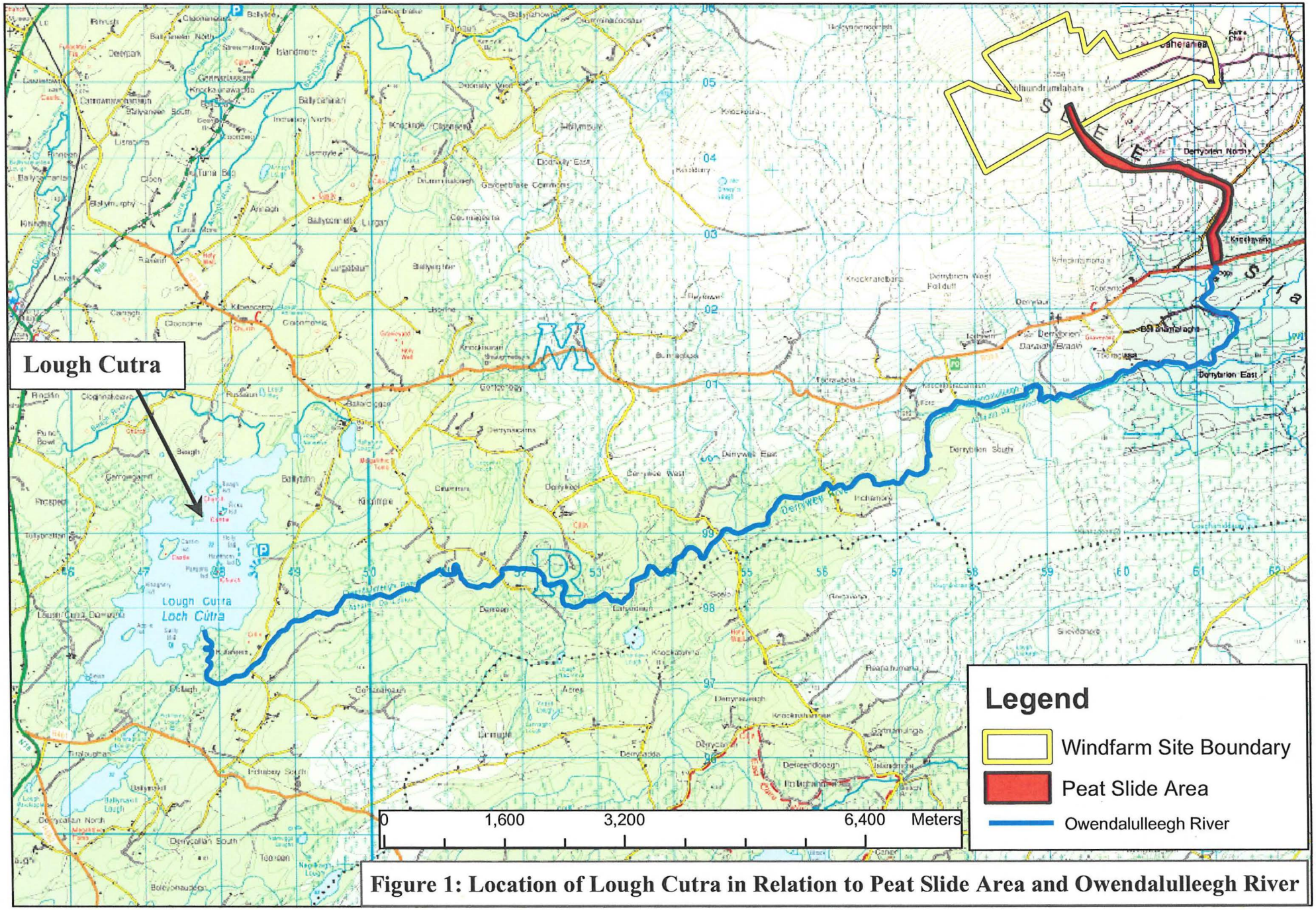


Figure 1: Location of Lough Cutra in Relation to Peat Slide Area and Owendalulleegh River

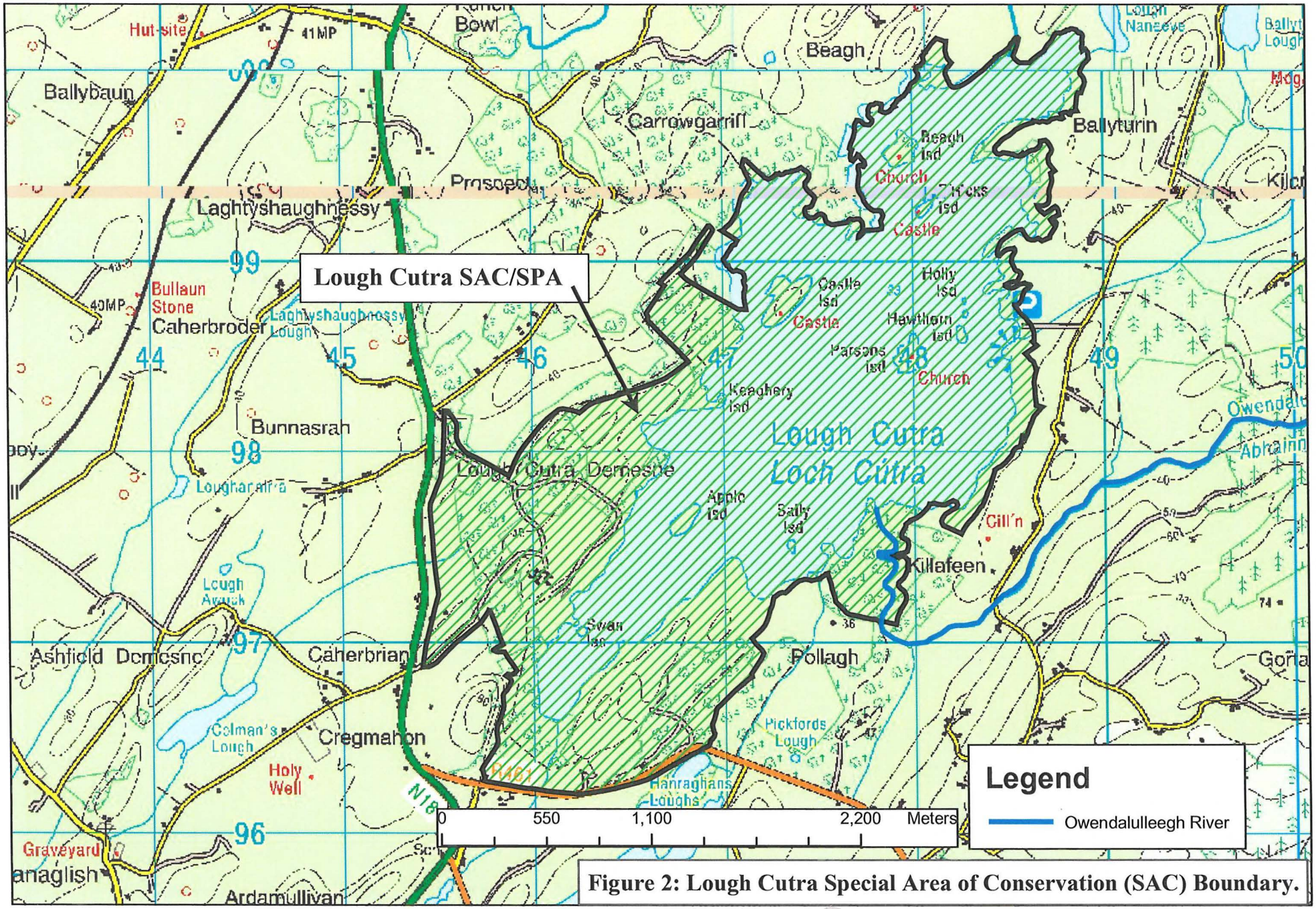


Figure 2: Lough Cutra Special Area of Conservation (SAC) Boundary.

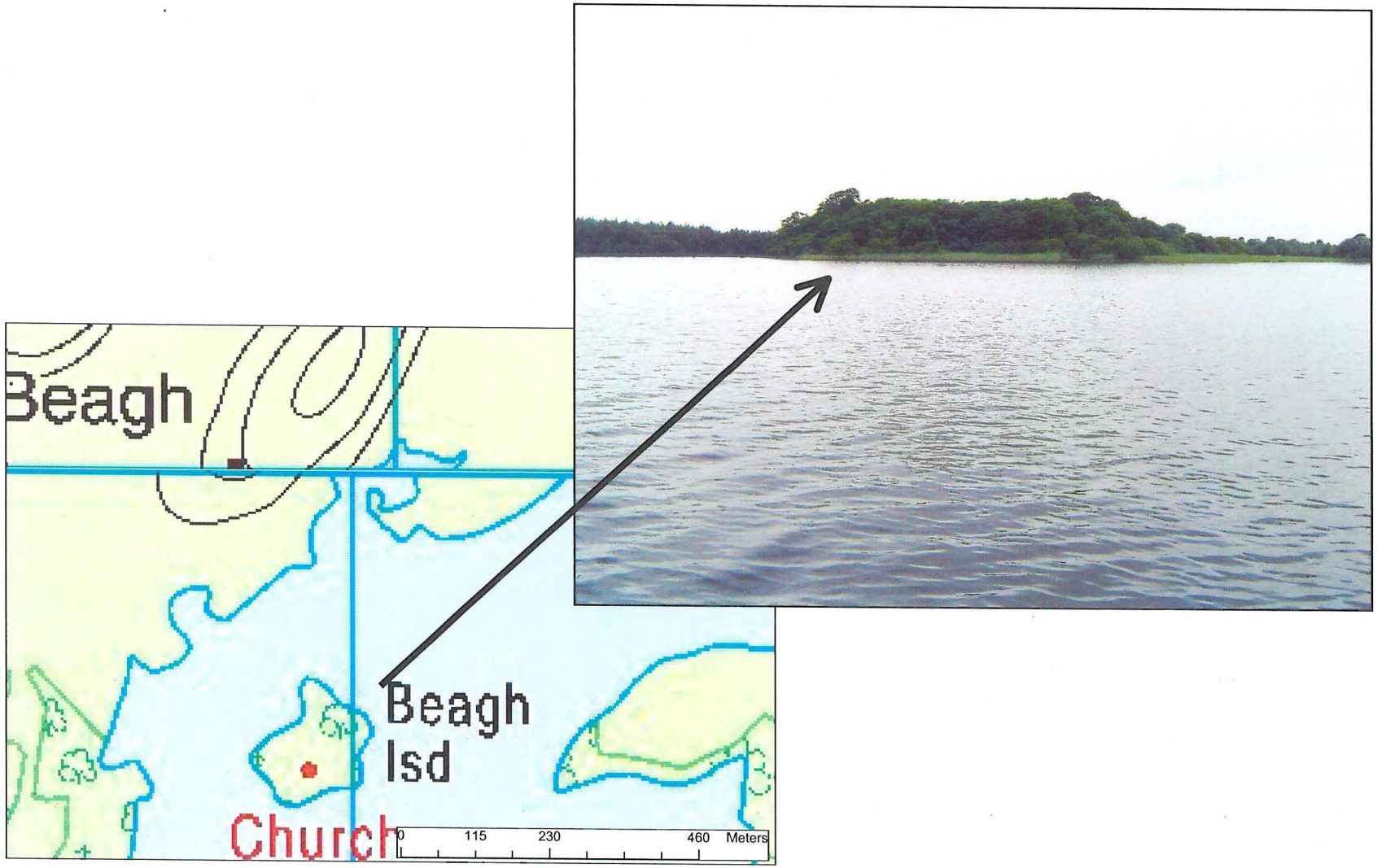


Figure 3(a) and 3(b): Beagh Island, the former Cormorant colony used to breed at this site.

Figure 4: Location of bats within the Lough Cutra demesne showing the cellars within the bats roost in winter. The entrance/ exits (yellow oval and close-up) used by the bats open out towards the lake.

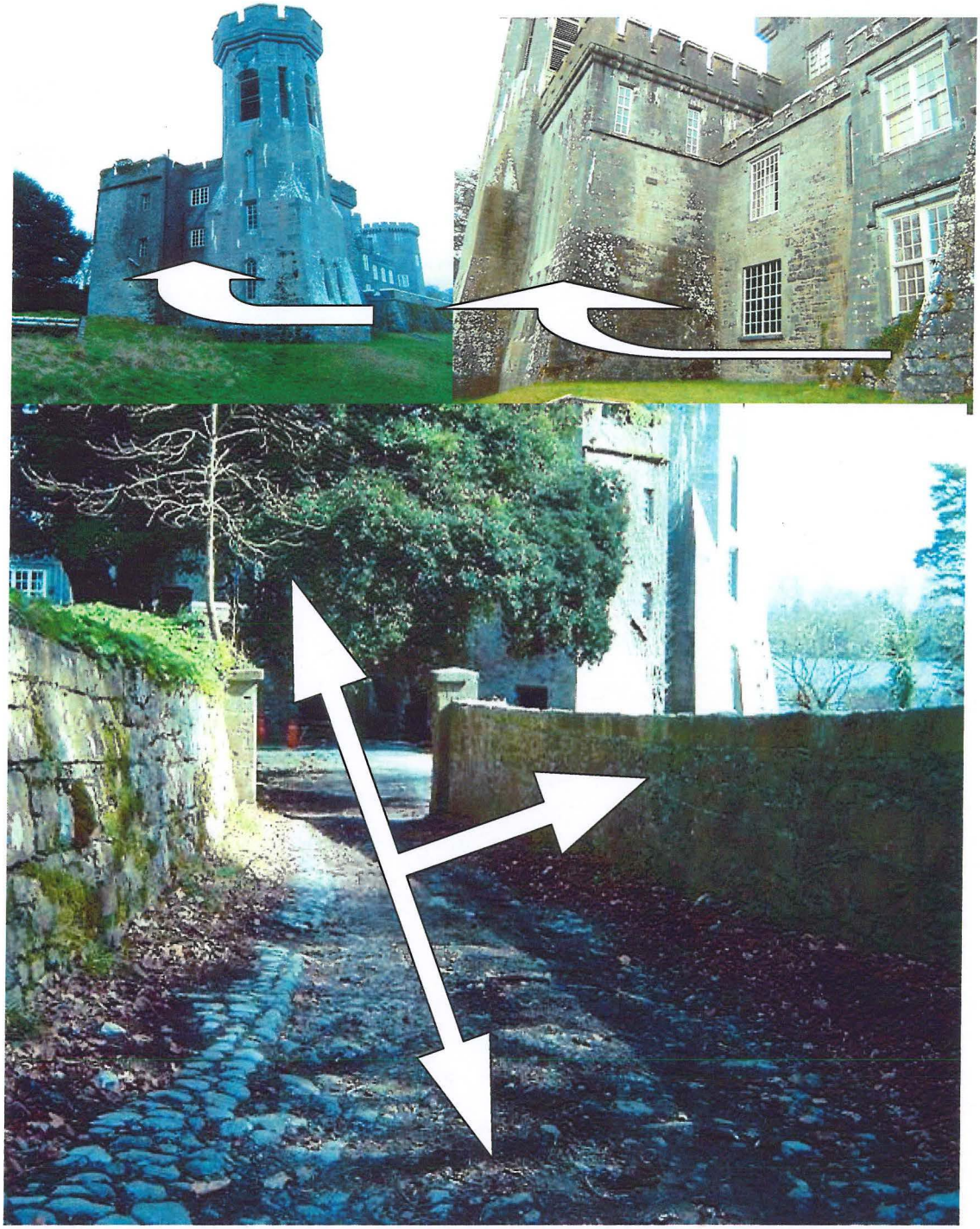


Figure 5: Movements of lesser horseshoe bats on emergence from the cellar roost. Bats flew along the edge of the castle to the clock tower prior to dispersal along the avenue and along either side of the pheasantry.

Figure 6(a): Bats flew along the edge of the pheasantry towards woodland.

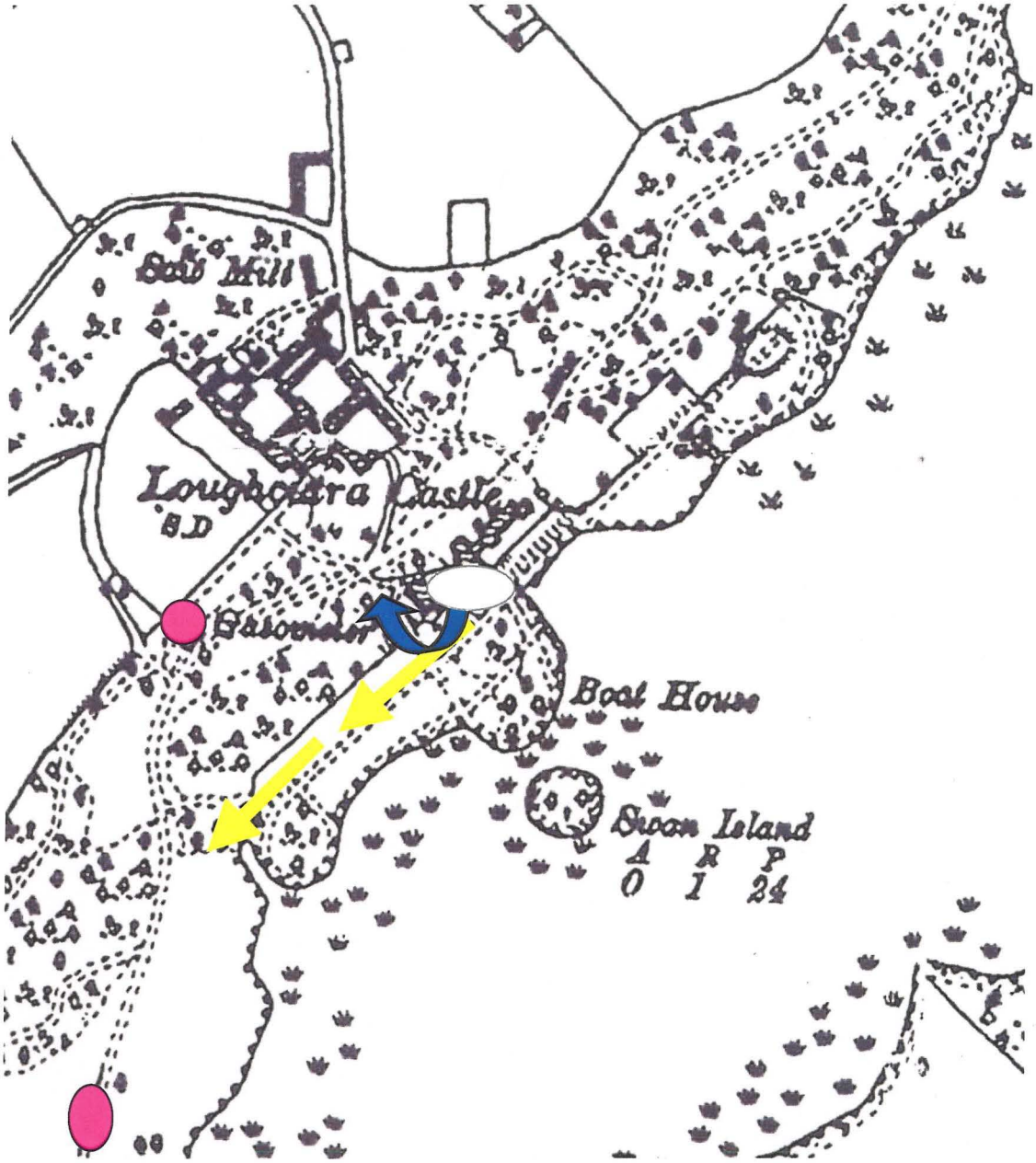


Figure 6 (b) Bat activity at Lough Cutra. The grey oval indicates the roost location. The yellow and blue lines indicate the movements of bats from the castle towards feeding areas. The pink ovals denote sites at which lesser horseshoe bats were noted during the night assessment.

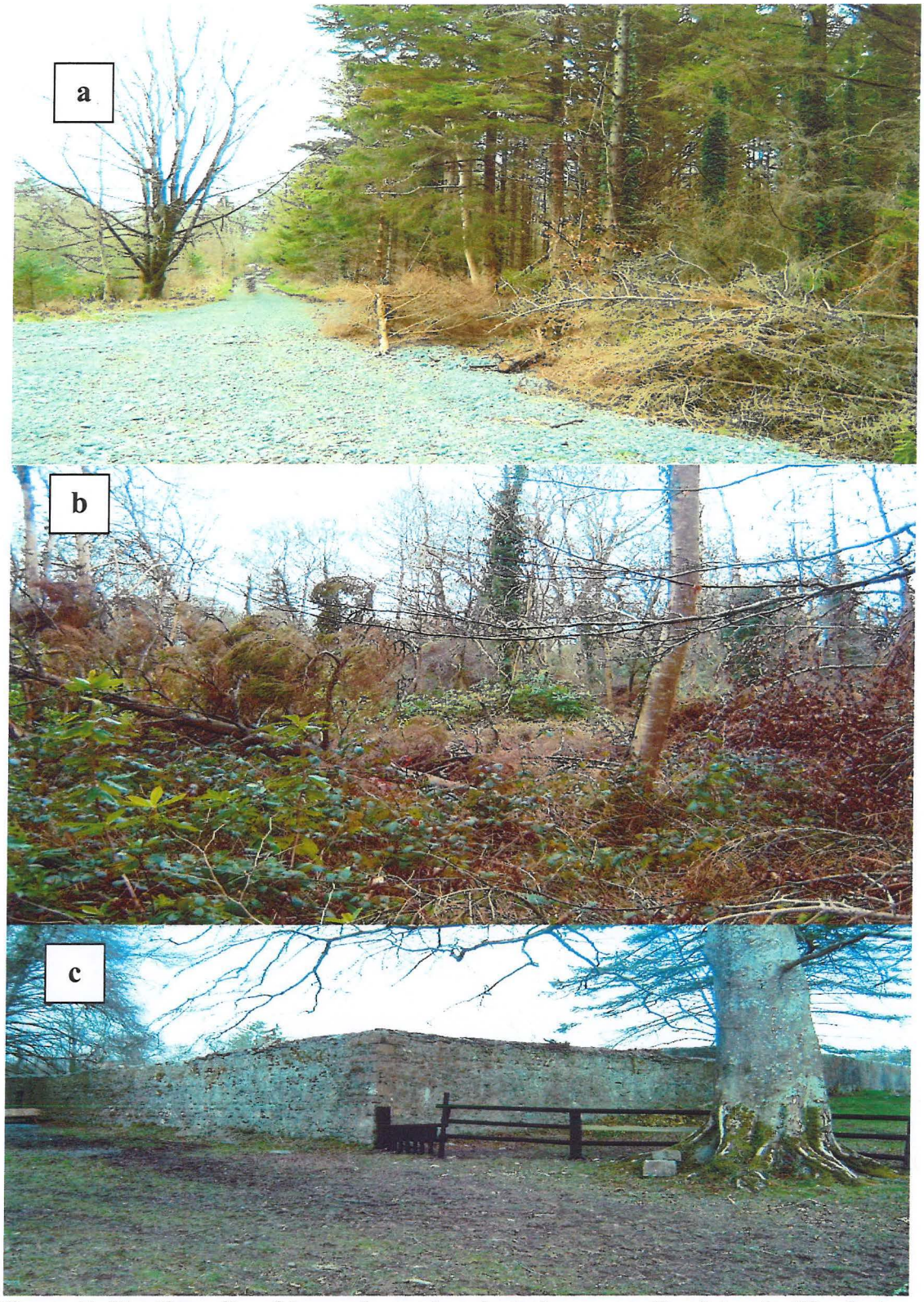


Figure 7: Feeding site of lesser horseshoe bat along woodland track. The bat was noted both on the track (a) and within the woodland (b).
(c) Feeding site of lesser horseshoe bat at walled garden.

Figure 8: Likely feeding sites for bats. A lesser horseshoe bat was noted at the stagnant water in the first photograph.

Figure 9: Potential feeding areas along woodland tracks and along the shoreline of Lough Cutra.

Figure 10: Trees with high potential as bat roosts. Such sites are only occasionally used by species such as the lesser horseshoe bat but are important for other species.

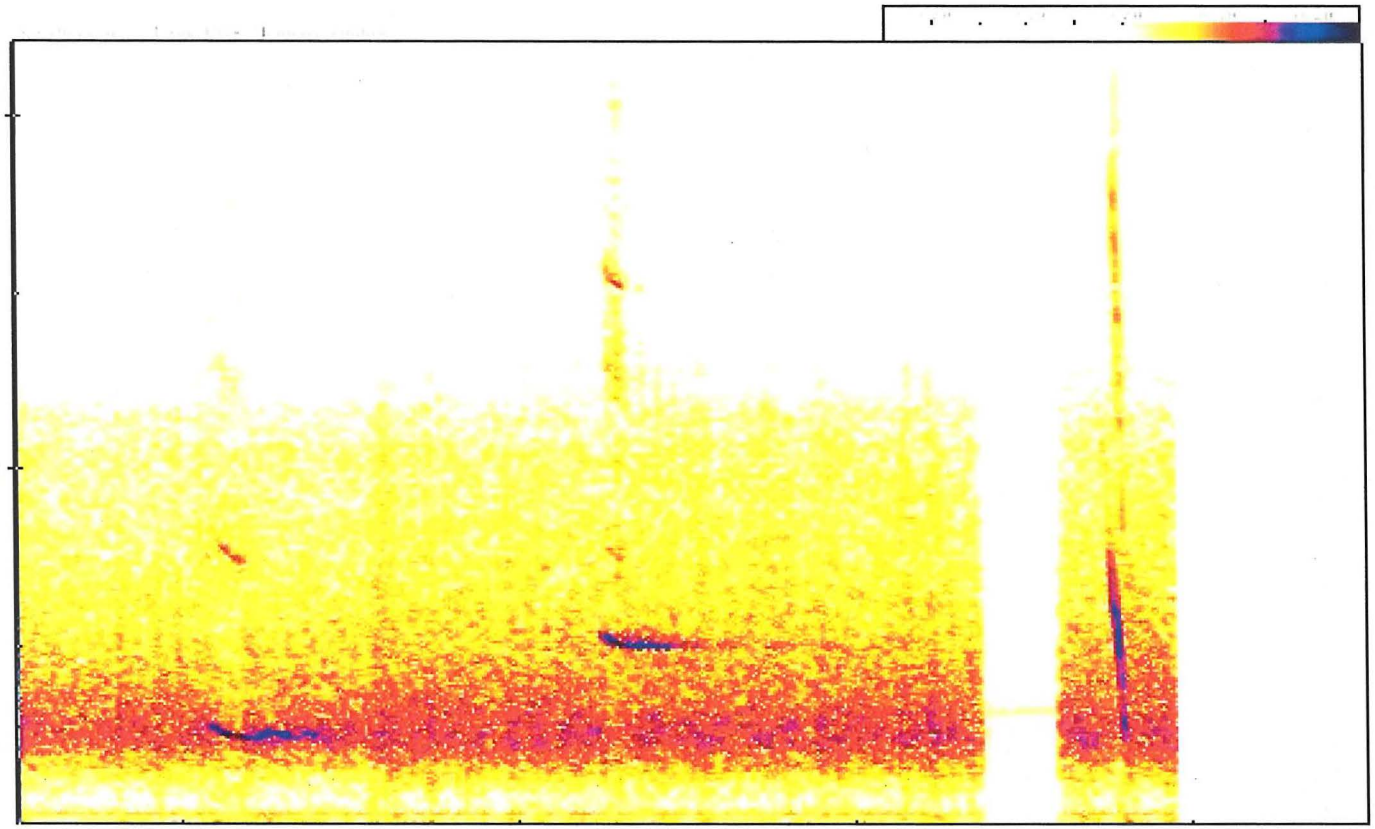


Figure 11: Sonogram showing three of the bat species present along the shoreline of Lough Cutra. From left Leisler's bat, soprano pipistrelle and Natterer's bat respectively.

Figure 12: River Owendalulleegh. The water of this river would be subjected to increased peat levels whenever the level is raised by heavy rainfall.

IMPACT ASSESSMENT OF DERRYBRIEN PEAT SLIDE ON HABITATS, CORMORANTS AND BAT FAUNA OF LOUGH CUTRA, CO. GALWAY

AUGUST 2004

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LIST OF APPENDICES

1 INTRODUCTION

Inis Environmental Services have been commissioned by Hibernian Wind Energy Ltd. to assess the impacts of a peat slide on the ecology of Lough Cutra, County Galway. The peat slide occurred upstream of Lough Cutra on an area of mainly afforested blanket peat in the Slieve Aughty Mountains during Autumn 2003. There is currently a windfarm being constructed in the area adjacent to where the peat slide occurred.

As a result of the peat slide, an estimated 6000 m^3 of peat entered the upper reaches of the Owendallulleegh River (ESBI, unpublished data) and flowed along its length to Lough Cutra (approximately 21km upstream). A visible plume was observed at the confluence of the Owendallulleegh River with Lough Cutra.Concerns over the possible impacts of the peat slide on the ecology of Lough Cutra have led to this study being carried out.

Lough Cutra is a large freshwater lake that occurs on an area of limestone but the water quality is influenced mainly by the sediment washed into the lake from the sandstone mountains nearby. This lake is situated about 4 km southeast of Gort, Co. Galway.

The lake is recognized as being of international ecological importance based on the quality of wildlife habitats present, the presence of Lesser Horseshoe Bats and the occurrence of a regionally important population of cormorants (in the past). This site has been designated as a candidate Special Area of Conservation (SAC) because of the presence of Lesser Horseshoe Bats, a species listed on Annex II of the EU Habitats Directive. The site is also designated as a Special Protection Area because of the population of breeding Cormorants.

This aim of the study was to determine whether there have been significant impacts on the ecology of Lough Cutra in particular on the internationally important population of Lesser Horseshoe Bats, on the internationally important Fen Habitats that occur around the lake and on the regionally important population of Cormorants that have been recorded at the site in the past.

Unfortunately there was not a similar study carried out prior to the occurrence of the peat slide and therefore it is difficult to compare the results of this study to the situation prior to the peat slide. There have been, however, some surveys carried out in the past including:

- NHA survey of the site.
- An Environmental Impact Statement on the Abstraction of Water from Lough Cutra (2003).

Reports of these studies have been referred to in an attempt to determine possible impacts resulting from the peat slide. The report has been prepared in accordance with the published EPA guidelines (EPA 2002). Scientific names of plants and animals are included in the text.

1.1 Site Location

Figure 1 shows the location of Lough Cutra in relation to Peat Slide Area. The Owendalulleegh River is also highlighted, it can be seen that the river enters Lough Cutra on the Eastern shore and rises in the area where the peat slide occurred.

2 LEGISLATION AND STATUTORY CONTEXT

2.1 Habitats

The Habitats Directive was transposed into national law through the European Communities (Natural Habitats) Regulations 1997 (S.I. 94/97). There are a number of habitats listed in Annex I of the Habitats Directive that are rare in Western Europe and are listed for protection throughout the European Union. Sites selected for protection under the EU Habitats Directive in Ireland are known as Special Areas of Conservation and form part of a European network of sites. Lough Cutra is now designated as a candidate Special Area of Conservation (cSAC).

2.2 Birds

All birds are protected under Irish law and the Wildlife Act of 1976. The Third Schedule to the Wildlife Act 1976, was amended on the 6th December 1985, when the minister, in compliance with the European Communities Council Directive of 2 April, 1979 (No. 79/409/EEC), made regulations entitled the European Communities (Wildlife Act, 1976)(Amendment) Regulations, 1985 (No. 397 of 1985) removing the remaining twelve unprotected species from that schedule. As a consequence all wild birds are now protected throughout the state.

Under Article 4 of the Birds Directive it is required that the State must *strive to 'avoid pollution or deterioration of habitats'* of all wild birds, including species listed in Annex I of the Directive. Lough Cutra is designated as a Special Protection Area for Birds (SPA) on the basis of the population of breeding Cormorants.

2.3 Bats

Legal protection is given to almost all Irish mammal species under national (Wildlife Act, 1976 and Wildlife (Amendment) Act, 2000) and European (Habitats Directive via S.I. 94 of 1997) legislation. Of Ireland's mammals, greatest protection is afforded to species included in Annex II of the Habitat's Directive. This includes lesser horseshoe bats, *Rhinolophus hipposideros*. This species has a very restricted distribution on the island and is confined to the six western and southern counties of Mayo, Galway, Clare, Limerick, Cork and Kerry. The population of bats within this range is calculated to be in the region of 9,000 to 10,000 individuals, making this the second-most important population of this species in the world after Wales and England.

2.4 Designated Conservation Areas

Sites of national importance in the Republic of Ireland are termed proposed Natural Heritage Areas (pNHA's). While the Wildlife (Amendment) Act 2000 has been passed into law, pNHA's will not have legal backing until consultative process with landowners

has been completed; this process is currently underway for many proposed sites. To date the only sites that have gone through the designation process are a number of Raised Bogs, mainly in the midlands.

Special Areas of Conservation (SAC's) are sites of international importance because of the presence of listed habitats or species that are of European importance.

Special Protection Areas (SPA's) for Birds, are designated based on the presence of internationally significant populations of listed bird species.

Legal backing for the protection of candidate SPA's and SAC's in Ireland is provided by the EU Directive on the Conservation of Natural Habitats and of Wild Flora and Fauna (92/43/EEC; commonly known as the 'Habitats Directive').

Table 1 gives details of the designations relevant to Lough Cutra. Figure 2 shows the boundary of the designated site.

TABLE 1 Lough Cutra NHA/SAC/SPA (Source: Dúchas, 2003).

Name	Site Code	Designation	Notes	Distance and direction from river survey area
Lough Cutra	000299	pNHA SAC SPA	Lough Cutra is an oligo/mesotrophic freshwater lake lying on limestone. The main habitats of this site are; aquatic lake vegetation, reed beds confined to sheltered bays and mixed woodland. The site is internationally important for it's breeding and wintering population of Cormorants (166 pairs in 1985 and max 300 individuals in winter) (Information compiled in 1987). The Cormorants use the offshore islands for breeding purposes. The internationally important populations of Cormorants and Lesser Horseshoe Bats should be especially protected. Lough Cutra is an important site with its diverse habitat types and the presence of both calcicole and calcifuge floras.	0km Includes and adjacent to river mouth

3 METHODOLOGY

3.1 Desktop Review

A desktop review was carried out to identify features of ecological importance within the study area. Literature sources consulted are included in the text and listed at the rear of the document.

3.2 Field Survey Work

3.2.1 Flora and Habitat Survey

The aims of the habitat survey were:

- To describe the various habitats that occur at Lough Cutra.
- To record any areas where peat deposits may have affected the ecology of the particular habitat in question.

Lough Cutra and adjacent habitats were surveyed using Phase 1 habitat survey methodology (JNCC, 1993). A walk-about and boat survey of the area was conducted on 15 July 2004. Habitats were identified and target notes were made on all semi-natural habitats encountered during the survey including notes on dominant vegetation, qualitative assessment of plant species diversity, vegetation structure, topography, disturbance and management. The habitats encountered on the site visit were classified in accordance with Fossitt 2000 as recommended by the Heritage Council.

3.2.2 Bird Survey

The aims of the Bird Survey were:

- To assess the breeding Cormorant, *Phalacrocorax carbo*, colony.
- To determine if any peat deposition took place on the breeding island.
- To assess impacts, if any, on the colony as a result of peat deposition.

The survey area consisted of only one island, Beagh Island, at the northern tip of Lough Cutra (see Figure 3(a) and 3(b)). This is a small island approximately 40 metres in length and 25 metres in width.

The survey was carried out on 15th July 2004. A boat was used to access Beagh Island. Three personnel, including a boatman, were needed to carry out this assessment. Weather conditions were fair but water levels were extremely low due to low precipitation in the area over a long period. Bathymetry charts were used to navigate the lake.

The following bodies provided information for this report (via publicly available documents):

- ESB International (ESBI)
- Environmental Protection Agency (EPA)
- Galway County Council
- National Parks and Wildlife Service (NPWS)
- Geological Survey of Ireland (GSI)

Cormorant Survey Techniques

Cormorants nest high up in mature trees when nesting on islands within freshwater lakes. They construct a large rough nest made of sticks and twigs and lined with grass and sometimes moss. These nests are easily discernible from a long distance as they are added to each year by the returning pair of Cormorants.

The foliage around the nests is denuded due to the acidic nature of the Cormorants faeces. This denudation of the foliage further assists the observer when counting nests and assessing numbers of breeding pairs.

3.2.3 Bat Survey

The aims of the Bat survey:

- To record the presence and activity of bats in and around Lough Cutra Demesne paying particular attention to Lesser Horseshoe Bats.

Equipment

QMC Mini 3 heterodyne bat detector
Eco Tranquillity time expansion and heterodyne bat detector
Sony Recording Minidisc Walkman MZ-R700 and cable
"Batsound" sound analysis software and Toshiba Satellite laptop computer
Exide handlamp and Petzl headlamp

Survey Methodology

The Lough Cutra demesne was examined for the presence and activity of bats on March 22nd, March 25th, 26th and 27th, 2004. This assessment concentrated on lesser horseshoe bats but any incidental bat species were also recorded where present.

The number of bats hibernating within the basement of Lough Cutra castle was counted in the initial visit of March 22nd to determine the level of usage of the site within the winter of 2003-2004. Advice on the location of the roosting bats was provided by the estate manager, Mr. Edward Somerville as the Conservation Ranger, Ms. Ciara O' Mahony was unavailable during this period for consultation. It is possible following discussions with Ms. O' Mahony that this count is an underestimate as the wine cellars were not checked on the guidance of Mr. Somerville. Bats are also known to roost within the wine cellars. (Two lesser horseshoe bats were noted by the author on April 11th 2000).

Bat activity within the area was low on the night of March 22nd and the observations on feeding are taken from subsequent examination of March 25th to March 27th.

Emergence activity was observed from 7.00 pm and the direction of emerging bats was noted. The second night of study provided a better viewing point for determining the general routes of emergence of the bats and the likely feeding areas accessed from these commuting corridors.

Feeding activity was sought and observed until bat activity ceased during the night. A second phase of observation was then initiated prior to final return at or near to sunrise. This second bout of feeding was restricted to a small number of the original emerging population. The demesne was walked during the daytime on March 26th and 27th to identify potentially good feeding areas, roost sites and any potential commuting routes for bats through the estate and in and around Lough Cutra lake.

Staff on the estate was questioned in relation to any observations of bats in buildings or other built structures. Trees were not considered in this assessment as it is rare for lesser horseshoe bats to avail of trees as hibernation sites.

The area within which the landslide occurred at Derrybrien was visited to determine whether there were any visible effects to the suitability of the River Owendalulleegh for macro-invertebrates that would form a component of the lesser horseshoe bat diet and to appreciate the historical alterations to the river prior to the assessment by the incursion of the considerable quantity of peaty soil.

4 EXISTING ENVIRONMENT

4.1 Designated Sites

As detailed above Lough Cutra is designated as a Natural Heritage Area, Special Area of Conservation and a Special Protection Area for birds. The boundaries of the designated sites are illustrated in Figure 2.

4.2 Habitats and Vegetation

Following the Phase 1 habitat survey of the site and surrounding area the different habitat types (as classified according to Fossitt 2000) were identified. The following is a description of the various habitats found in and around Lough Cutra The habitat code according to Fossitt is in brackets after the habitat name. Habitats that are likely to have been affected by the peat slide were surveyed and are described, agricultural land that may occur within the designated site were not surveyed nor were other habitats that occur above the high water level.

4.2.1 Limestone Lake (FL3)

The site is difficult to classify in accordance with Fossitt although the site occurs on Limestone and has a number of calcicole elements the source of much of the water is from the surrounding sandstone mountains and Blanket Bog areas. As a result the water is acidic and brown in colour, as a result there is an abundance of plants that are usually recorded from acid base-poor conditions. Much of the lake is fringed with reed and tall sedge vegetation (described 4.2.2 below). Bulbous Rush (*Juncus Bulbosus*), Shoreweed (*Littorella uniflora*) and Alternate Water-milfoil (*Myriophyllum alternifolium*) are abundant in the shallow shore waters. Stoneworts (*Chara spp.*) were recorded occasionally. Pondweeds (*Potamogeton spp.*) are abundant in the deeper areas. This unusually diverse habitat could correspond to either of the Annex I habitat types '*Hard oligo-mesotrophic waters with benthic vegetation of Chara spp.*' or '*oligo- to mesotrophic standing waters with Littorella uniflora*' depending on the area of lake in

question. From areas that were surveyed it there was no evidence of damage caused to this habitat type as a result of the additional peat sediment in the lake resulting from the slide. It was no possible to carry out a comprehensive survey of this habitat type and it is recommended because of the conservation importance of the habitat type that a more comprehensive survey be carried out to determine whether this habitat type has been impacted upon.

4.2.2 Reed and Large Sedge Swamp (FS1)

Reed and sedge habitats are common around the shores of the lake and are distributed throughout in shallow water. The stands are typically dominated by single species, either Common Reed (*Phragmites australis*) or Common Club-rush (*Schoenoplectus lacustris*). There is no evidence of the peat slide having damaged this habitat in any discernable way.

4.2.3 Rich Fen (PF1) and Freshwater Marsh (GM1)

There are small pockets of fen and marsh habitat distributed around the lake shore. On wet peaty areas fen vegetation includes Black Bog-rush (*Schoenus nigricans*), Saw *Sedge (Cladium mariscus*) and a range of associated sedges (*Carex* spp.) and fen mosses. Other Species present included Jointed Rush (*Juncus articulatus*) and Soft Rush (*J. effuses*), Devil's-bit Scabious (*Succisa pratensis*), Water Mint (*Mentha aquatica*), Marsh Cinquefoil (*Potentilla palustris*), Horsetail (*Equisetum fluviatile*), Marsh Willowherb (*Epilobium palustre*), Bogbean (*Menyanthes trifoliate*), Tormentil (*Potentilla erecta*).

Other areas around the lake support a fen vegetation. Other areas where the substrate is mineral soil and there is a more fluctuating water table the species are more typical of freshwater marsh with species such as Common Spike-rush (*Eleocharis palustris*), Common Marsh-bedstraw (*Galium palustre*), Purple-loosestrife (*Lythrum salicaria*).

While the winter water levels were almost certainly above some of these areas no significant areas of peat deposit were located and no discernable damage was recorded as a result of the peat slide.

4.2.4 Wet Woodland (WN 6)

There are a few restricted areas where this habitat is present. The woodland is dominated by Willow (*Salix spp.*) with an abundance of Alder and Holly present. Species in the understory include Creeping Buttercup (*Ranunculus repens*), Meadowsweet (*Filipendula ulmaria*) and Creeping Bent (*Agrostis stolonifera*). An area adjacent to the mouth of the Owendalulleegh River was surveyed and there was no discernable impacts recorded as a result of the peat slide, there was no evidence of peat deposits within the wooded area. There was evidence of deer using the area.

4.2.5 Exposed calcareous rock (ER2) and Exposed sand

Much of the lake shore comprises areas of either exposed calcareous rock or sand, the habitats are species poor.

There was no evidence of peat deposits along the shoreline although during the winter much of the area was covered in a peat deposit (E. Somerville, *pers. comm.*).

4.3 Cormorants

Historical Data
In 1986, 166 pairs of Cormorants were recorded breeding on Beagh Island at the northern tip of Lough Cutra. These numbers were internationally important. However these numbers have been declining over time and only 21 pairs were recorded in 1997.

Numbers of Cormorant do not over winter at the site but single birds may be seen from time to time.

Cormorant Survey Results
The results of this investigation show that there are no longer any breeding Cormorant, *Phalacrocorax carbo*, present at Lough Cutra. No nests were recorded on Beagh Island nor were any Cormorants seen. No peat deposition was recorded at Beagh Island or any of the other islands on the lake.

It is clear that the absence of Cormorants is not due to the peat slip event as NPWS staff have indicated that there was little to no breeding activity at this location for the past few years.

A further survey of lakes in the general area of south Galway/North Clare shows a large colony of breeding Cormorant has established itself on Illaunmore at Muckanagh Lough, ten kilometres southwest of Lough Cutra. It is felt that these birds have relocated to this area from Lough Cutra.

4.4 Bats

Population in National Context
The lesser horseshoe bat has been in decline for a considerable period and its numbers in Ireland may also be less than historically and the above figure is at least 2,000 lower than a figure estimated for this species by the National Parks and Wildlife Service in the 1990's.

The species has a more restricted choice of roost as it requires a space through which it may fly to reach a hanging perch. Unlike all other Irish species, it does not avail of gaps or crevices in stone or wood or between slate/ tile and felt as many house-dwelling bat species may. Nor are there many trees of suitable girth to provide roosting opportunities for this bat.

The restricted distribution for this species is not fully understood and it is presumed that winter conditions on the southern and western region are the limiting factors. This species is the most typically recorded cave-dweller of all of our bat species. Limestone caves account for most winter records of this species.

Lesser horseshoe bats may also be found in cellars of houses, castles or abbeys and it is just such a case for the bat population of the Lough Cutra demesne.

Bats have been recorded annually within the basement of the castle and this population affords the status of Special Area of Conservation for this species.

Roosting bats at Lough Cutra
There was only one site shown to the author within the castle where bats over-winter and hence the number is incomplete but indicative of the number of bats utilising the particular site at this time of year.

45 bats were noted within the cellars of the castle on March 22nd 2004. This is similar to a count by Dúchas Conservation Ranger, Ciara O' Mahony in January 1999 in this section (46 on 17th January 1999). The farm manager had asserted that no other sites were used and the wine cellar and other sites were not accessed.

Counts for the estate have reached a total of 93 in January 2001 (17th January 2001) and have been as low as 75 in January 2002 (24th January 2002).

The bats were predominantly in a relatively deep torpor during the initial observation and bat activity within the area was low on the night of the study. Little or no flying insects were apparent during observations by the author.

The bats roost within the castle basement/ cellar and wine cellar and emerge from the castle on the side facing towards Lough Cutra. Access is readily available to the under-floor space via four barred windows (see Figure 4).

Commuting route from Lough Cutra Castle (see Figure 5, 6(a), 6(b))
All bats that emerged from the castle flew along the edge of the castle to the tower. Most bats then flew up the path leading from the castle towards the pasture to the southwest and west with some possible movements to the north following on the edge of the castle. One or two bats flew along a line of yew trees flanking the pheasantry close to the house.

Clearly the number of bats emerging was less than the total population present and it is reasonable to estimate that as few as twenty emerged on any night of observations.

The majority of bats either flew along the pathway to a midway point whereat they flew over the wall and down along the line of the pheasantry on the western side.

No bats flew in the opposite direction away to the northeast of the castle directly from the roost. This may be due to a greater exposure (i.e. less vegetation) in the initial section of the lake flanking the house.

Feeding bats (see Figure 7, 8, 9)

Feeding activity was difficult to fully assess within a short assessment as bats may commute over a considerable distance. Lesser horseshoe bats emit a weak, highly directional ultrasonic signal that may be undetected even within close range.

Observations on feeding can only provide a very basic evaluation of the likely feeding territory of these bats as a full study based on the radiotracking of a number of individual bats was not deemed necessary in the current examination.

Lesser horseshoe bats were noted to feed along woodland tracks and within the vegetation adjoining the tracks and along the walled garden. Bat activity was not restricted to the lakeshore. Indeed lesser horseshoe bats were only noted at one site at the lakeside; a still water body that lies close to the pheasantry. Bats did not remain to feed here and it served only as a feeding site during commuting.

Feeding by lesser horseshoe bats is very often associated with broadleaf woodland but this species has also been observed by the author to feed on the shoreline of lakes and turloughs in the Gort area. While this bat is typically associated with lines of good vegetation cover, they may also cross small open areas either commuting or feeding.

Thus, lesser horseshoe bats may feed over lake sites and potentially even commute to and from roosts across open water as has been reported from radio-tracking studies of lesser horseshoe bats roosting on an island in Bavaria, Germany.

Feeding may be spread over a number of kilometres and has been reported to be concentrated within approximately 3 kilometres of maternity roosts within areas of good feeding potential (e.g. Dromore Wood, Ruan, county Clare, Sinéad Biggane NUIG *pers. comm.*) up to a distance of 9 kilometres in Wales at the largest roost sites (Maurice Webber, Robert Stebbings Consultancy, *pers. comm.*).

Within such a distance from the roost, there is considerable variety of habitat types. However, bat species are most associated with riparian and other watery habitats with good vegetation cover.

Lesser horseshoe bats are known to feed within each fortnightly period throughout winter and have been reported to commute several kilometres even during this the least active part of the year for bats (Carol Williams, Irish Bat Conference, May 2003).

Species of bat noted in Lough Cutra demesne (see Figure 10, 11)

Lesser horseshoe bat	*Rhinolophus hipposideros*
Soprano pipistrelle	*Pipistrellus pygmaeus*
Common pipistrelle	*P. pipistrellus*
Leisler's bat	*Nyctalus leisleri*
Natterer's bat	*Myotis nattereri*

It was not intended that a full assessment of the bat fauna of this site be undertaken and the above list is an incidental rather than an exhaustive list of the bat species present. It is likely that most Irish bat species are present within this site. Suitable roost sites for these species are included in the figures simply to illustrate that this demesne has great potential for a wide range of bats.

There are a number of buildings on the estate that would offer roosting opportunities for lesser horseshoe bats. These range from the various areas of the castle itself to the stable yard and gate lodges. A considerable pile of lesser horseshoe bat droppings in the cellar around an old boiler indicates that bats roost here in large numbers. No bats were in this area during this assessment.

Buildings such as the icehouse would also have high potential as bat roosts given some greater cover from disturbance.

5 IMPACTS

5.1 Habitats

There was no evidence of damage caused to habitats in or around Lough Cutra as a result of the peat slide.

5.2 Cormorants

There has been no impact on breeding Cormorant at Lough Cutra as they no longer breed at this location.

5.3 Bats

Potential Loss of feeding from the peat slide at Derrybrien (see Figure 12)

The importance of aquatic invertebrates to most bat species is indisputable whether through the direct ingestion of such prey while hatching over water or through the consumption of prey that had hatched previously from the water but were flying in woodland, wetland or were perched on a plant or other substrate.

Lesser horseshoe bats consume a variety of prey including crane fly, caddis flies, moths, lacewings and even small midges. Waterside vegetation is one of the most likely sites to encounter this bat.

Observations upon the bats during this assessment have shown that the bats returned to their winter site in 2003-2004 and were still present here in late March (towards the end of the hibernatory period). Feeding activity was noted during this period in the woodland and vegetation close to but not at the lakeside.

No sustained feeding was noted at the lakeshore. However, it would be inappropriate to draw conclusions on any negative effects on the foraging potential of the lake for bats based on such a small window of observation. Feeding activity over the lake would have

been indicative that food was available to bats. The absence of bats may simply indicate that bats have identified more fruitful feeding areas.

To fully appreciate the feeding activity at Lough Cutra, it would be necessary to follow the entire feeding activity of a number of bats over a large distance for a number of nights. Avoidance of the lake (typically a good feeding site for bats) by the resident bats may offer an indication that insect availability is considerably less than would be expected for such a site.

The absence of any information on the feeding and commuting routes of the bats prior to the landslide impairs the ability to compare the "before" and "after" situations. For example, if it could be shown that bats emerging from the castle had formerly flown towards the lake in both directions and now only approached the lake where vegetation was dense, it may indicate that the lake is less beneficial as a feeding site than formerly (or there may be a need to examine other possibilities, e.g. predation in the more open terrain).

The population of bats within Lough Cutra are possibly resident throughout the year although this has not been the subject of assessment to date. Lesser horseshoe bats may use the same building for summer and winter roosting once the requirements of the two roost types is met.

Should the bats be present in summer, there would also be a potential for impact upon these bats and their offspring. There is clearly a gap in the knowledge regarding the bats upon the demesne that may have great significance in interpreting the effects of the landslide.

6 RECOMMENDATIONS

- Due to access difficulties it was not possible to carry out a comprehensive survey of the sub-littoral plant communities of Lough Cutra. It is recommended that the Eastern Shore of the Lough be walked and the habitat and vegetation communities described to determine whether the habitat has been impacted upon from the deposition of peat. Preliminary surveying undertaken to date indicate that there is no evidence of major peat deposition within this habitat.
- The invertebrate fauna of Lough Cutra and the River Owendallulleegh should be examined to provide a more accurate evaluation of the potential effects of the landslide upon this aspect and the consequent potential for feeding reduction for insectivorous vertebrates including the Lesser Horshoe Bat population at Lough Cutra.
- Where there is evidence that the water quality is incapable of supporting invertebrate diversity, immediate measures should be taken to improve the quality.
- A visit to the Lough Cutra demesne to determine whether lesser horseshoe bats are present in summer and breeding here should be undertaken.

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NPWS SITE DESCRIPTION

SITE NAME: LOUGH CUTRA

SITE CODE: 000299

Lough Cutra is a large oligo/mesotrophic freshwater lake lying on limestone but with much sediment washed down from the sandstone hills above. This lake is situated about 4 km south-east of Gort, Co. Galway.

This site is a candidate SAC selected for alkaline fen, a habitat listed on Annex I of the EU Habitats Directive, and for Lesser Horseshoe Bats, a species listed on Annex II of the EU Habitats Directive.

The vegetation around the lake is diverse, with reedbeds confined to sheltered bays, marshes and fens on sandy and peaty ground and natural and planted woodlands. Shallow water communities include species such as Jointed Rush (*Juncus articulatus*), Bulbous Rush (*J. bulbosus*), Alternate Water-milfoil (*Myriophyllum alternifolium*), Water-plantain (*Alisma plantago-aquatica*), Floating Club-rush (*Scirpus fluitans*), Lesser Water-plantain (*Baldellia ranunculoides*), Water Lobelia (*Lobelia dortmanna*) and Shoreweed (*Littorella uniflora*). Winter flooded areas support marsh vegetation with Common Spike-rush (*Eleocharis palustris*), Common Marsh-bedstraw (*Galium palustre*), Purple-loosestrife (*Lythrum salicaria*), amongst others, and with notable species such as Lesser Meadow-rue (*Thalictrum minus*), Northern Bedstraw (*Galium boreale*) and Blue-eyed-grass (*Sisyrinchium bermudiana*). On wet peaty areas fen vegetation includes Black Bog-rush (*Schoenus nigricans*), Saw *Sedge (Cladium mariscus*) and a range of associated sedges (*Carex* spp.) and fen mosses.

Woodland occurs around much of the lakeshore, as well as on a number of islands in the lake. Wet woodland on peat is dominated by Willow (*Salix cinerea*) and Alder (*Alnus glutinosa*). An old record of Irish Spurge (*Euphorbia hybernica*) probably comes from drier woodland which occurs in the Lough Cutra Demesne.

These woodlands provide feeding grounds for a summer roost of Lesser Horseshoe Bats. Between 1999 and 2001 up to 93 bats have been recorded in hibernation at Lough Cutra Castle and it is thought likely that a summer nursery roost also occurs here.

The lake is a regionally/locally important site for waterfowl. Monthly counts between November 1995 and March 1996, as part of an intensive study on flooding in the catchment, gave the following numbers: Whooper Swan (18), Mallard (101), Teal (69), Tufted Duck (83) and Goldeneye (58). The latter also use the nearly Ballynakill Lough. The lake has a long-established breeding colony of cormorants, with 34 nests in 1996. Higher numbers (166 pairs, 1985) have been recorded in the past. Small numbers also winter on the lake. In recent years there have been no records of Greenland White-fronted Geese from the lake, although in the past flocks of 60-80 birds were regular and were considered to be birds from the Rahasane or Creganna population.

The lake is used for fishing and tourism. Precautions should be taken to ensure the lake and its surrounding area is protected from damaging operations such as application of artificial fertilisers, development close to the lakeshore, drainage and felling of woodland areas.

Lough Cutra is of conservation interest for the range of wetland habitat types it contains, particularly alkaline fen, a habitat listed on Annex I of the E.U. Habitats Directive. The presence of an internationally important colony of Lesser Horseshoe Bats, a species listed on Annex II of the Habitats Directive, and a regionally important population of Cormorants add further interest to the site.

20.03.2003

DERRYBRIEN WINDFARM

PEAT SLIP

ENVIRONMENTAL IMPACT ASSESSMENT

ON

THE OWENDALLULEEGH RIVER

MARCH 2004

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1.0 INTRODUCTION

A landslide occurred near the southern boundary of the Derrybrien Wind Farm on the evening of 16th October 2003. The slide involved disturbance and partial displacement of approximately 450,000m^3 of peat. On 17th October, the limit of the displaced peat was measured at approximately 100m from the Black Road Bridge, a distance of approximately 2.45 km from the head of the slide. On 29th/30th October, following heavy rain, the slip mass re-mobilised before the emergency stabilisation measures were substantially underway, and solid peat entered the watercourse downstream of Black Road Bridge. The flow of solid peat continued for approximately 24 hours.

As a result of the landslide, an estimated 6000 m^3 of peat entered the upper reaches of the Owendallulleegh River (ESBI, unpublished data) and flowed along its length to Lough Cutra. This watercourse is of ecological and fisheries importance. A visible plume was observed at the confluence of the Owendallulleegh River with Lough Cutra (aerial photo and observations made by Shannon Regional Fisheries Board – Preliminary Assessment Report)

Inis Environmental Services was appointed by ESBI to undertake a joint survey with ESBI and the Shannon Regional Fisheries Board to assess the extent of impact of the peat slip on the Owendallulleegh river system.

The current report provides an assessment of the integrity of aquatic habitats in the river and provides information of the extent of peat deposition in the main stem corridor. It reports the results of a walkover type survey, carried out in December 2003, and a desk appraisal. The key aims of the study were as follows: -

- To assess the extent of peat deposition along the river;
- to determine the habitat integrity of aquatic and riparian areas;
- to provide a preliminary assessment of the potential impact of the land slide on the river;
- to suggest mitigation measures to assist the rehabilitation of the river, and,
- to recommend further survey work, where necessary, to assess fish stocks and other ecological indicators.

This study was undertaken by Inis Environmental Services on behalf of ESB International (ESBI). Field work was carried out by Inis Environmental Services in association with ESBI and the Shannon Regional Fisheries Board (ShRFB).

2.0 METHODOLOGY

2.1 Survey area

The survey area comprised of the entire length of the main stem Owendallulleegh River from Flaggy Bridge (NOS Grid Reference M61161 62512) to the mouth of the river, where it enters Lough Cutra, (NOS Grid Reference R47811 97721). This represents a study length of approximately 22 kilometres. The study area was divided into eleven sections. The overall area is shown in figure 1 and the eleven sections of river assessed are shown in figures A1.1 to A1.11 in appendix 1.

The survey was carried out over a two-week period comprising a team of

- Inis Environmental - (two persons);
- Shannon Regional Fisheries Board – (Three to five persons).
- ESBI (three persons).

Weather conditions were good and water level was low facilitating the survey. The survey comprised a walk down of the entire river main stem with recording of observations. A Health and Safety Induction course was held on the first morning of the survey to advise all survey members of the potential hazards and work methodology to be followed.

The survey was completed within a two-week period (9^{th} – 22^{nd} December 2003). The following maps, provided by ESBI under Licence from GSI, were utilised for the assessment:

- Ordnance Survey of Ireland, Discovery Series 1:50,000. Sheets 52.
- Ordinance Survey of Ireland, local 1:5000 sheets.

2.2 Aquatic Habitat Assessment

The aquatic habitats present in the eleven study sections were defined with reference to the habitat classification scheme published by the Heritage Council in *A Guide to Habitats in Ireland (*Fossitt, 2000). Codes such as FW1, refers to habitat types of eroding upland rivers, as defined in this publication. The diversity (species richness) of aquatic/riparian fauna is primarily a function of the integrity and physical diversity of the aquatic habitats. The more diverse the aquatic habitat is in terms of substrate, depth, riparian vegetation, etc. the richer the biological community is likely to be. Salmonid fish (trout and salmon) in particular have specific habitat requirements and the presence and abundance of these fish has been shown to be strongly correlated with key physical habitat variables (Haury, 1999). Habitat considerations for juvenile salmonids in streams and rivers include stream size and flow (Hatfield & Bruce 2000), depth and gradient (Kennedy & Strange 1986), substrate (Greenberg & Dahl 1998), and canopy (O'Grady, 1993). Physical habitat assessments were undertaken at intervals along the river. These sites were assessed in terms of: -

- Wetted width (m)
- Depth (m)
- Bank height (m)
- Riffle (%)
- Glide (%)
- Pool (%)
- Bedrock (%)
- Cobble (%)
- Gravel (%)
- Boulder (%)
- Sand/Silt (%)

Aquatic Flora Assessment

Qualitative assessments of instream vegetation were undertaken during the habitat assessment study. The species present were identified and the percentage cover of riparian and instream vegetation was

estimated visually. An impact on vegetation was recorded where vegetation had been eroded, or covered by peat to a depth likely to affect growth. As the survey was carried out mid-winter, plants were identified from overwintering parts and were not always identifiable to species level. Similarly, cover of emergent aquatic species is lower in winter than at the peak of the growing season (summer). A list of aquatic and riparian plant species for the 10km grid squares containing the Owendallulleegh River was also extracted from the CD ROM of Preston, C. D., Pearman, D. A. and Dines, T. D., eds (2002). *New Atlas of the British and Irish Flora*. Oxford University Press, Oxford.

3.0 EXISTING ENVIRONMENT

3.1 General

The Owendallulleegh River within the study area is described and evaluated on the basis of aquatic and riparian habitats. The presence of protected aquatic species is also considered. The areas investigated are described below.

3.2 Designated Areas

The National Parks and Wildlife Service (NPWS) is responsible for natural heritage conservation in Ireland. It is responsible for the designation of the following areas of statutory protection:

- *Special Areas of Conservation (SACs)* - These were established under the 1992 Habitats Directive of the Council of the EU for the conservation of natural and semi-natural habitats and species of flora and fauna.

- *Special Protection Areas (SPAs)* – These areas are designated for the protection of birds, and were established under the Birds Directive of the EU in 1979.

- *Natural Heritage Areas (NHAs)* – These are nationally important protection areas and were established under Irish law.

- *Statutory Nature Reserves* - These are relatively small land areas, very often forest or previously afforested areas that are maintained as protected nature reserves.

The Owendallulleegh River is not on or within a site designated or being considered for designation for statutory nature conservation. However, it flows into Lough Cutra, which is a candidate Special Area of Conservation (cSAC) and a designated Special Protection Area (SPA) under the EU Birds Directive. Gortacarnaun Wood, a designated SAC, is also adjacent to the river. In table 1, these and other designated areas adjacent to the study area are described. The location of these sites in relation to the Owendallulleegh River is shown in figures 2 and 3. Additional information on Lough Cutra (Site code 00299) and Lough Coy (002117) are provided in appendix 2. No information on the Newhall site (002293) was available at the time of preparing this report. Under Article 6 of the Habitats Directive the onus is on the developer to assess the indirect impacts on any designated sites (Special Areas of Conservation –SACs or Special Protected Areas SPAs) as a result of a plan or project.

3.3 Hydrology of the area

The study area is located in the Owendallulleegh River (or Derrywee River) river system (EPA code 29/O/01). This is an undrained river system located in EPA hydrometric area 29. The Owendallulleegh is an upland spate river that rises in the Slieve Aughty Mountains in south County Galway. It flows west through the townlands of Derrybrien, Inchamore, Lahardaun, Derreen, and Kilafeen to enter the southern end of Lough Cutra. It has a main channel length of 22.5km (McGarrigle *et al*, 2002). The catchment area is approximately 40km^2 and includes extensive areas of cutover bog and coniferous forestry. Lough Cutra is an oligo/mesotrophic landlocked lake, which has a surface area of 3.9km^2. Catchment details and selected physical characteristics of the Owendallulleegh River (from source to Lough Cutra) are provided in tables 2 and 3 respectively.

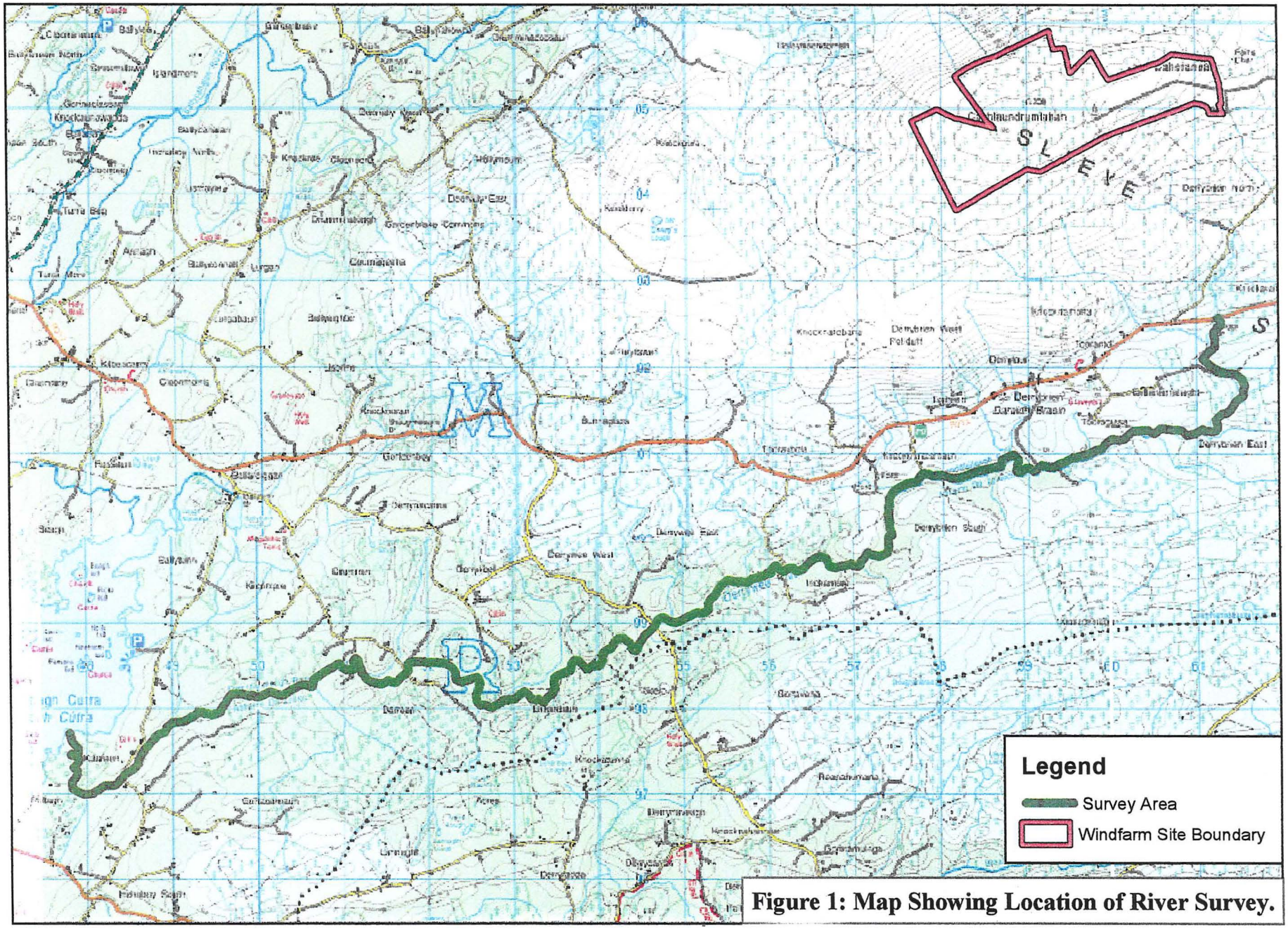

Figure 1: Map Showing Location of River Survey.

The Owendallulleegh River flows for a distance of approximately 22 km and flows into Lough Cutra. The outlet of Lough Cutra forms the Beagh river, which sinks at the Punch Bowl and remerges as the Cannahowna river (Gort River and Castletown river), where water is abstracted for the Gort Water supply. It then disappears underground again and re-emerges into Lough Coole and feeding into the turlough system at Coole – Garryland. Ultimately it is thought to discharge to the sea at Kinvarra.

Table 1 Designated sites surrounding river survey area (Source: NPWS).

Name	Site Code	Designation	Notes	Distance and direction from river survey area
Lough Cutra	000299	pNHA SAC SPA	Lough Cutra is an oligo/mesotrophic freshwater lake lying on limestone. The main habitats of this site are; aquatic lake vegetation, reedbeds confined to sheltered bays and mixed woodland. The site is internationally important for its breeding and wintering population of Cormorants (166 pairs in 1985 and max 300 individuals in winter) (Information compiled in 1987). The Cormorants use the off-shore islands for breeding purposes. The internationally important populations of Cormorants and Lesser Horseshoe Bats should be especially protected. Lough Cutra is an important site with its diverse habitat types and the presence of both calcicole and calcifuge floras.	0km Includes and adjacent to river mouth
Gortacarnaun Wood	002180	SAC	Old oak woodlands are scarce in Ireland and the habitat is of particular conservation importance as it is listed on Annex I of the EU Habitats Directive.	0km Adjacent to south bank river
Drummin Wood	002181	SAC	Drummin Wood is of considerable conservation significance as it conforms to a woodland habitat type that is scarce in Ireland and one that is listed on Annex I of the EU Habitats Directive. The occurrence of Red Data Book plant and animal species adds to the importance of the site.	0.2km North
Lough Coy	002117	SAC	The site consists of a small permanent lake in the middle of an almost circular turlough basin. Lough Coy is an excellent example of a 'riverine' type of turlough, and is in essence the floodplain of an underground river. The entire site consists of turlough habitat, an EU Habitats Directive Annex I priority habitat. Of particular note is the occurrence of three Red Data Book plant species at this site - these are Mudwort (*Limosella aquatica*), Fen Violet (*Viola persicifolia*) and Northern Yellow-cress (*Rorippa islandica*). Lough Coy is an excellent example of a eutrophic (nutrient-rich) turlough. The extreme water fluctuation supports a distinctive zonation of vegetation and provides many niches for specialist plants. It is an important site for wintering waterfowl.	7.7km North
Newhall	002293	SAC	No synopsis available	7.8km North North-west
Coole-Garryland	000252	SAC	Turloughs and protected bird species are the qualifying interests of this designated area.	6km south

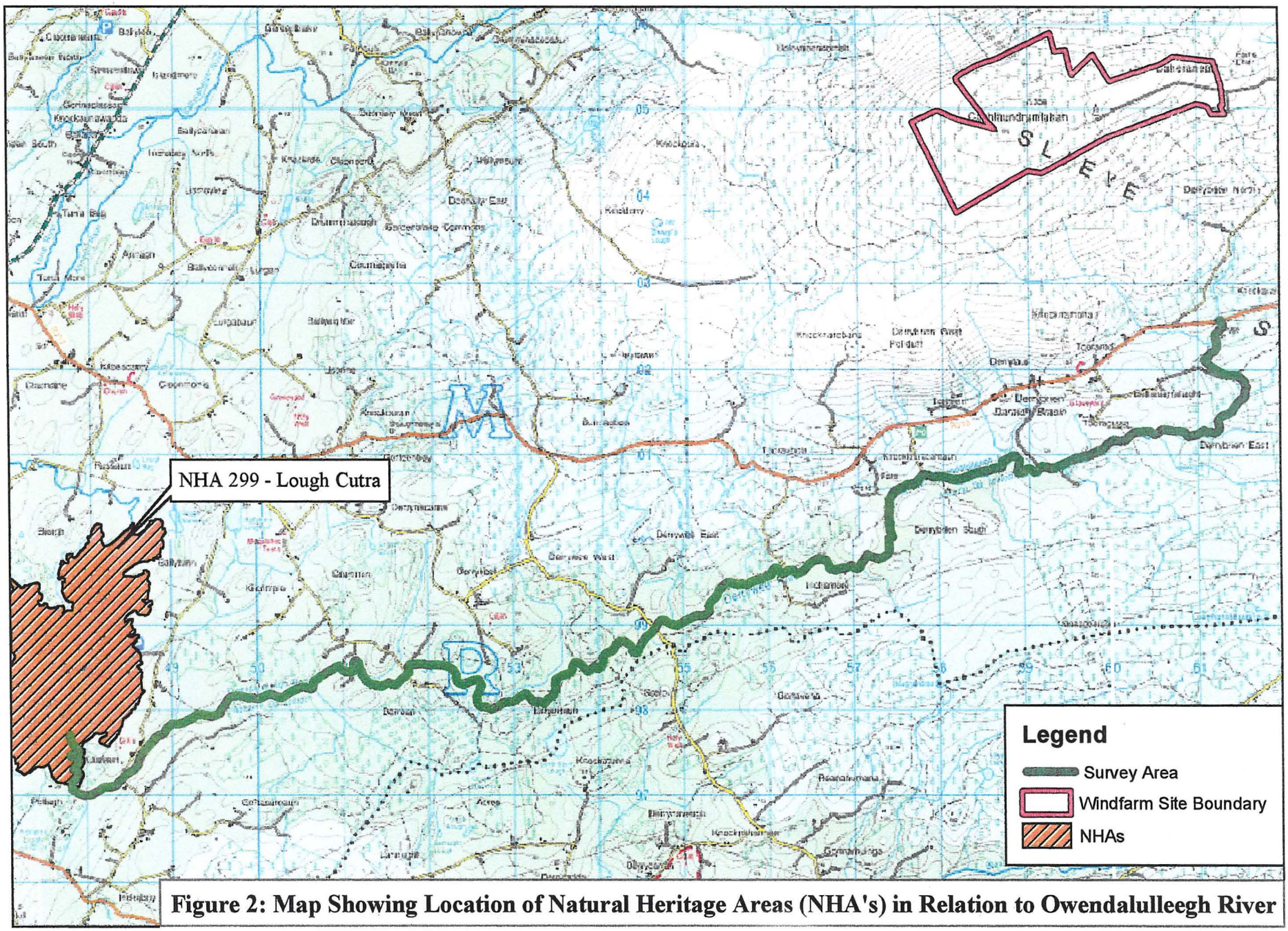

Figure 2: Map Showing Location of Natural Heritage Areas (NHA's) in Relation to Owendalulleegh River

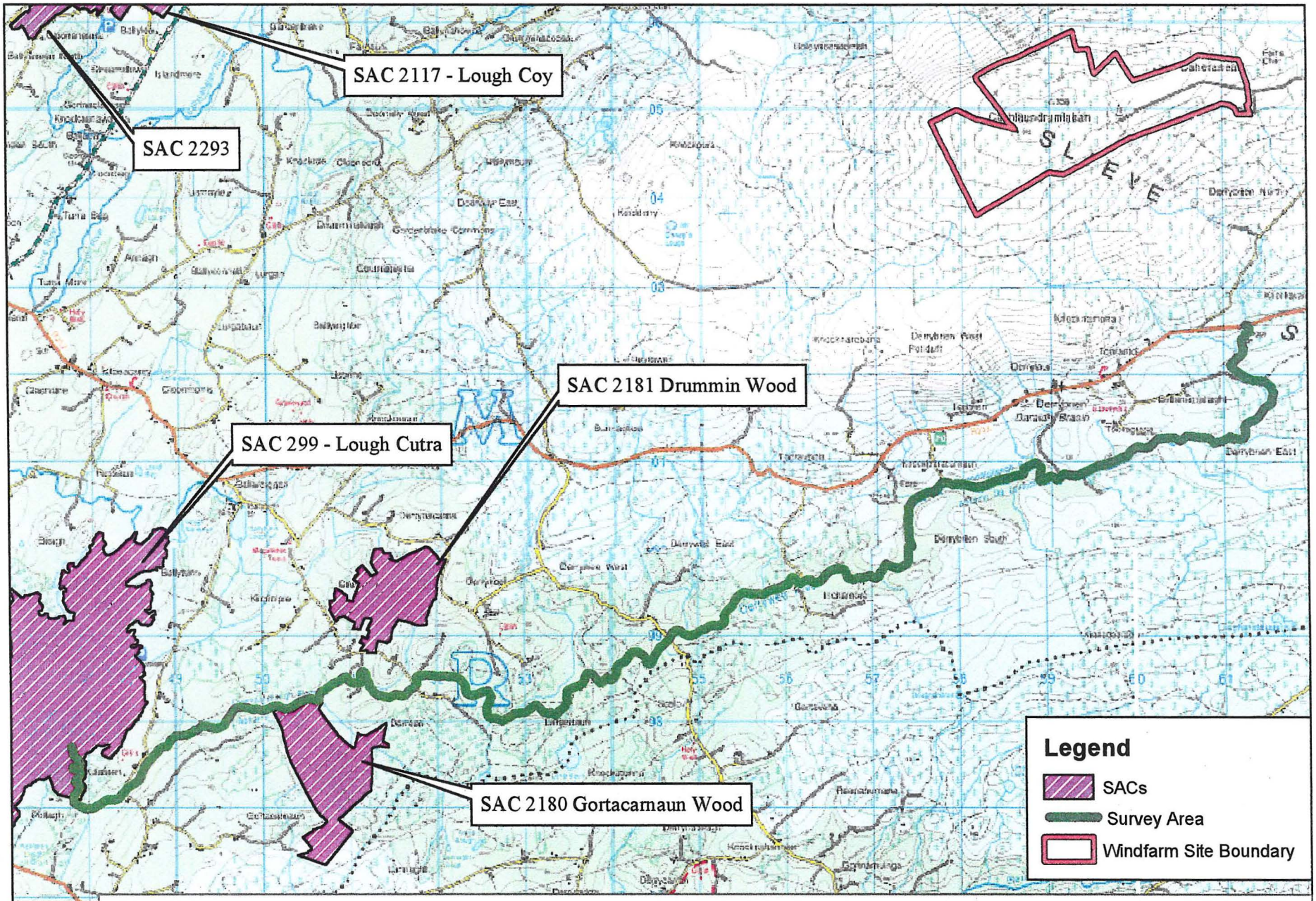

Figure 3: Map Showing Location of Special Areas of Conservation (SAC's) in Relation to Owendalulleegh River

Table 2 Catchment details of the Owendallulleegh River (from source to Lough Cutra). Adapted from McGarrigle *et al* (2002).

Detail	Value
EPA Code	29/O/01
OS Catchment number	146
NOS Grid Reference	R 478 976
Hydrometric area	29
Tributary of	Lough Cutra

Table 3 Physical characteristics of the Owendallulleegh River (from source to Lough Cutra). Calculated from the features shown on the NOS Discovery Series Map 52 and information provided in McGarrigle *et al*, 2002).

Characteristic	Value
Catchment area (km^2)	40
Length (km)	22.5
Basin length (km) [1]	17.2
Basin surface storage (%) [2]	0.005
Drainage density [3]	1.09
Stream order	3rd
Beneficial uses	General amenity and angling
Status	Tributary of designated SAC

Stream order was calculated using the Strahler method (Strahler, 1964).

3.4 Previous studies

3.4.1 Fish and fisheries of the Lough Cutra catchment

The fish fauna of Ireland is not as diverse as other European countries due to the impact of glaciation. Most of the fish species present in Irish river catchments have colonized from the sea or have been artificially introduced. The fact that the Lough Cutra catchment is landlocked will further reduce the number of fish species present. Native fish species in the Lough Cutra catchment include brown trout *Salmo trutta* and one out of the three Irish lamprey species (brook lamprey *Lampetra planeri*). Brook lamprey are listed under the European Union Directive on the Conservation of Natural and Semi-Natural Habitats and of Wild Fauna and Flora (Habitats Directive, 92:43:EEC). The catadromous[4] European eel *Anguilla anguilla* is thought to access Lough Cutra via underground river channels. Introduced fish species in the catchment include northern pike *Esox lucius*, stone loach *Barbatula barbatula*, perch *Perca fluviatilis*, and gudgeon *Gobio gobio*. There have been reports that carp *Cyprinus carpio* has been introduced to the lake but the ShRFB has not confirmed this. A list of the fish species, which are known to occur in the Lough Cutra catchment, and the Owendallulleegh River, along with their distribution and conservation status, is given in table 4. Lough Cutra is a privately owned lake and coarse/mixed fishery.

[1] Basin length is the straight-line distance between the mouth of the basin (in this case the confluence with the Lough Cutra) and the drainage divide nearest the source of the main stream.
[2] Basin surface storage (%) is the percentage of the basin covered in lentic water bodies (i.e. lakes).
[3] Drainage density is an index of the length of stream per unit area of basin. It is calculated by dividing the catchment area by the total length of perennial streams in the catchment.
[4] A fish species which spends most of its life in freshwater but migrates to the sea to spawn.

Table 4 A list of fish species recorded from the Lough Cutra catchment, and Owendallulleegh River, indicating their distribution, protection status, and utilisation (compiled from a number of unpublished sources).

				Protection			*Exploitation*		
Common name	**Scientific name**	**Origin**	**Distribution**	**EU HD**	**Berne**	**RDB**	**Recreational**	**Commercial**	**Present in Owendallulleegh River**
Brown Trout	*Salmo trutta*	N	W				•		•
European Eel	*Anguilla anguilla*	N	W				•	•	•
Carp*	*Cyprinus carpio*	I	L				•		
Gudgeon	*Gobio gobio*	I	L						•
Northern Pike	*Esox lucius*	I	W				•		
Perch	*Perca fluviatilis*	I	W				•		•
Brook lamprey	*Lampetra planeri*	N	L	II	Annex III	I			•
Stone Loach	*Barbatula barbatula*	I	L						•

*Not confirmed.

N=Native, I=Indigenous, W=Widespread, L=Local, E=Extinct.
EU Habitats Directive (EU HD) - Annex II (Species whose conservation requires the designation of SACs), Annex V (Exploitation subject to management)
Berne Convention (Berne) - Annex II (Strictly Protected fauna species), Annex III (Protected fauna species).
Red Data Book (RDB) - Ex – Extinct, E - Endangered, V - Vulnerable, R - Rare, I – Indeterminate, II – Internationally Important

3.4.2 Plant records

The following rare species are recorded for the 10km squares between Flaggy Bridge and L. Cutra. As this data was recorded on a 10km-square basis, it is not possible to state definitively whether the plant record is from the Owendallulleegh River, or from other wetland/streams in the 10km square.
As can be seen from the descriptions of the species' preferred habitats, most of these species prefer slow-moving or standing water or damp ground, and may have been recorded from L. Cutra or other areas of standing water within the relevant 10km squares and thus are less likely to have been affected by the peat slip event. These are marked +.

Orange foxtail *Alopecurus aequalis* – grows in muddy, marshy areas,

Slender tufted-sedge *Carex acuta* – grows along rivers and in ditches and marshes

Water sedge *Carex aquatilis* – grows in swampy areas by rivers and marshes

+Rigid hornwort *Ceratophyllum demersum* – grows in ponds, ditches and slow rivers

+Mudwort *Limosella aquatica* – grows in wet sandy mud by ponds

+Lesser pondweed *Potamogeton pusillus* – grows in lakes, streams and ponds usually in base-rich water

+Northern yellow-cress *Rorippa islandica* – grows on pond sides and other damp places

+Marsh yellow-cress *Rorippa palustris* – grows in open damp ground

+Blue-eyed grass *Sisyrinchium bermudiana* – grows in wet meadows and stony ground by lakes

+Greater bladderwort *Utricularia vulgaris sens. lat.* – grows in base-rich still or slow-moving water

+Fen violet *Viola persicifolia* – grows in fens

3.4.3 Protected aquatic fauna

The status of fauna listed in the European Union Directive on the Conservation of Natural and Semi-Natural Habitats and of Wild Fauna and Flora (Habitats Directive, 92:43:EEC) in the Owendallulleegh catchment is presented as follows;

Common name	Scientific name	Lough Cutra	Owendallulleegh River
Brook lamprey	*Lampetra planeri*	Not known	Present
Eurasian Otter	*Lutra lutra*	Common	Common

3.4.3.1 Brook lamprey

The brook lamprey is the smallest of the three lamprey species native to Ireland and it is the only one of the three species that is non-parasitic and spends all its life in freshwater. Brook lamprey is listed in Annex II of the Habitats Directive (92:43:EEC) and Appendix III of the Bern Convention. The Shannon Regional Fisheries Board has recently recorded Brook lamprey in the Owendallulleegh catchment.

3.4.3.2 Eurasian Otter

The otter is a legally protected species under the Wildlife Act, 1976 (and Wildlife (Amendment) Act, 2000). It is listed under Annex II of the EU Habitats Directive and under Annex II[5] of the Berne Convention. It is found throughout Ireland where it has apparently avoided the population declines that have occurred in many other countries. During the survey, the signs of otters (spraints and tracks) were recorded from many areas in the study area and up as far as chainage 182.

3.5 On-site Investigations

3.5.1 Aquatic habitats

The principal habitat type surveyed is categorised as eroding/upland river (FW1, Fossit 2000). For the purposes of this study, this was subdivided into in-stream areas and riparian, or riverbank, areas. A full aquatic and riparian habitat evaluation is presented in tables 5, 6, 7 and 8. The results of the physical habitat survey are given in table 9. The river length has been divided into 100m chainage lengths for the purpose of assessment, commencing at chainage zero at the Lough Cutra confluence.

3.5.2 Vegetation

A list of plant species recorded during the walkover study is given in Appendix 3. Very little vegetation was recorded from the deeper pools. Pondweed *Potamogeton* sp. was recorded at a few locations. Shallow areas were found to support a limited number of species. These areas were dominated by aquatic mosses such as *Fontinalis* and *Racomitrium* spp. Alternate water-milfoil *Myriophyllum alterniflorum* was recorded as being locally abundant. Emergent, marginal-type vegetation was found along the banks, particularly where these were shelved rather than steep-sided, and on islands and elevated cobble/gravel areas in the channel. The principal species recorded were watercress *Rorippa nasturtium-aquaticum*, water dropwort *Oenanthe* sp., fool's water-cress *Apium nodiflorum* and bulbous rush *Juncus bulbosus*. Willowherbs *Epilobium* spp., floating sweet-grass *Glyceria fluitans*, lesser spearwort *Ranunculus flammula* and brooklime *Veronica beccabunga* were locally frequent. Liverworts were locally dominant or abundant on steep-sided, shaded or overhanging banks, where they were constantly damp but rarely submerged. The dominant riparian species recorded were willows *Salix* spp., ash *Fraxinus excelsior*, hazel *Corylus avellana* and rowan *Sorbus aucuparia*, with an abundant great wood-rush *Luzula sylvatica* ground layer. Gorse *Ulex europaeus*, blackthorn *Prunus spinosa*, hawthorn *Crataegus monogyna* and bramble *Rubus fruticosus* were locally dominant, while bilberry *Vaccinium myrtillus* and soft rush *Juncus effusus* were locally abundant. Sedges *Carex* spp. were locally frequent. Some sections were dominated by planted evergreens such as sitka spruce *Picea sitchensis*. Most of the riverbank above the influence of flood events was dominated by either woodland or heath/bog flora, with unimproved grassland found in a few areas.

3.5.3 Peat Deposition

Estimates of peat deposition were made on the basis of bank side surface area and depth of peat. In general depths of peat at some locations ranged form 0.1 m thickness up to 0.5 m thickness. Larger deposits tended to occur at river bends where peat mounding was observed and at fords used on the river by local farming communities. Areas where larger depths of peat were observed tended to be small in area and could easily be removed if required.

[5] Annex II Berne Convention: Strictly protected fauna species.

Table 5 Aquatic, riparian and fisheries habitat evaluation chainage section 169-200.

Chainage section	Description	Map number	Aquatic habitat appraisal	Fisheries habitat appraisal	Level of instream impact	Level of riparian impact	Comment	Mitigation
200 - 189	From Flaggy Bridge downstream. The start point of the survey. Steep banks and a narrow channel characterize this section. There are hillocks on the eastern edge of the river that rise to 140m asl. Liverworts grow where moisture seeps down to the river.	1	One of the most heavily impacted areas of the river – strong scouring and removal of all instream vegetation. Degree to which instream habitats were affected depended on their relative exposure to the flow of moving peat i.e. whether they were on the inside or outside of a bend. Marginal species are showing good recovery three weeks after the peat slip where peat cover is light.	Here there are large amounts of peat deposited on the margins of the river. Sand banks are evident at bends in the river. These should dissipate with precipitation over time. Instream the riverbed has been scoured gravels and rocks transported downstream. All fish would have been displaced or killed by this flow of material.	Profound Negative	Profound Negative	Physical nature of river has been significantly altered here.	Large areas of peat on the margins may require removal. Alternatively could be planted and stabilized. Damage directly above and around culvert at M 61137 02304. This dam (005) should be removed. The culvert size and gauge should be changed. Instream physical enhancements may be required.
189 – 169	The section from chainage 189 – 182 is still fast moving and narrow until it meets a distributary at 182. From 182 – 169 the river widens and slows.	2	Aquatic vegetation is minimal from 189 – 182. Large amounts of siltation evident. Again there is recovery evident where peat cover is light. From 182 – 169 not as much impact due to the increasing river width.	Area between chainages 189 – 182 has been severely impacted. However, not much scouring has occurred in this section. From 182 – 169 there is good habitat available with good pools and glides - but siltation is evident. The banks have not been eroded as in chainage 200 – 189.	Substantial - Profound Negative	Substantial - Profound Negative	Fish were seen moving upstream within chainage 183. Because the fractions of peat are now small the pools seem clear enough but silt is present. Otter activity was observed at chainage 177.	Areas of peat need to be removed from the margins. Trees and shrubs instream should be left, as removal would be deleterious to habitats and fish.

Table 6 Aquatic, riparian and fisheries habitat evaluation chainage section 169-111.

Chainage section	Description	Map number	Aquatic habitat appraisal	Fisheries habitat appraisal	Level of instream impact	Level of riparian impact	Comment	Mitigation
169 151	River structure consists of long pools with alternating glide/run habitat. River widths up to 12m	3	This section is less severely impacted. Deposition on the river margins is reduced and vegetation is intact at most locations. Cover is much reduced where cobbles and boulders have been turned and scoured. Sheltered areas in the bends of the river have more moderate cover.	Despite some physical impacts, much of the instream habitat along this stretch has been left intact. Areas suitable for salmonid spawning, nursery, rearing and foraging continue to occur.	Moderate – Substantial Negative	Moderate – Substantial Negative	Impacts predicted to be short-tem at this section. Banks are still intact and good habitat is evident in the majority of the length of this section.	No action needed here. Natural recovery processes would suffice.
151 – 129	Long wide sections of slow water with some extensive riffles. Some very wide sections here (up to 19m). Substrate consists of cobble and gravel.	4	Fluctuation in instream vegetation cover reflects variations in streambed disturbance. Cover is much reduced where cobbles and boulders have been turned and scoured. However this damage was not recorded frequently in this section.	No scouring evident. No serious instream damage evident. No peat deposits. There are good areas of gravel evident. Periphyton present on gravels. The majority of larger peat material has been 'sieved out' by the narrow nature and overhanging shrubs from 200-182 of the river	Slight Negative	Slight Negative	This section is physically unchanged from its original form. Banks are still intact and good habitat is evident in the majority of the length of this section. Impacts negligible. Otter activity evident in this section.	No action needed here
129 – 111	Some large pools along this stretch, three small distributaries and three fords characterize this section. Bank height rises here along this section. Fish (salmonids) were noted moving in the pools here. This section is for the most part slow moving with some good riffles evident at the fords.	5	Cover of peat on the margins here is very light except for small pockets. Liverwort flora, the most abundant riparian-type marginal vegetation, is undamaged. Instream vegetation is low and scouring damage is not evident.	Good spawning areas in this section with gravels intact. Also good holding pools and nursery areas available. Damage is limited to marginal areas where peat has deposited. No instream damage evident with the exception of some trees and shrubs that have been washed down. These will form extra habitat for fish in future.	Slight Negative	Slight Negative	This section seems largely undamaged to the eye. There is no evidence of scouring or of large movements of gravels and cobbles. Because the fractions of peat are now small the pools seem clear enough but silt is present in the interstitial spaces. Otter activity in the form of paw prints and anal jelly was observed.	No action needed here

Table 7 Aquatic, riparian and fisheries habitat evaluation chainage section 111-31.

Chainage section	Description	Map number	Aquatic habitat appraisal	Fisheries habitat appraisal	Level of instream impact	Level of riparian Impact	Comment	Mitigation
111- 91	Deep pools and large sections of bedrock characterize this section. There is good bankside vegetation and some good stands of mixed forestry line the edges of the river in places. Tunneling (trees) was observed at two locations.	6	Due to the depth of water in areas instream vegetation was low where it was possible to assess. Again liverworts were undamaged.	Large deep holding pools that are impossible to assess for benthic damage. However there are good areas of glide (50%) accessible and these seem untouched. Peat has not deposited instream with the exception of areas in the lee of trees in the river. Peat has deposited on the margins in some areas.	Slight Negative	Slight Negative	This section seems largely undamaged to the eye. Large numbers of deer are using this area. The only discernable difference is the peat that has deposited on the banks.	No action needed here
91 – 70	This entire section has deciduous woodland on the bankside. As a result shading occurs on most of the sections. Long pools are evident with no damage recorded.	7	Vegetation that was seen was intact. There is impoverished riparian flora as a result of shading. The instream flora is low where shading occurs but is relatively undisturbed. The lower areas 64-56 supports very good areas of instream vegetation and also seems undisturbed by then peat slip event.	Where possible to assess instream predictors no damage was recorded. Gravels were evident but on a whole deep areas and glides predominated. Siltation was observed. Peat has deposited on the margins in some areas.	Slight Negative	Slight Negative	This section was undamaged and instream vegetation was intact where noted. Areas of peat deposition were apparent.	No action needed here
70 – 50	Wide sections of river bordered on the northern bank by good improved agricultural grassland complexes. The river exhibits deep pools again with glides predominating.	8	Good sections of instream growth are evident at the lower end of this section. Again heavy shading by overhanging trees has stunted growth in some sections. All instream vegetation that was observed was undisturbed.	Where wading permitted inspection of the instream predictors these seemed undisturbed. Peat has deposited on the margins in places.	Slight Negative	Slight Negative	This section was undamaged and instream vegetation was intact where noted. Areas of peat deposition were apparent.	No action needed here
50 – 31 (SAC 2180 Gortacarnaun Wood)	Characterized by widening sections of river with good pool systems. Some nice fast water at chainage 45 with nice undisturbed gravels present. Between chainages 39 – 34 on the southern bank there is heavy woodland cover entailing observers to make use of the northern bank.	9	There have been no impacts on vegetation found in this section. Open unshaded areas support good instream vegetation.	Minimal impacts were observed in this section. Peat has deposited on the banks at various locations and overhanging trees bear the detritus of the deluge.	Imperceptible Negative	Imperceptible Negative	Fresh otter spraints were noted in this section. There is no perceptible damage in this section.	No action needed here

Table 8 Aquatic, riparian and fisheries habitat evaluation chainage section 31-1.

Chainage section	Description	Map number	Aquatic habitat appraisal	Fisheries habitat appraisal	Level of instream impact	Level of riparian impact	Comment	Mitigation
31 – 11	Extensive areas of riffle separate some long deep pools. Instream predictors were difficult to assess in places due to the depth of pools.	10	There have been no impacts on vegetation found in this section. Open unshaded areas support good instream vegetation.	No impacts recorded on this section. Some small amounts of peat have settled on the margins at certain points.	Slight Negative	Slight Negative	There is no perceptible damage in this section.	No action needed here
11 – 1	Due to the depth of this section the ShRFB surveyed this section in boats. This section leads onto the mouth of the river and a large sand bank is present at this mouth.	11	There have been no impacts on vegetation found in this section. Depth of channel made assessment of instream vegetation impossible.	Although no impacts were recorded on this section some peat may have settled at the mouth of this river. Some small amounts of peat have settled on the margins at certain points.	Slight Negative	Slight Negative	There is no perceptible damage in this section.	No action needed here

Table 9 Approximate amount of peat (m^3) deposition observed on the river margins. (Estimated by ESBI)

Chainage section	Amount of peat (m^3) deposition observed on the margins (approx.)
200 - 189	1260.1
189 – 169	936.59
169 – 151	102.35
151 – 129	51.25
129 – 111	45
111- 91	21.5
91 – 70	276.25
70 – 50	79.75
50 – 31	16.15
31 - 11	65.15
11 - 1	67

Table 10 Results of the physical habitat survey.

Site number	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
Grid co-ords.	M611 625	M611 624	M 6113 623	M611 272	M610 206	M 611 196	M 611 345	M611 121	M604 119	M 601 121	M 579 702	M 575 538	M 57371 125
Bank height range (m)		1 - 2m	1 - 2m	3 - 7m	.5 - 3.5	.4 - 3.5	.4 - 2	.2 - .6	.5 - 1.5	1.5 - 2	.1 - 2	.1 - 2	.1 - 1.2
River width range (m)		1 - 2m	.2 - 1.1m	2 - 4m	.3 - 1.5m	1 - 4m	.7 - 4m	2 - 4m	3 - 8m	5 - 10m	5 - 14m	7 - 15m	8 - 19m
Depth range (m)		.1 - .5	.1 - .5m	.5 - .75m	.1 - .5m	.1 - .75m	.1 - .8m	.1 - .7m	.1 - 1.5m	.1 - .75m	.1 - 8m	.1 - .8m	.2 - .6m
Riffle %		50	20	10		10	10	10	50	20	30	20	5
Glide %		40	10	30	10	20	80	80	40	70	50	5	75
Pool %		10	70	40	60	70	10	10	10	10	20	75	20
Bedrock %		90	60	85	30	30	50		10				
Cobble %				5	10	10	30	75	20	60	15	15	80
Gravel %		10	40	15	60	60		25	70		15	85	20
Boulder %							20			40	70		
Sand/Silt %													

Site number	**14**	**15**	**16**	**17**	**18**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**
Grid co-ords.	R572 997	R561 996	R557 994	R546 989	R517 984	R517 984	R510 984	R502 981	R484 971	R482 972	R480 972	R487 978	R487 978
Bank height range (m)	.1 - 2.5	.1 - 5	0.5 - 2	0.1 - 2	1-3m	1-3m	1 - 3m	1-15m	1-3m	.1-2	.5-2m	.1 - 2.5	.1 - 5
River width range (m)	10 - 19m	2 - 20m	2 - 8m	3 - 30m	2-17m	5-14m	2-12m	10-14m	6-12m	17-25m	16-30m	10 - 19m	2 - 20m
Depth range (m)	.1 - .75m	.1 - 1m	.1 - 1.5m	.1 - >2m	.1-3	.2-3.5	.1 - 2.5	.1 -4.5	.2->2m	.2 -.4m	.75-5m	.1 - .75m	.1 - 1m
Riffle %	25	25	10	20	10	10	20	5		10		25	25
Glide %	75	25	80	50	60	35	30	10	50	90		75	25
Pool %		50	10	30	30	55	50	85	50		100		50
Bedrock %	10	60		70	30	30	5	80	10			10	60
Cobble %	20			20	40	20						20	
Gravel %	70	10	20	10	10	10	90					70	10
Boulder %		30	80		20	40	5	20	30	5			30
Sand/Silt %									60	95	100		

4.0 IMPACT

4.1 Characteristics of the impact

The results of this preliminary investigation suggest that the peat, which entered the upper reaches of the Owendallulleegh River, had a significant impact on the aquatic habitats in the river. The impacts were related to (1) physical impacts of peat on the river (i.e. scouring, bed erosion, etc.) and (2) impacts on water quality through elevated suspended solids and other parameters.

4.1.1 Physical impacts

Evidence of physical impacts are particularly apparent in the upper reaches of the river where an acute slide of peat into the channel scoured the river bed and denuded it of deposited materials such as gravels and cobbles. Physical impacts on the middle section of the river were less significant where suspended peat was transported. Deposition along this stretch of river was confined primarily to river bends and islands. No evidence of scouring was apparent along this section.

On the lower section of river, evidence of impacts were much reduced due to the spatial and temporal dilution of peat flocs and the riparian deposition of peat in the upper and middle section of the river. Suspended peat was transported along this stretch by river flows and deposition was confined primarily to river bends, islands and areas of reduced flow. No evidence of scouring was apparent along this section.

4.4.2 Scale of the impact

The most severe impact occurred in the upper section of the river, from Flaggy Bridge to confluence at Derrybrien East. In this area, the energy of moving peat, water and debris was greatest, and resulted in the near total loss of vegetation and scouring of the riverbed in some parts. Heavy deposition of peat on the banks also occurred in this area. The impact on the remaining downstream section was less significant. The presence of a 'high water mark' of debris deposited along the entire length of channel from Derrybrien to Lough Cutra indicates the ultimate height to which the banks were affected. In most areas below Tooraglassa, this is limited to a light covering of twigs and plant debris.

The main physical impact of peat silt on instream and riparian habitats is to be found within 0.5km downstream of Flaggy Bridge, where heavy peat deposition and scouring of the river channel had a profound impact. In contrast with this, practically the entire remaining habitat, from Bellaghnamallaght to L. Cutra, shows low/no impact, with localised areas of moderate impact. Habitat quality and species composition in areas of low/no impact is as expected for this type of river, where low nutrient availability and a spate-type flood regime do not favour the growth of emergent aquatic plants. Low cover of instream vegetation in areas of low/no impact is coincident with areas of heavy shading or deep pools, both of which are unsuitable for the growth of the most instream species typical of upland rivers. Those areas where instream vegetation has suffered moderate/low damage would be expected to recover naturally over the next 2-3 years.

Areas of deposited peat will provide new habitat for colonisation by some emergent species that are tolerant of its low pH, e.g. lesser spearwort, over the coming growing season (spring/summer 2004). However most of these deposits will be moved or modified by spate floods and are generally unlikely to provide habitat beyond approximately two years, given the eroding nature of this type of river. Most of the instream species found on this river prefer a mineral- (rock) derived substrate for growing, as opposed to one derived from organic matter (e.g. peat) – that is why they are found in this eroding type of river. While some deposition of fine peat is evident in the streambed, this is not of sufficient quantity to significantly affect plant growth.

With regard to plants and habitats along most of the affected stretch of the Owendallulleegh River, no remedial action is necessary, or even desirable, as the communities present will regenerate naturally over the next 1-3 years. Peat deposits should not be removed except where they present a possible danger to humans/livestock, or a potential threat to fisheries. Accessing and removing deposits is more likely to cause harm to habitats and plants than if they are left to naturally recolonise and/or be eroded (assuming that heavy plant such as caterpillar-tracked vehicles would be used to carry out the work).

5.0 MITIGATION

Some remedial works are desirable in the upper section at Flaggy Bridge in order to stabilise denuded areas of river channel and prevent unnecessary release of sediment into the watercourse. The use of matting, geotextile or similar 'soft' engineering solution to stabilise the bank sides and allow natural regeneration to occur is preferable over the use of 'hard' engineering. As well as facilitating habitat restoration and quickly fitting in with the natural landscape, 'soft' solutions have long-term advantages of being better adapted than hard bank retention engineering to absorbing some of the energy of spate events. Planting of vegetation 'plugs' at intervals along the stabilization structure would accelerate recolonisation. Any plants used should be taken from a suitable nearby site and the use of native species is recommended.

The planting of trees to replace those damaged in the flood would help to stabilise adjacent areas. The most suitable species are those native species already found growing naturally in this area – ash, mountain ash and downy birch.

Remediation of instream vegetation is problematic as aquatic mosses are slow growing. Two options are available. The first,'do nothing', option will leave the channel to recover by itself with no interference. This will be a slow process (3+ years). Alternatively, a small number of medium-sized (football-sized) boulders with moss growth could be introduced from unaffected parts of the river, preferably from the closest point possible (to retain a species composition as close to the original as possible). Such boulders would create a more diverse flow regime and variety of instream microhabitats. It is recommended that this option be considered only when all other remediation and stabilisation works have been completed, at which stage the condition of the streambed in the worst affected area should be re-assessed. The possible introduction of such boulders should be discussed with ShRFB staff.

5.1 Proposed further work

It was not possible to assess the status of fish populations and other fauna in the river during the current survey. It is therefore recommended that a fish stock assessment coupled with a macroinvertebrate survey be undertaken. This survey should use standard quantitative methods (electrical fishing and serber sampling) and should be undertaken at 5-10 sites along the river corridor. The ideal time to undertake this survey would be during the period July-September when the maximum numbers of juvenile fish would be expected to be present in a stream of this nature. At this time detailed recommendations regarding instream physical mitigation work can be made.

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APPENDIX 1 SURVEY AREAS ON THE OWENDALLULLEEGH.

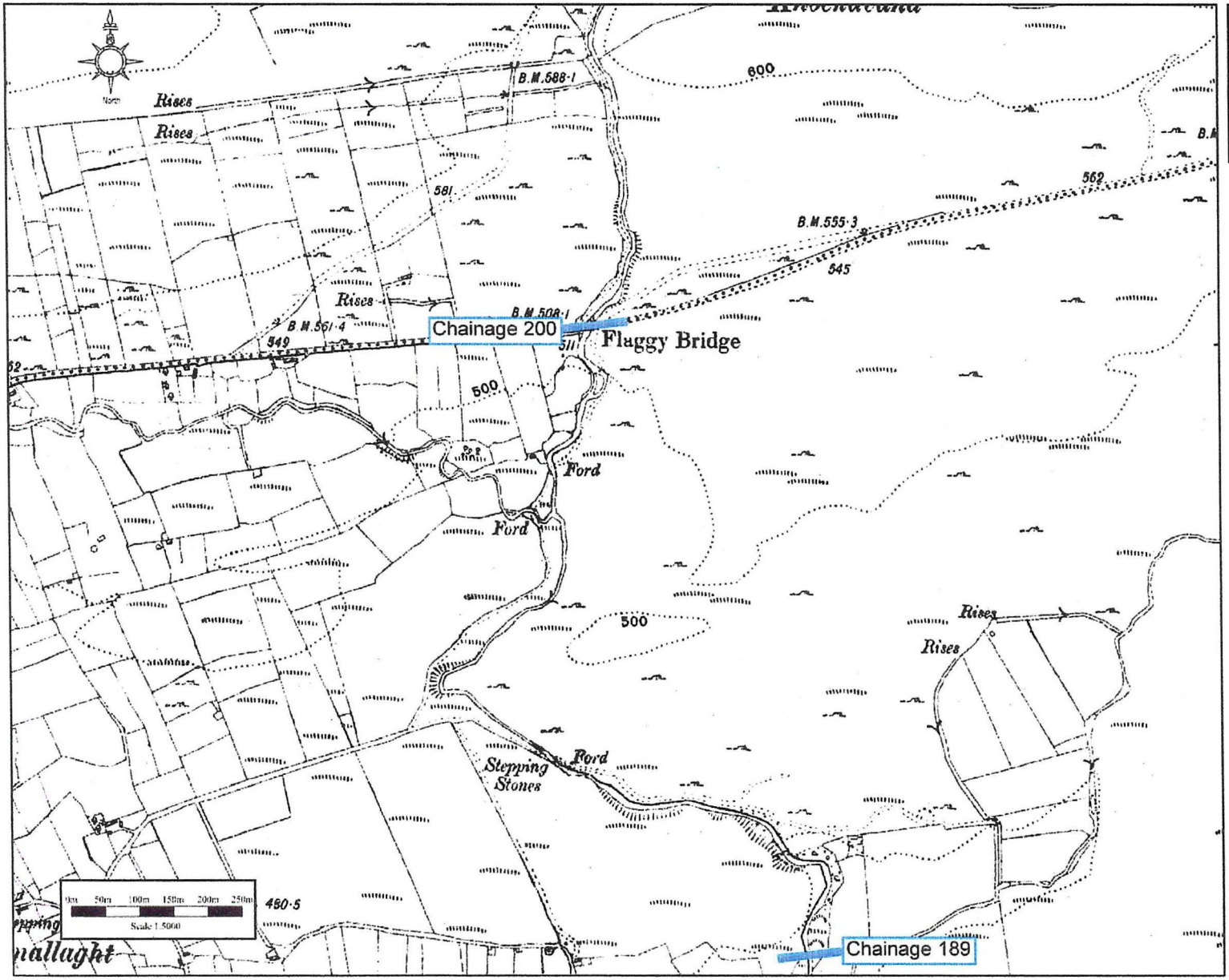


Figure A1.1
Section one was located downstream of Flaggy Bridge. Survey section was between chainages 200 - 189.

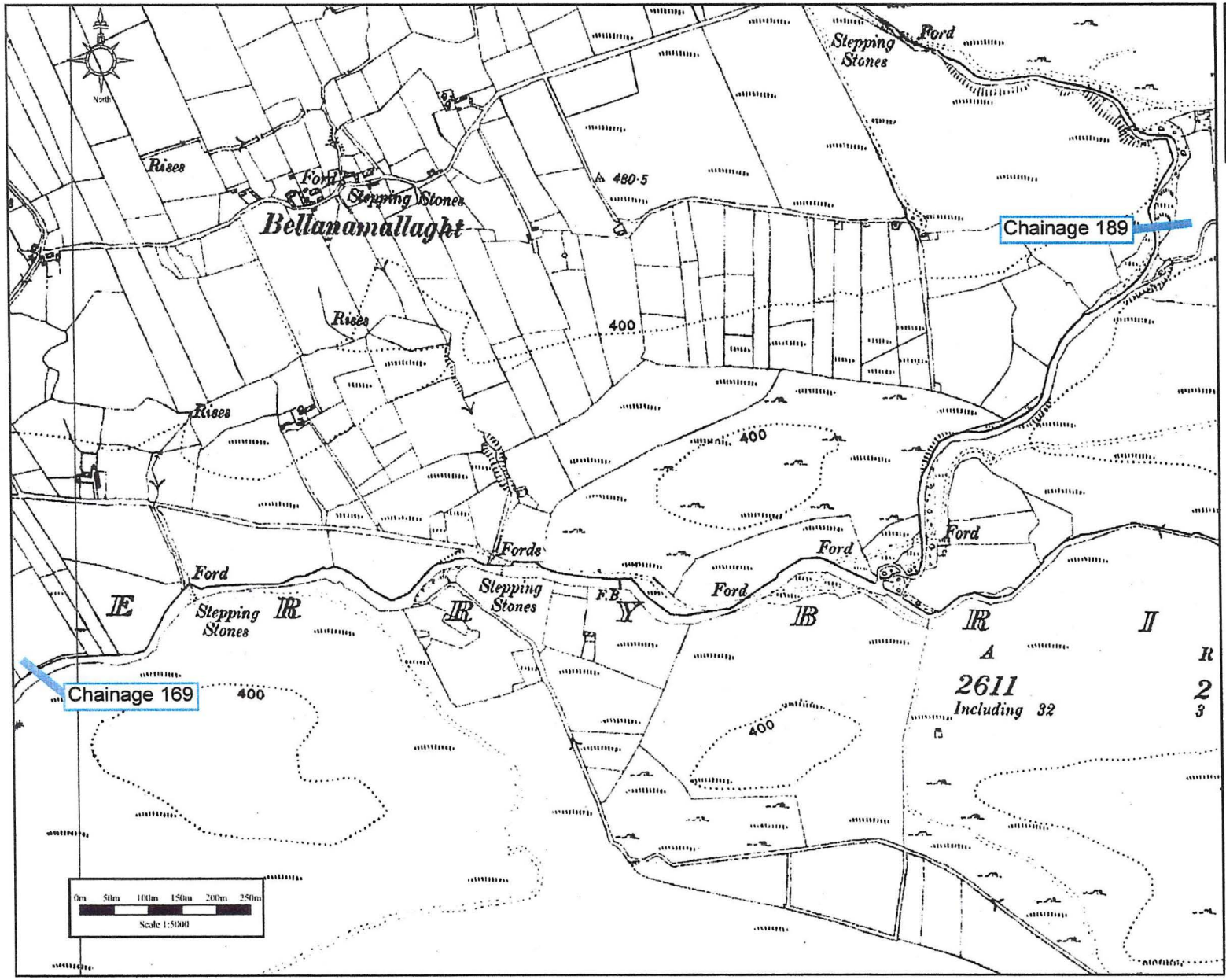


Figure A1.2
Section two was located on the second section down-stream of Flaggy Bridge. Survey section was between chainages 189 - 169.

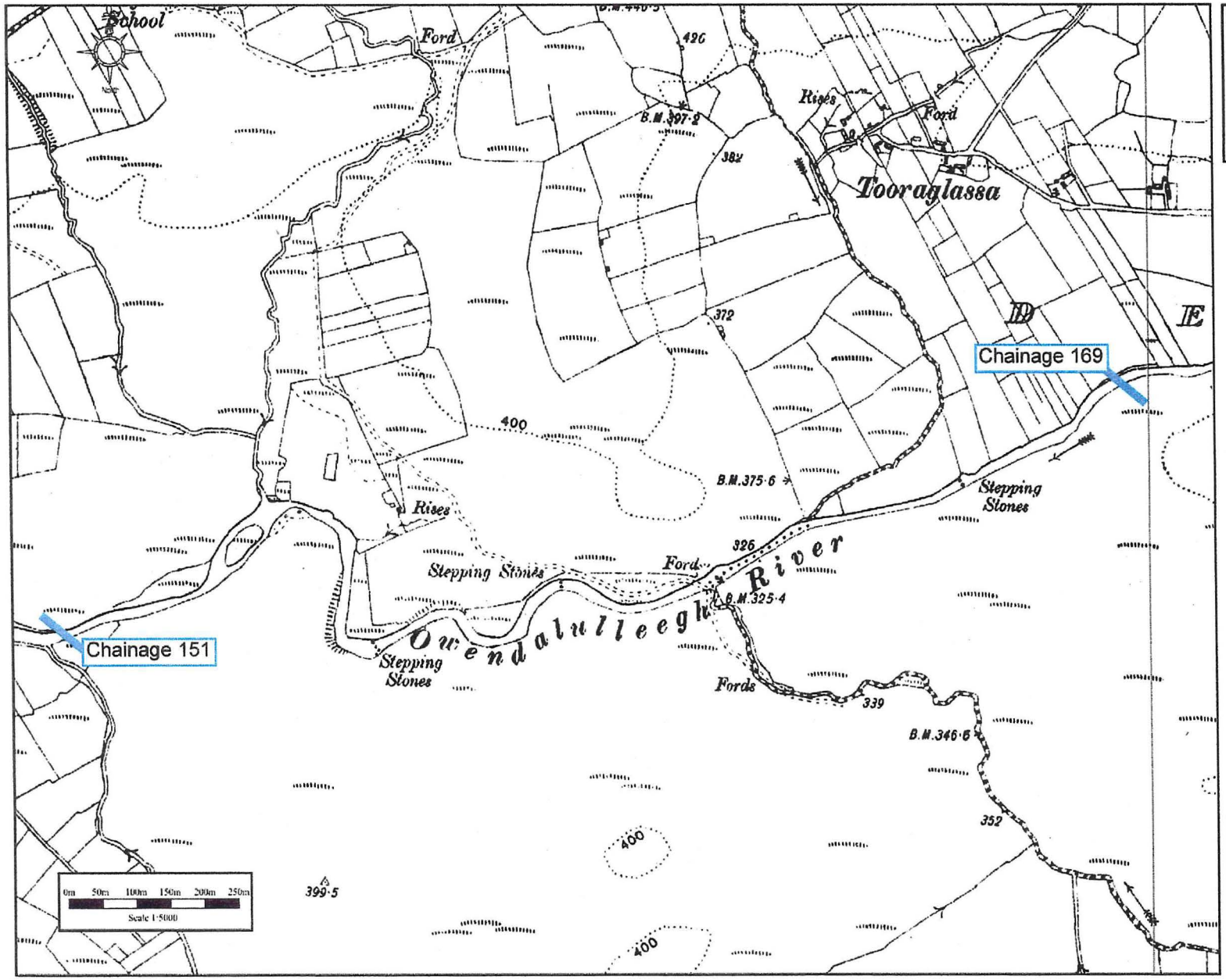


Figure A1.3
Section three was located in the townland of Toorglassa. Survey section was between chainages 169 - 151.

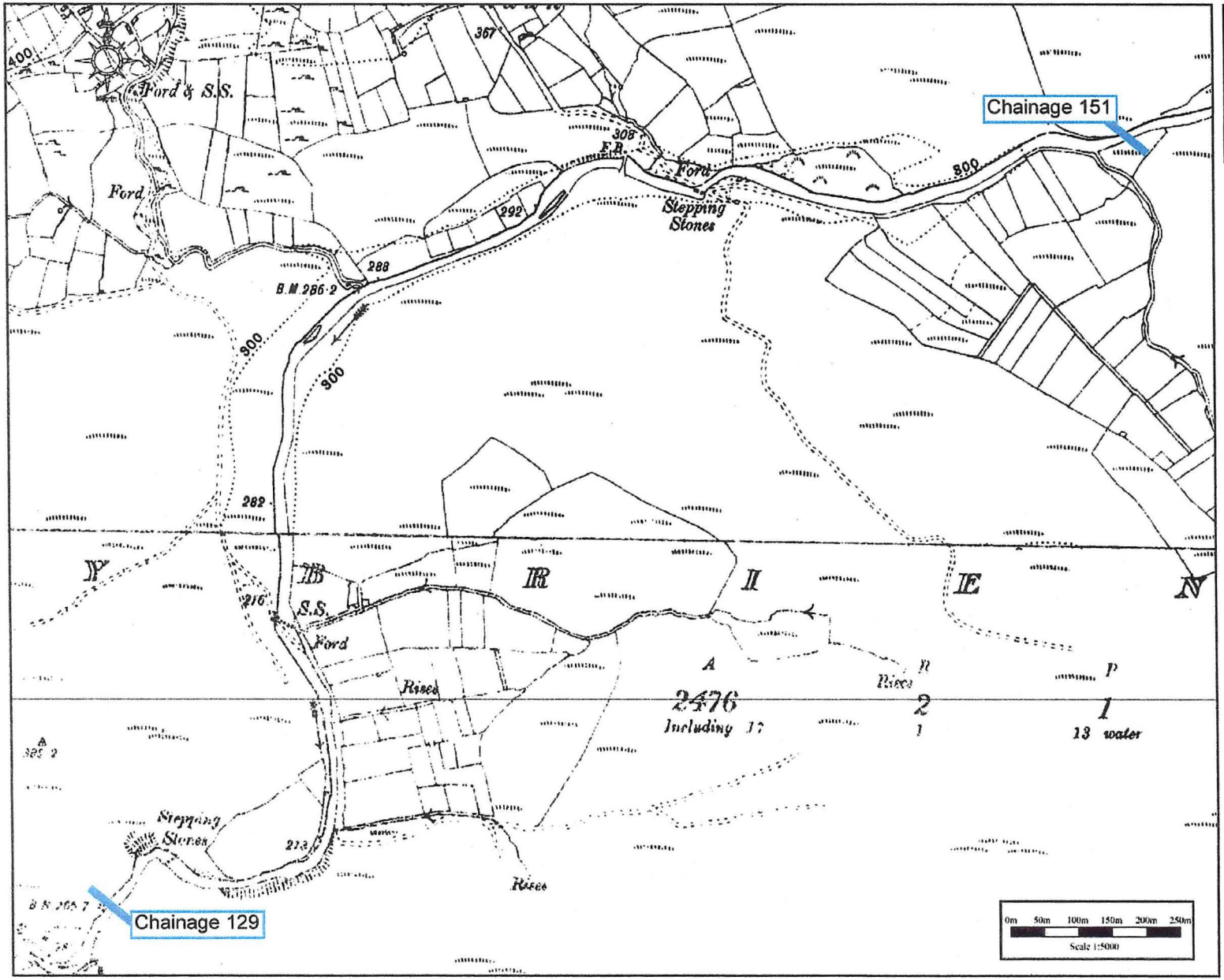


Figure A1.4
Section four was between chainages 151 and 129.

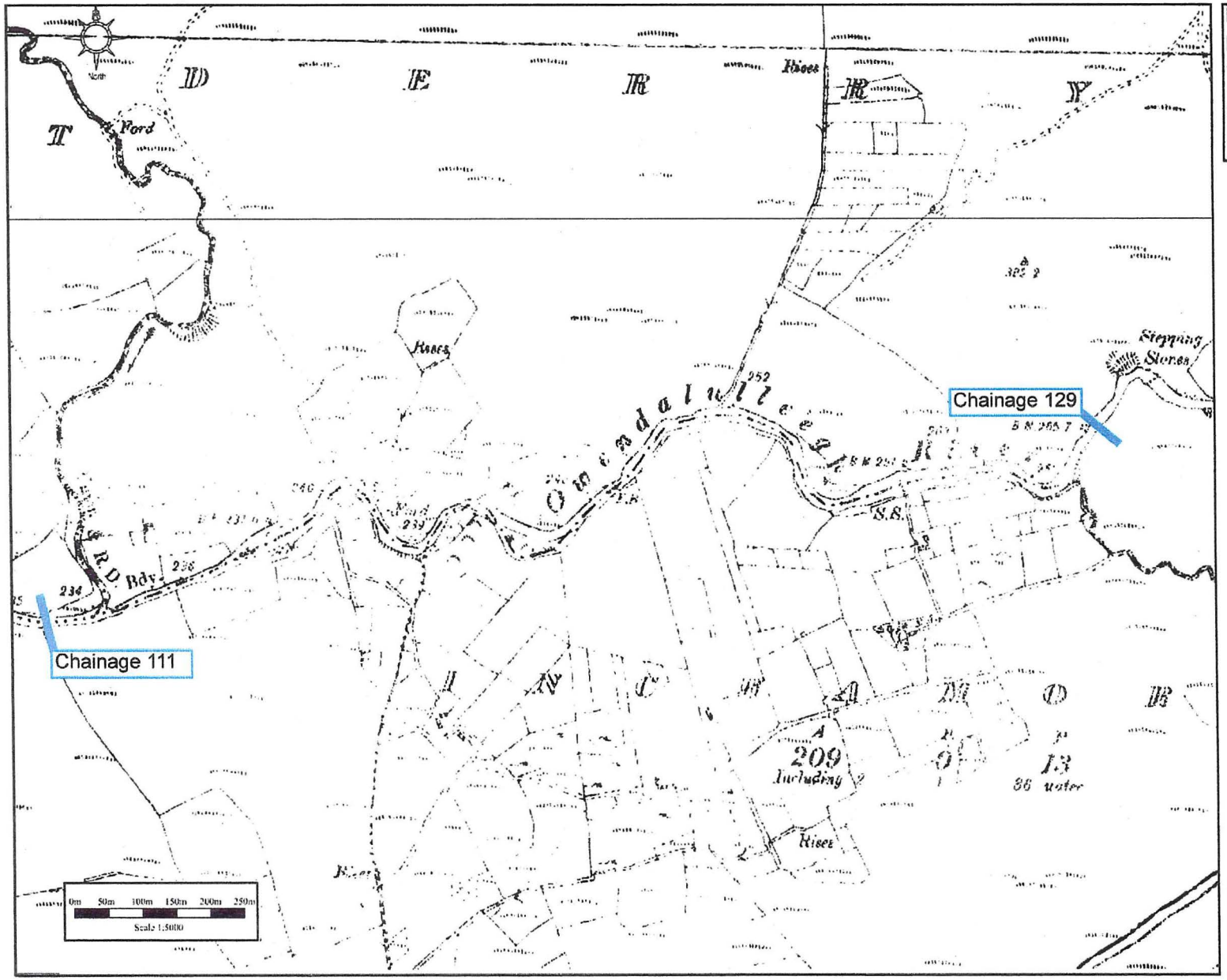


Figure A1.5
Section five was between chainages 129 and 111.

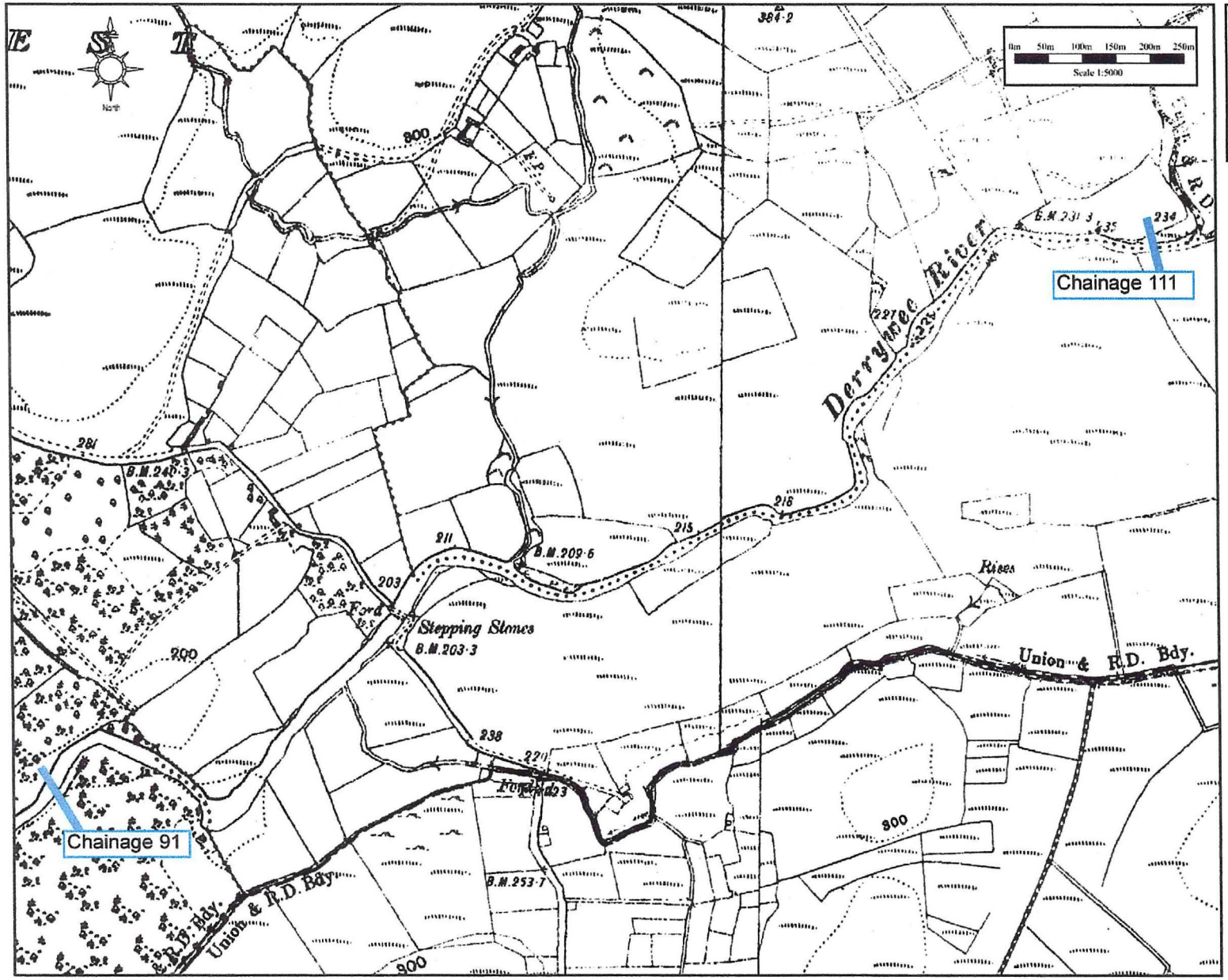


Figure A1.6
This figure shows the extent of survey section six.This section extended from chainage 111 to chainage 91.

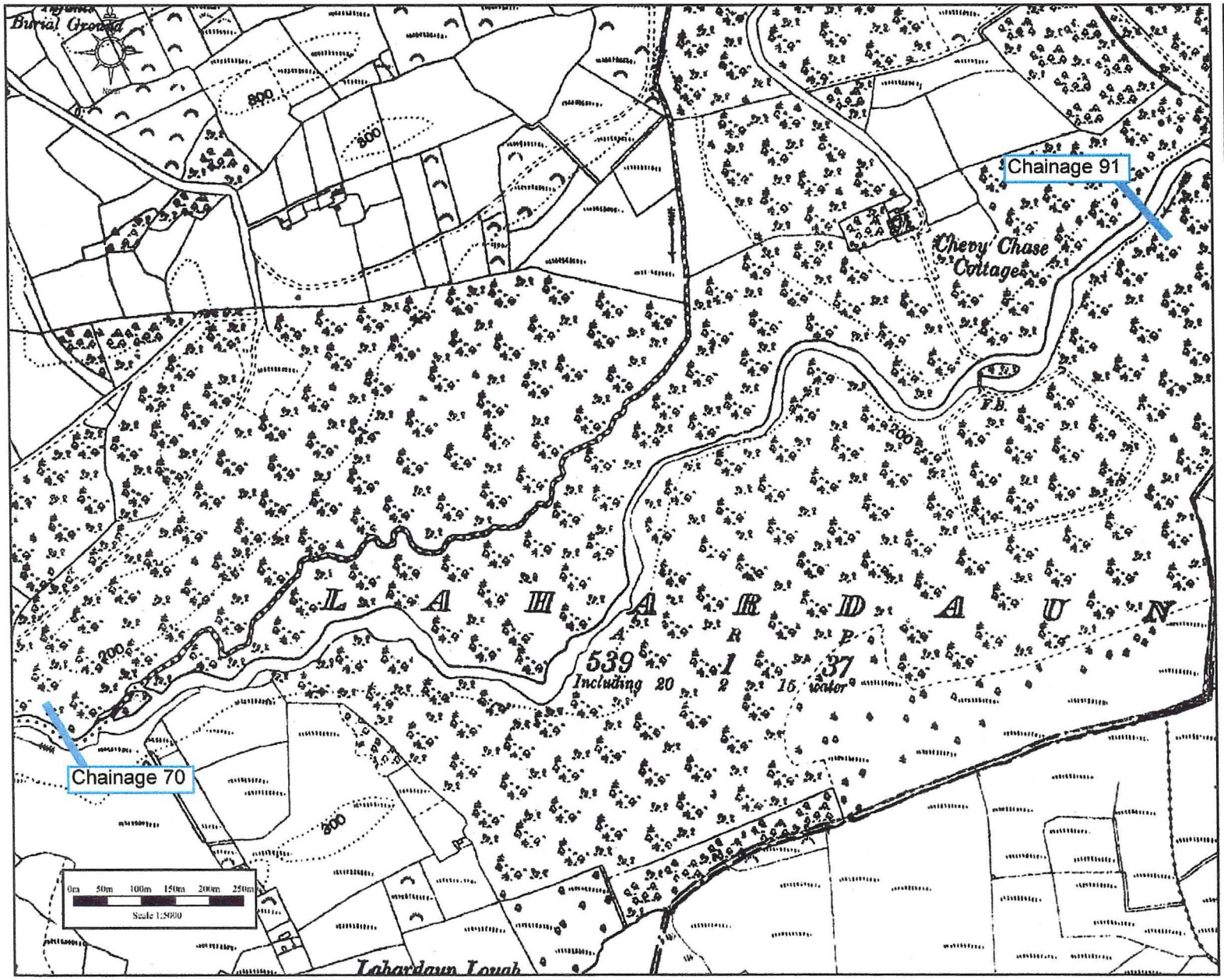


Figure A1.7
Section seven was located in the stretch of river near Chevy Chase cottage. Survey section was between chainages 91 - 70.

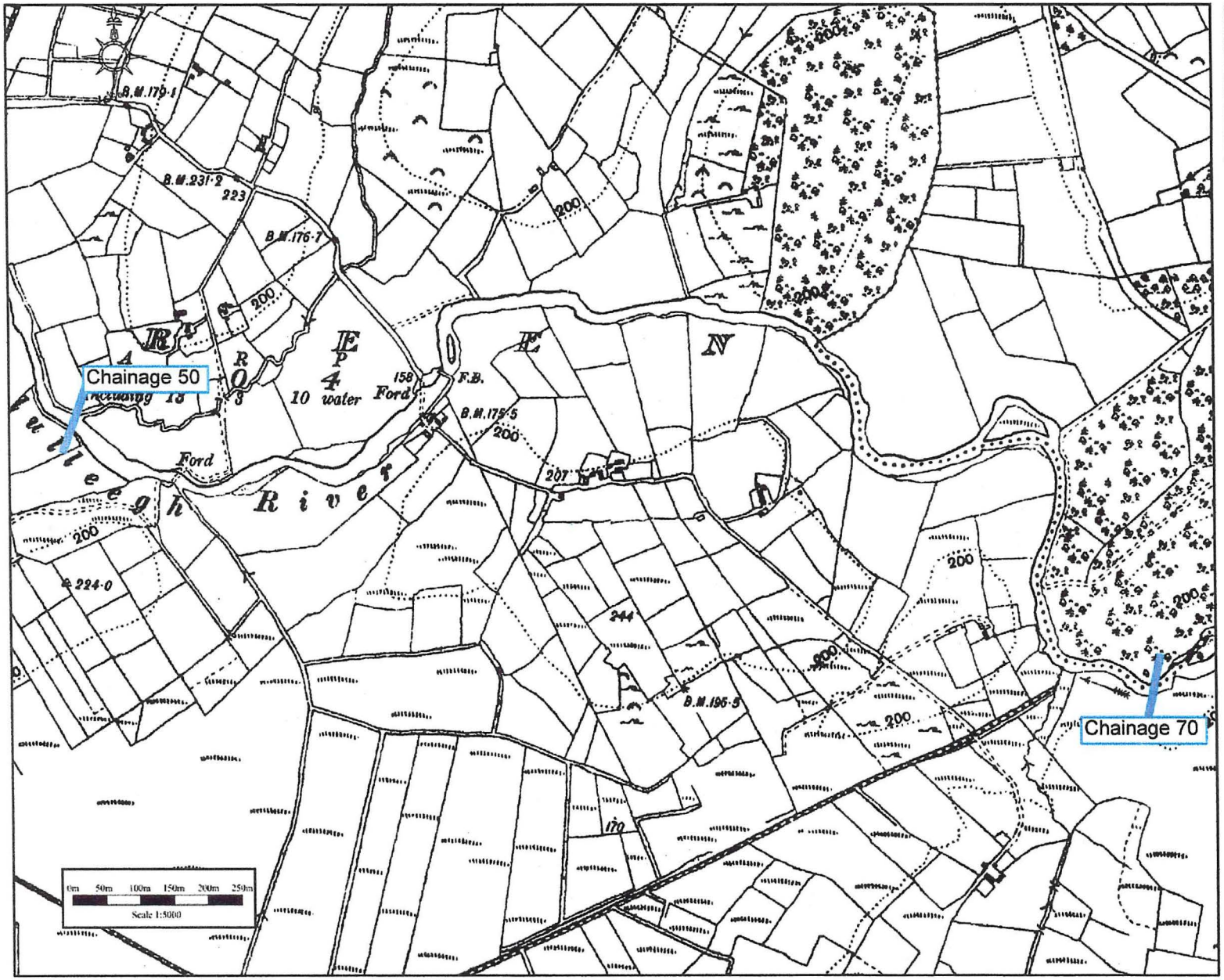


Figure A1.8
Section eight was located immediately downstream of the Chevy Chase cottage stretch and extended from chainage 70 to 50.

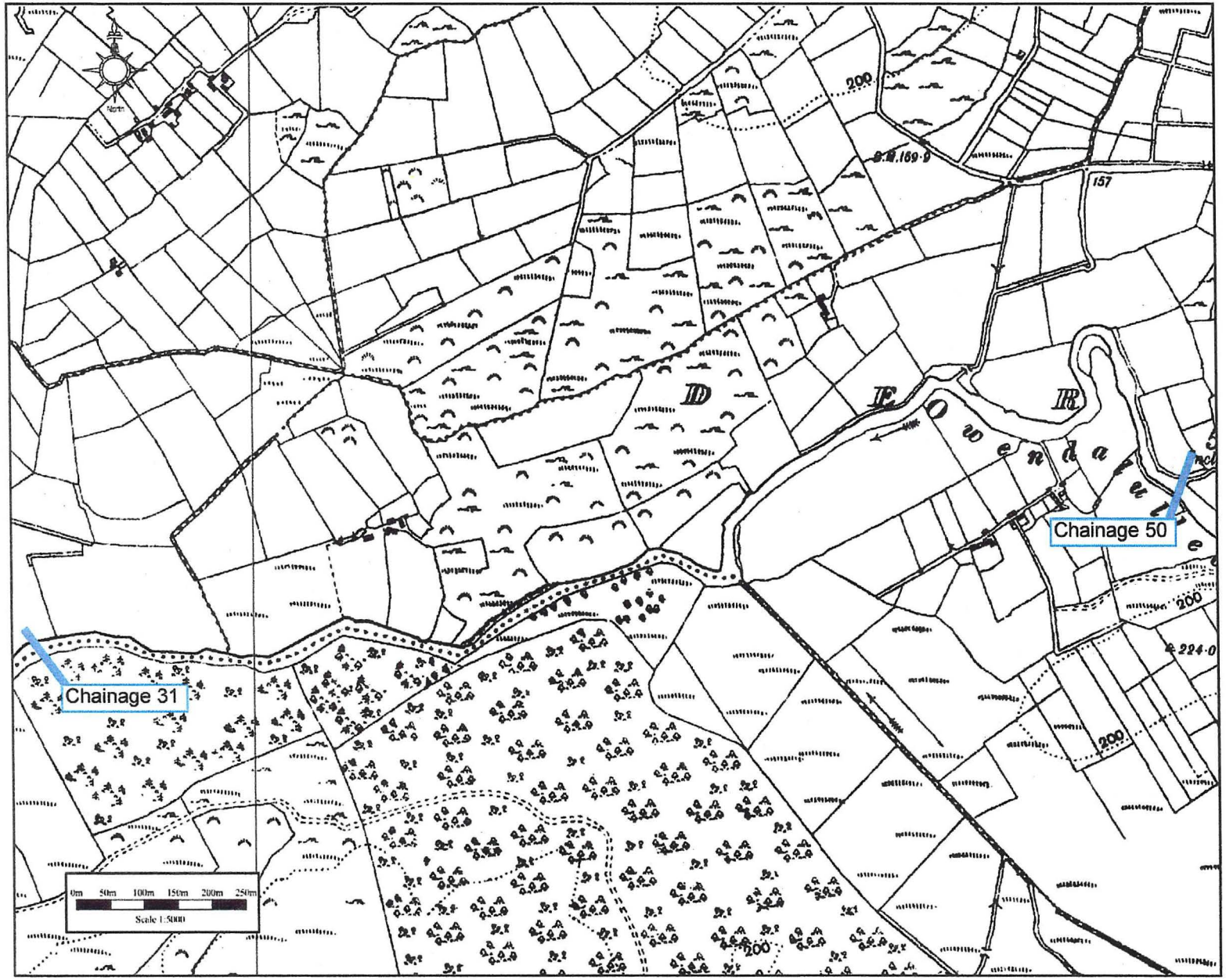


Figure A1.9
This figure shows the extent of survey section nine. This section extended from chainage 50 to chainage 31.

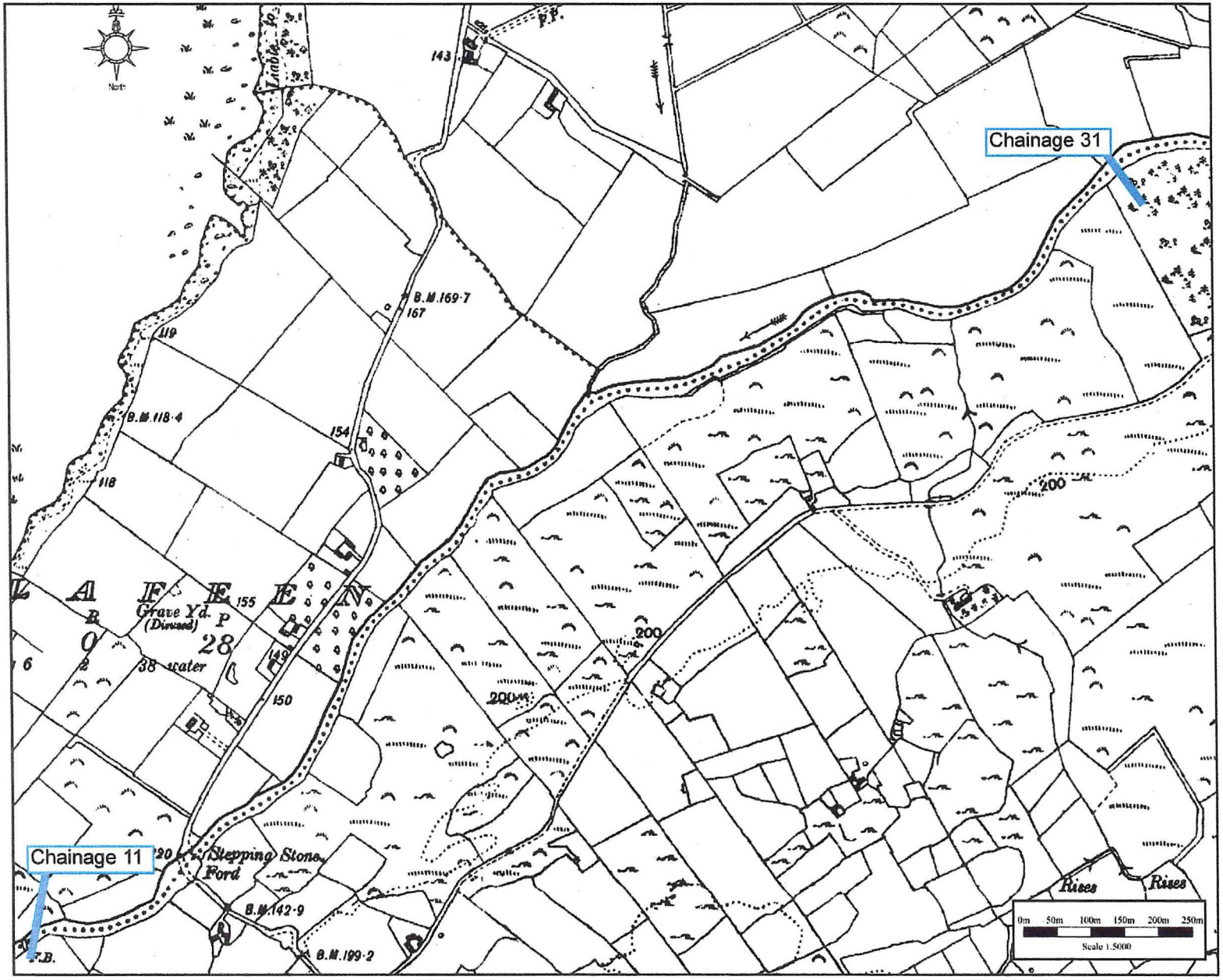


Figure A1.10
Section ten was located in the lower reaches of the river river. Survey section was between chainages 31 and 11.

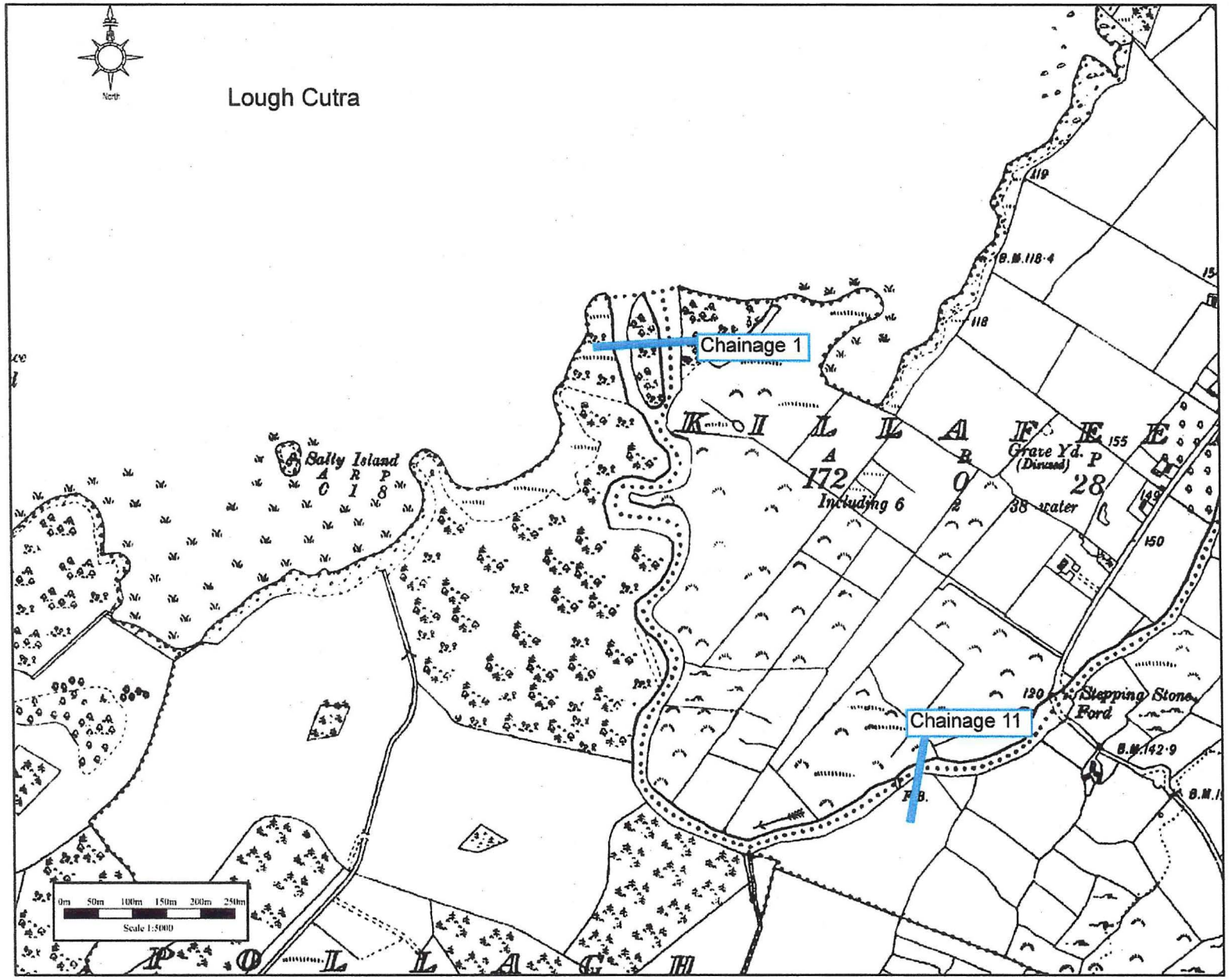


Figure A1.11
This section was the lower-most section of the river and extended from chainage 1 at the mouth of the river to chainage 11.

APPENDIX 2 NPWS SITE SYNOPSES

SITE NAME LOUGH CUTRA

SITE CODE 000299

Lough Cutra is an oligo/mesotrophic freshwater lake lying on limestone. This lake is located 4km south-east of Gort. The lake covers an area of 390 ha and has a catchment consisting of blanket bog and mineral soils.

The main habitats of this site are; aquatic lake vegetation, reedbeds confined to sheltered bays and mixed woodland. Reedbeds of Common Reed (*Phragmites australis*), Common Club-rush (*Scirpus lacustris*) and Great Fen-sedge (*Cladium mariscus*) exist. The flora shows a mixture of calcicole and calcifuge species with the Irish Spurge (*Euphorbia hyberna*) noted in the area. There is no information available on the status of the woodland habitats in this site.

The site is internationally important for its breeding and wintering population of Cormorants (166 pairs in 1985 and max 300 individuals in winter) (Information compiled in 1987). The Cormorants use the off-shore islands for breeding purposes.

The lake is used for fishing and tourism. Precautions should be taken to ensure the lake and its surrounding area is protected from damaging operations such as application of artificial fertilizers, development close to the lakeshore, drainage and felling of woodland areas. The internationally important populations of Cormorants and Lesser Horseshoe Bats should be especially protected.

Lough Cutra is an important site with its diverse habitat types and the presence of both calcicole and calcifuge floras. The site is also of interest as it has internationally important numbers of Cormorants on the Island.

SITE NAME: LOUGH COY

SITE CODE: 002117

Lough Coy is situated approximately 6.5 km north-east of Gort and lies close to the Slieve Aughty hills. The site consists of a small permanent lake in the middle of an almost circular turlough basin. There are drift deposits as well as outcropping rocks and boulders on the relatively steep side walls and small areas of scrub towards the top of the basin. The underlying soils consist of alluvial gleys and a gleyed rendzina-like soil.

A large swallowhole occurs at one side of the basin slightly above summer water level and water enters and leaves the turlough mostly through this. During the winter the fluctuation in levels is extreme and there are no emergent plants such as Common Club-rush (*Scirpus lacustris)* or Common Reed (*Phragmites australis)* in the lake. The turlough experiences a large throughput of water and is dependant on the flows in the tributaries of the Coole River. Lough Coy is an excellent example of a 'riverine' type of turlough, and is in essence the floodplain of an underground river.

Practically the entire site consists of turlough habitat, an EU Habitats Directive Annex I priority habitat. In summer the water area contracts to a degree depending on the prevailing weather and flat mud is exposed which splits into polygonal plates. This is the habitat for a variety of specialised plants such as Mudwort (*Limosella aquatica*), Needle Spike-rush (*Eleocharis acicularis*), Northern Yellow-cress (*Rorippa islandica*) and the liverwort *Riccia cavernosa*. The lakeshore itself has some of these species along with Knotgrass (*Polygonum aviculare*) and Redshank (*Polygonum persicaria*). Above this is a more continuous cover of the sedges *Carex nigra* and *C. hirta*, Reed Canary-grass (*Phalaris arundinacea*), Creeping Cinquefoil (*Potentilla reptans*), Corn Mint (*Mentha arvensis*) and Creeping Buttercup (*Ranunculus repens*). A vegetation characterised by Meadowsweet (*Filipendula ulmaria*), Northern Bedstraw (*Galium boreale*), Common Bird's-foot-trefoil (*Lotus corniculatus*) and Adder's-tongue (*Ophioglossum vulgare*) grows amongst the rocks and includes both Dog Violet (*Viola canina*) and Fen Violet (*V. persicifolia*). The limestone boulders on the upper slopes have a covering of the moss *Cinclidotus fontinaloides*. The fringe of scrub at the edge of the basin is mostly of Blackthorn (*Prunus spinosa*), Buckthorn (*Rhamnus catharticus*) and Ash (*Fraxinus excelsior*), with some Hazel (*Corylus avellana*).

Lough Coy is part of a complex of small sites (along with nearby Blackrock, Ballylee and Bullaunagh turloughs) which supports a nationally important population of Whooper Swans and regionally/locally important numbers of several duck and wader species. Maximum counts at Lough Coy in winter 1995/96 were as follows: Whooper Swan 78, Wigeon 285, Teal 283, Pochard 45, Lapwing 300, Dunlin 120 and Curlew 80. Birds move frequently between the various sites in response to water levels and disturbance. Lough Coy is often one of the few sites in the district which holds water in late summer and autumn and consequently is of importance for post-breeding birds and early autumn arrivals - 132 Mallard were counted in August 1996 and 149 Wigeon in September 1996.

Of particular note is the occurrence of three Red Data Book plant species at this site - these are Mudwort (*Limosella aquatica*), Fen Violet (*Viola persicifolia*) and Northern Yellow-cress (*Rorippa islandica*).

The main landuse within the site is cattle grazing which is quite heavy at the lake margins and on parts of the slopes. There is some removal of gravel from the drift deposits on the north western edge.

Lough Coy is an excellent example of an eutrophic (nutrient-rich) turlough. The extreme water fluctuation supports a distinctive zonation of vegetation and provides many niches for specialist plants. It is an important site for wintering waterfowl.

SITE NAME : COOLE-GARRYLAND COMPLEX

SITE CODE : 000252

The Coole-Garryland Complex is situated in a low-lying karstic limestone area west of Gort, County Galway. It contains a series of seasonal lakes (turloughs), which are fed by springs and a partly submerged river, surrounded by woodland, pasture and limestone heath. The more well-known turloughs present in the site include Lydacan, Crannagh North, Raheen, Crannagh South, Coole, Garryland, Newtown and Hawkhill.

Turloughs are listed as priority habitat on Annex I of the EU Habitats Directive, and the turloughs at Coole-Garryland are particularly good examples of this habitat type. Vegetation

of the turloughs includes Shoreweed (*Littorella uniflora*), Spike-rush (*Eleocharis palustris*), Water-purslane (*Lythrum portula*) and Fen Violet (*Viola persicifolia*). A species of Starwort, *Callitriche palustris*, has recently been recorded from the site, its only known station in Ireland. The Coole river itself is of particular interest for the occurrence of a rare riverine habitat characterised by Trifid Bur-marigold (*Bidens tripartita*), Red Goosefoot (*Chenopodium rubrum*) and species of Knotgrass (*Polygonum* spp.).

The turloughs are fringed by a range of habitats on limestone pavement, including scrub communities containing Buckthorn (*Rhamnus catharticus*) and Hawthorn (*Crataegus monogyna*). In places, heath communities have developed over the limestone pavement, consisting of Ling Heather (*Calluna vulgaris*), Juniper (*Juniperus communis*), Blue Moor-grass (*Sesleria albicans*) and occasional Yew (*Taxus baccata*). In addition, the site contains good examples of smooth pavement and associated species-rich grasslands. Small areas of orchid-rich grassland occur at Coole-Garryland. The colourful array of orchids which can be found here include Pyramidal Orchid (*Anacamptis pyramidalis*), Spotted Orchids (*Dactylorhiza* spp.), Fragrant Orchid (*Gymnadenia conopsea*), Fly Orchid (*Ophrys insectifera*) and Greater Butterfly Orchid (*Platanthera chlorantha*).

A remarkable feature of the turloughs at Coole-Garryland is that they are closely associated with areas of woodland. Although substantial parts of the original deciduous forest have been converted to coniferous woodland composed of non-native species, stands of semi-natural deciduous woodland survive. Pedunculate Oak (*Quercus robur*) and Ash (*Fraxinus excelsior*) are the dominant species on deeper, more fertile soils, where there is also some Hazel (*Corylus avellana*), occasional Yew (*Taxus baccata*) and Elm (*Ulmus* spp.). There are also some unusual areas of dwarf Pedunculate Oak woodland growing on limestone pavement. This species of oak does not typically colonise this type of substrate.

Some of the deciduous woodlands have a mixture of native and non-native species. These mixed woodlands have a diverse shrub layer comprised of Spindle (*Euonymus europaeus*), Privet (*Ligustrum vulgare*), Burnet Rose (*Rosa pimpinellifolia*), Guelder Rose (*Viburnum opulus*), Blackthorn (*Prunus spinosa*), Pear (*Pyrus pyraster*) and Honeysuckle (*Lonicera periclymenum*). The ground flora is rich and includes Wood Anemone (*Anemone nemorosa*), Dog Violet (*Viola riviniana*), Shining Crane's-bill (*Geranium lucidum)*, Maidenhair Spleenwort (*Asplenium trichomanes*), Northern Bedstraw (*Galium boreale*), Biting Stonecrop (*Sedum acre*), Harebell (*Campanula rotundifolia*) and Bitter Vetch (*Lathyrus montanus*). The woodlands are notable for the presence of rare species of Myxomycete fungi, namely, *Licea idris*, *Licea marginata* and *Macbrideola decapillata,* the first-named in one of only three known sites for the species.

The nationally rare Mudwort (*Limosella aquatica*) and Dropwort (*Filipendula vulgaris*) also occur at this site. These two plant species are listed in the Irish Red Data Book.

The complex of habitats at Coole-Garryland provides habitat for a variety of mammal species, including Otter and Pine Marten. The otter is listed on Annex II of the EU Habitats Directive, while Pine Marten is considered to be threatened in Europe. The Coole-Garryland complex is also home to one of the most important and unique assemblages of insects in the country, including several notable species of beetles and flies.

The area is of importance for wintering waterfowl, especially Whooper Swan (mean peak of 324 in 1995/96 - 98/99), Bewick Swan (79 in winter 96/97), Wigeon (mean peak of 1044 in 1995/96 - 98/99), Mallard (mean peak of 330 in 1995/96 - 98/99), Pochard (mean peak of 176 in winter 1995/96 - 98/99), along with smaller numbers of Teal, Tufted Duck, Lapwing, Curlew and Dunlin.

In 1996 seven pairs of Lapwing bred at Newtown Turlough and two pairs of Common Sandpiper bred at Coole Lough.

A substantial portion of this site is in the ownership of the National Parks and Wildlife Service. It is a popular amenity area, and uncontrolled visitor access would pose a threat to sensitive animals. Other threats to the site may result from the intensification of agriculture (e.g. fertiliser application or pollution of water courses) outside the Nature Reserve.

The turlough system at Coole-Garryland is considered to be the most diverse in the country, for both its physiography and vegetation. It is unique in that it is so closely associated with woodland. The juxtaposition of these two distinct habitats, in addition to the presence of a variety of turloughs, has led to the development of uncommon communities, and rare species of insect and plant occur which are associated with both the turlough and the turlough/woodland transition. Overall, the range of good quality habitats at Coole-Garryland supports a high diversity of plant and animal species, rendering this site of prime importance for conservation.

APPENDIX 3 AQUATIC AND RIPARIAN PLANT SPECIES

Appendix 3.1 Plant species recorded

Common name	**Botanical name**
Instream species	
Alternate water milfoil	*Myriopyllum alternifolium*
Aquatic moss	*Fontinalis sp.*
Aquatic moss	*Racomitrium sp.*
Pondweed	*Potamogeton sp*
Emergent aquatic species	
Brooklime	Veronica beccabunga
Bulbous rush	Juncus bulbosus
Floating sweet-grass	Glyceria fluitans
Fool's water-cress	*Apium nodiflorum*
Lesser spearwort	*Ranunculus flammula*
Lesser water-parsnip	*Berula erecta*
Water dropwort	*Oenanthe* sp.
Water starwort	*Callitriche* sp.
Watercress	*Rorippa nasturtium-aquaticum*
Marginal species	
Ash	*Fraxinus excelsior*
Bilberry	*Vaccinium myrtillus*
Blackthorn	*Prunus spinosa*
Bog stitchwort	*Stellaria uliginosa*
Bracken	*Pteridium aquilinum*
Bramble	*Rubus fruticosus*
Common marsh bedstraw	*Galium palustre*
Creeping buttercup	*Ranunculus repens*
Downy birch	*Betula pubescens*
Gorse	*Ulex europaeus*
Great wood-rush	*Luzula sylvatica*
Hawthorn	*Crataegus monogyna*
Hazel	*Corylus avellana*
Horsetail	*Equisetum* sp.
Lady's smock	*Cardamine pratensis*
Liverworts	
Marsh ragwort	*Senecio aquaticus*
Rowan	*Sorbus aucuparia*
Sedges	*Carex* spp.
Sharp-flowered rush	*Juncus acutiflorus*
Sitka spruce	*Picea sitchensis*
Soft rush	*Juncus effusus*
Wild angelica	*Angelica sylvestris*
Willowherbs	*Epilobium* spp.
Willows	*Salix* spp

Appendix 3.2 Aquatic/riparian plant species recorded for the 10km-squares between Flaggy Bridge (Derrybrien) and Lough Cutra, as listed in the 'New Atlas of the British & Irish Flora (Preston, C. D., Pearman, D. A. and Dines, T. D., eds (2002). Oxford University Press, Oxford).

Species of limited distribution in Ireland are marked thus: *
Red data book species are marked thus: #
Flora Protection Order species are marked thus: !

Common name	Scientific name	Record	Status
Hemp agrimony	*Agrimonia eupatoria*	1987-1999	Native
Water plantain	*Alisma plantago-aquatica*	1987-1999	Native
!Orange foxtail	*Alopecurus aequalis*	1987-1999	Native
Marsh foxtail	*Alopecurus geniculatus*	1987-1999	Native
Wild angelica	*Angelica sylvestris*	987-1999	Native
Lesser marshwort	*Apium inundatum*	1987-1999	Native
Fool's water-cress	*Apium nodiflorum*	1987-1999	Native
Lesser water-plantain	*Baldellia ranunculoides*	1987-1999	Native
Lesser water-parsnip	*Berula erecta*	1987-1999	Native
Common water starwort	*Callitriche stagnalis sens. lat.*	1987-1999	Native
Marsh marigold	*Caltha palustris*	1987-1999	Native
Lady's smock	*Cardamine pratensis*	1987-1999	Native
*Slender tufted-sedge	*Carex acuta*	1987-1999	Native
Lesser pond-sedge	*Carex acutiformis*	Pre-1970	Native
*Water sedge	*Carex aquatilis*	1987-1999	Native
Lesser tussock-sedge	*Carex diandra*	Pre-1970	Native
Lesser tussock-sedge	*Carex diandra*	1987-1999	Native
Brown sedge	*Carex disticha*	Pre-1970	Native
Brown sedge	*Carex disticha*	1987-1999	Native
Tufted sedge	*Carex elata*	Pre-1970	Native
Tufted sedge	*Carex elata*	1987-1999	Native
Glaucous sedge	*Carex flacca*	1987-1999	Native
Hairy sedge	*Carex hirta*	1987-1999	Native
Slender sedge	*Carex lasiocarpa*	Pre-1970	Native
Slender sedge	*Carex lasiocarpa*	1987-1999	Native
Bog sedge	*Carex limosa*	1987-1999	Native
Common sedge	*Carex nigra*	1987-1999	Native
False fox-sedge	*Carex otrubae*	1987-1999	Native
Oval sedge	*Carex ovalis*	1987-1999	Native
Bottle sedge	*Carex rostrata*	1987-1999	Native
Bladder-sedge	*Carex vesicaria*	1987-1999	Native
Yellow-sedge subspecies	*Carex viridula subsp. brachyrrhyncha*	1987-1999	Native
Yellow-sedge subspecies	*Carex viridula subsp. viridula*	1987-1999	Native
*Rigid hornwort	*Ceratophyllum demersum*	1987-1999	Native
Great fen-sedge	*Cladium mariscus*	Pre-1970	Native
Great fen-sedge	*Cladium mariscus*	1987-1999	Native
Needle spike-rush	*Eleocharis acicularis*	1987-1999	Native
Many-stalked spike-rush	*Eleocharis multicaulis*	Pre-1970	Native
Many-stalked spike-rush	*Eleocharis multicaulis*	1987-1999	Native
Common spike-rush	*Eleocharis palustris*	Pre-1970	Native
Common spike-rush	*Eleocharis palustris*	1987-1999	Native

Floating club-rush	*Eleogiton fluitans*	1987-1999	Native

Common name	**Scientific name**	**Record**	**Status**
Canadian pondweed	*Elodea canadensis*	1987-1999	Alien
Marsh willowherb	*Epilobium palustre*	1987-1999	Native
Water horsetail	*Equisetum fluviatile*	1987-1999	Native
Marsh horsetail	*Equisetum palustre*	1987-1999	Native
Meadowsweet	*Filipendula ulmaria*	1987-1999	Native
Marsh bedstraw	*Galium palustre*	1987-1999	Native
Water avens	*Geum rivale*	1987-1999	Native
Small sweet-grass	*Glyceria declinata*	Pre-1970	Native
Small sweet-grass	*Glyceria declinata*	1987-1999	Native
Floating sweet-grass	*Glyceria fluitans*	1987-1999	Native
Marestail	*Hippuris vulgaris*	Pre-1970	Native
Marestail	*Hippuris vulgaris*	1987-1999	Native
Marsh pennywort	*Hydrocotyle vulgaris*	1987-1999	Native
Wild iris	*Iris pseudacorus*	1987-1999	Native
Slender club-rush	*Isolepis cernua*	1987-1999	Native
Sharp-flowered rush	*Juncus acutiflorus*	1987-1999	Native
Jointed rush	*Juncus articulatus*	1987-1999	Native
Bulbous rush	*Juncus bulbosus*	1987-1999	Native
Soft rush	*Juncus effusus*	1987-1999	Native
Hard rush	*Juncus inflexus*	1987-1999	Native
Duckweed	*Lemna minor*	1987-1999	Native
Ivy-leaved duckweed	*Lemna trisulca*	1987-1999	Native
#!Mudwort	*Limosella aquatica*	1987-1999	Native
Shoreweed	*Littorella uniflora*	1987-1999	Native
Yellow loosestrife	*Lysimachia vulgaris*	1987-1999	Native
Water purslane	*Lythrum portula*	1987-1999	Native
Purple loosestrife	*Lythrum salicaria*	1987-1999	Native
Water mint	*Mentha aquatica*	1987-1999	Native
Hybrid water mint	*Mentha aquatica x M. arvensis*	1987-1999	Native
Bog bean	*Menyanthes trifoliata*	1987-1999	Native
Blinks	*Montia fontana*	1987-1999	Native
Water forget-me-not	*Myosotis scorpioides*	1987-1999	Native
Alternate water-milfoil	*Myriophyllum alterniflorum*	1987-1999	Native
Yellow water-lily	*Nuphar lutea*	1987-1999	Native
White water-lily	*Nymphaea alba*	1970-1986	Native
White water-lily	*Nymphaea alba*	1987-1999	Native
Fine-leaved water-dropwort	*Oenanthe aquatica*	1987-1999	Native
Hemlock water-dropwort	*Oenanthe crocata*	1970-1986	Native
Hemnlock water-dropwort	*Oenanthe crocata*	1987-1999	Native
Water-pepper	*Persicaria hydropiper*	1987-1999	Native
Reed canary-grass	*Phalaris arundinacea*	1987-1999	Native
Common reed	*Phragmites australis*	1987-1999	Native
Small pondweed	*Potamogeton berchtoldii*	1987-1999	Native
Fen pondweed	*Potamogeton coloratus*	1987-1999	Native
Curled pondweed	*Potamogeton crispus*	1987-1999	Native
Various-leaved pondweed	*Potamogeton gramineus*	1987-1999	Native
Shining pondweed	*Potamogeton lucens*	1987-1999	Native
Broad-leaved pondweed	*Potamogeton natans*	1987-1999	Native
Fennel pondweed	*Potamogeton pectinatus*	1987-1999	Native

Perfoliate pondweed	*Potamogeton perfoliatus*	1987-1999	Native
Bog pondweed	*Potamogeton polygonifolius*	1987-1999	Native
Common name	**Scientific name**	**Record**	**Status**
*Lesser pondweed	*Potamogeton pusillus*	1987-1999	Native
Common water-crowfoot	*Ranunculus aquatilis*	Pre-1970	Native
Lesser celandine	*Ranunculus ficaria*	Pre-1970	Native
Lesser celandine	*Ranunculus ficaria*	1987-1999	Native
L. celandine subspecies	*Ranunculus ficaria subsp. bulbilifera*	1987-1999	Native
L. celandine subspecies	*Ranunculus ficaria subsp. ficaria*	1987-1999	Native
Lesser spearwort	*Ranunculus flammula*	1987-1999	Native
Ivy-leaved crowfoot	*Ranunculus hederaceus*	1987-1999	Native
Pond water-crowfoot	*Ranunculus peltatus*	1987-1999	Native
Celery-leaved buttercup	*Ranunculus sceleratus*	1987-1999	Native
Thread-leaved water-crowfoot	*Ranunculus trichophyllus*	1987-1999	Native
Great yellow-cress	*Rorippa amphibia*	1987-1999	Native
#Northern yellow-cress	*Rorippa islandica*	1987-1999	Native
Water-cress	*Rorippa nasturtium-aquaticum*	1987-1999	Native
Water-cress	*Rorippa nasturtium-aquaticum* agg.	1987-1999	Native
*Marsh yellow-cress	*Rorippa palustris*	1987-1999	Native
Eared willow	*Salix aurita*	1987-1999	Native
Goat willow	*Salix caprea*	1987-1999	Native
Olive willow	*Salix caprea x S. viminalis*	1987-1999	Native
Grey willow	*Salix cinerea*	1987-1999	Native
Sally	*Salix cinerea subsp. oleifolia*	1987-1999	Native
Crack willow	*Salix fragilis*	1987-1999	Alien
Creeping willow	*Salix repens*	1987-1999	Native
Osier willow	*Salix viminalis*	Pre-1970	Alien
Brookweed	*Samolus valerandi*	1987-1999	Native
Common club-rush	*Schoenoplectus lacustris*	1987-1999	Native
Water figwort	*Scrophularia auriculata*	1987-1999	Native
Common figwort	*Scrophularia nodosa*	1987-1999	Native
Lesser clubmoss	*Selaginella selaginoides*	1987-1999	Native
Marsh ragwort	*Senecio aquaticus*	1987-1999	Native
#Blue-eyed grass	*Sisyrinchium bermudiana*	Pre-1970	Native
Unbranched bur-reed	*Sparganium emersum*	1987-1999	Native
Branched bur-reed	*Sparganium erectum*	1987-1999	Native
Least bur-reed	*Sparganium natans*	Pre-1970	Native
Bog stitchwort	*Stellaria uliginosa*	1987-1999	Native
Comfrey	*Symphytum officinale*	1987-1999	Native
Meadow-rue	*Thalictrum flavum*	1987-1999	Native
Bulrush	*Typha latifolia*	1987-1999	Native
Intermediate bladderwort	*Utricularia intermedia sens. lat.*	Pre-1970	Native
Lesser bladderwort	*Utricularia minor*	Pre-1970	Native
Lesser bladderwort	*Utricularia minor*	1987-1999	Native
*Greater bladderwort	*Utricularia vulgaris sens. lat.*	Pre-1970	Native
Wild valerian	*Valeriana officinalis*	1987-1999	Native
Blue water-speedwell	*Veronica anagallis-aquatica*	1987-1999	Native
Brooklime	*Veronica beccabunga*	1987-1999	Native
Pink water-speedwell	*Veronica catenata*	1987-1999	Native
Viburnum	*Viburnum opulus*	1987-1999	Native
Marsh violet	*Viola palustris*	1987-1999	Native
#Fen violet	*Viola persicifolia*	1987-1999	Native

APPENDIX 4: SITE PHOTOS

Plate 1 Chainage 196 showing level to which peat slip material reached on this section of river. Bedrock is visible as a result of scouring by transported peat.

Plate 2 Chainage 198 showing silt deposition and level of peat on the banks.

Plate 3 Chainage 199. It is recommended that this blockage be removed. The left bank should be planted in high density formation with shrubs or trees that are ecologically similar to the surrounding flora.

Plate 4 Chainage 198-199 the gauge of the pipes here should be increased to assist flow through.

Plate 5 Chainage 199 – just south of Flaggy Bridge (chainage 200) showing peat deposition on the banks.

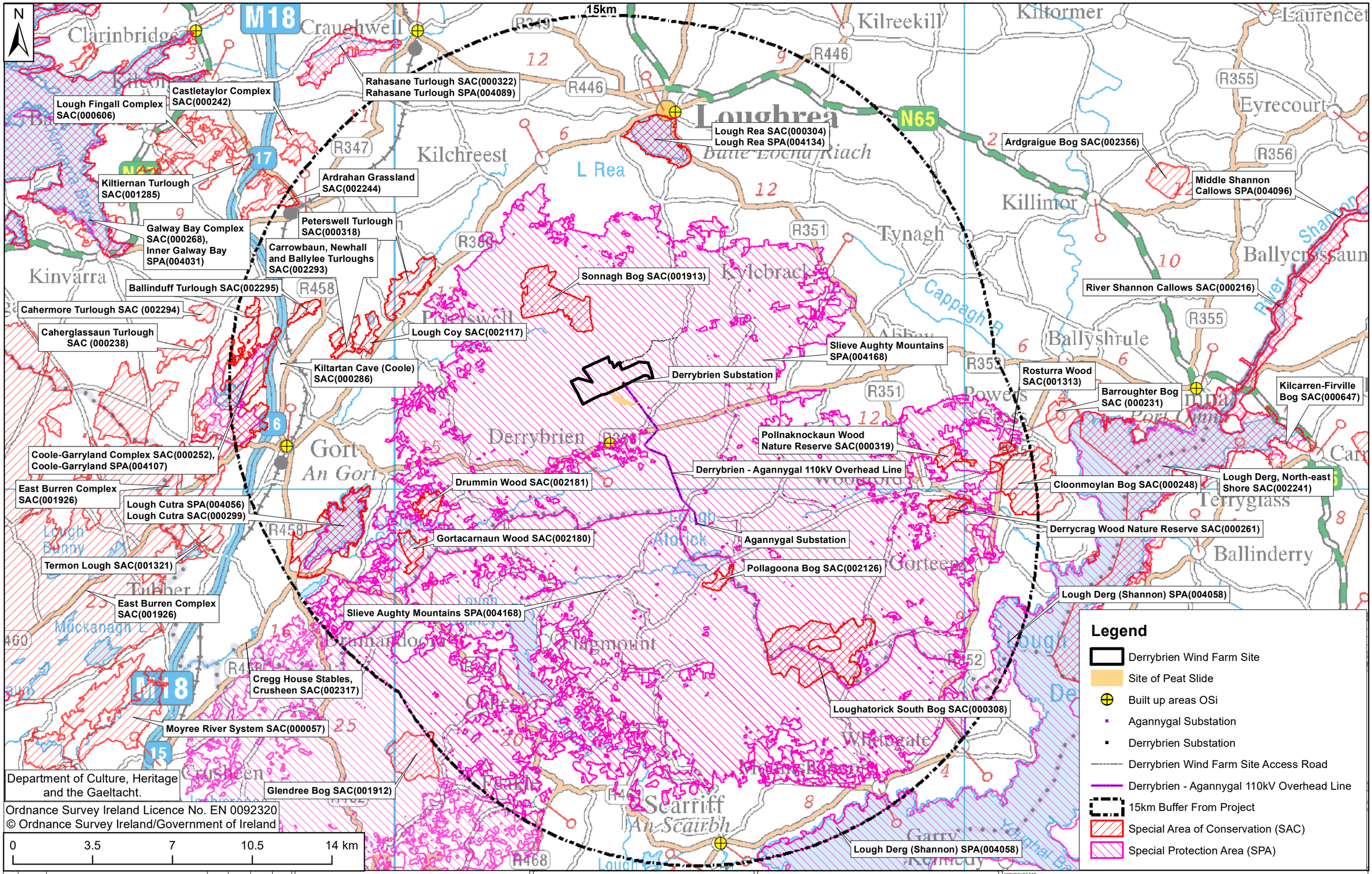
Plate 6 Scene of river from bridge (M 547 990) showing negligible impacts. This is the scenario for most of the lower sections of the river.

Plate 7 River showing some small light detritus on the banks

Plate 8 sand/silt washed down from the mountains. This photo was taken in the lower reaches of the river.

Plate 9 Section of river at confluence (chainage 182) exhibiting very little physical change. Gravels are still in situ here. River has widened considerably and accordingly the power of the slip has dissipated.

Plate 10 Fish were seen moving upstream in this section (Chainage 184)



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DRAWING TITLE: **Figure 1- European Sites within 15km radius of Project**

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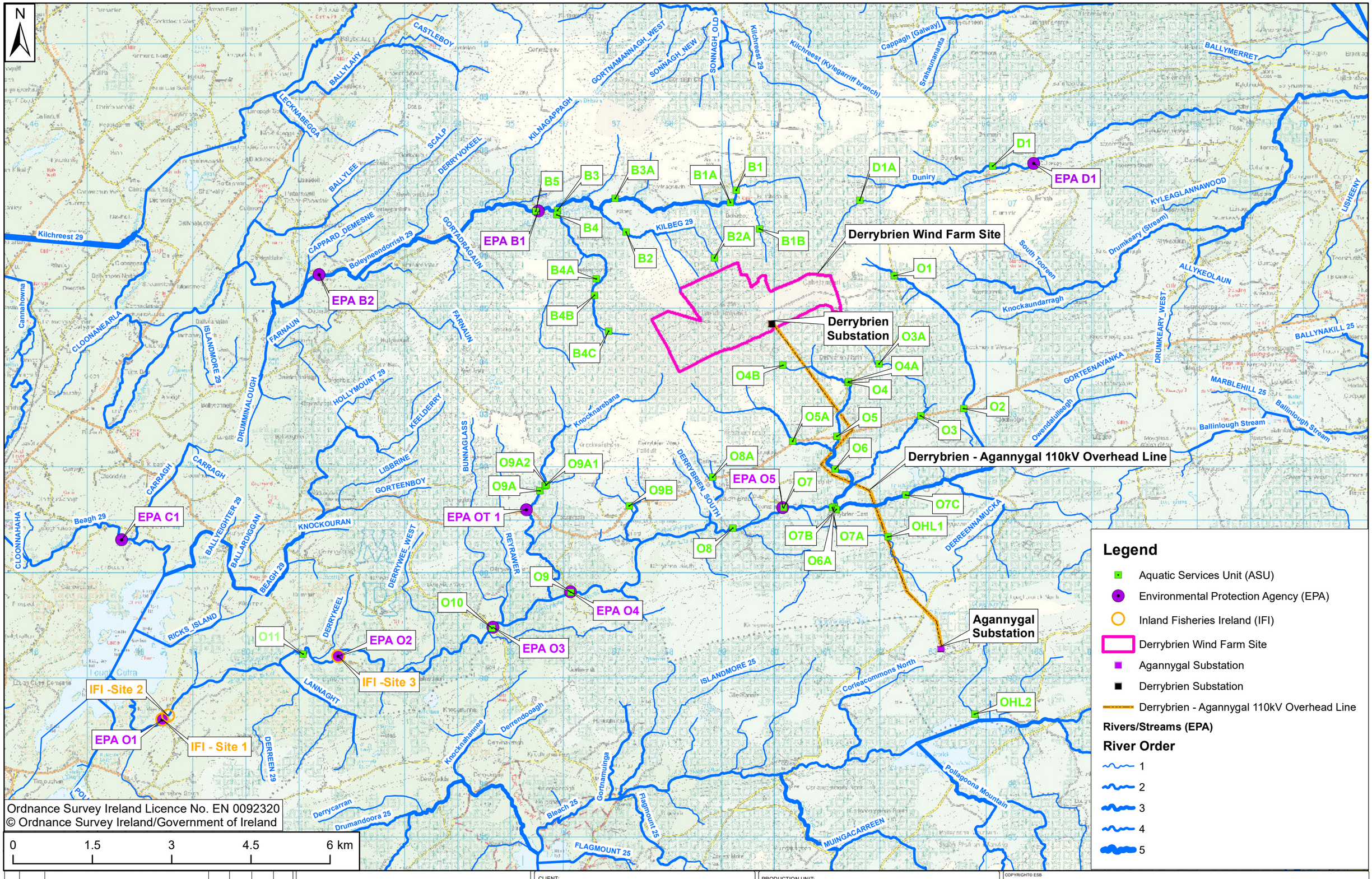

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DRAWING TITLE: Figure 2 - Locations of ASU,EPA & IFI Sampling Points

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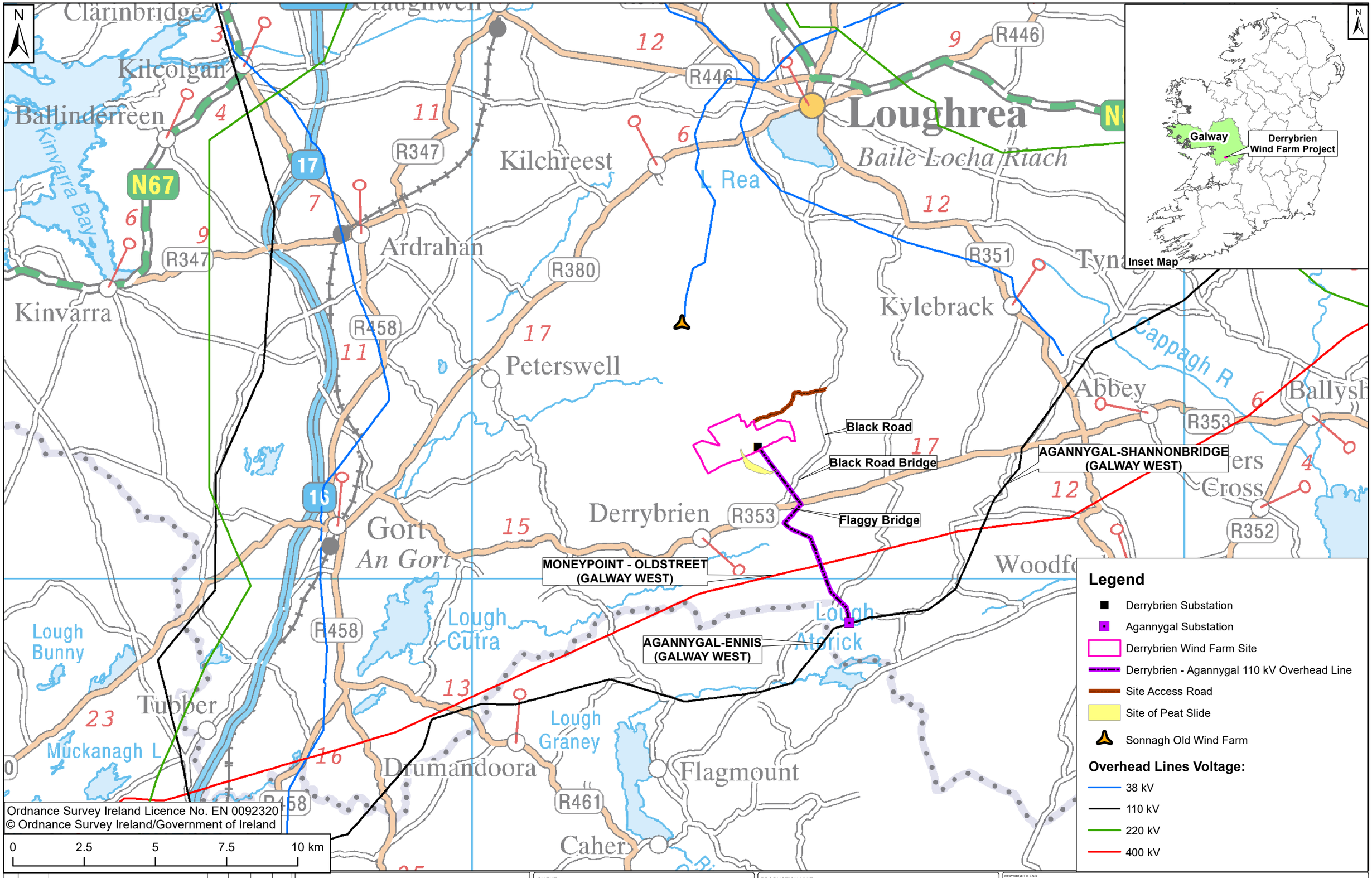

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0	29/07/20	Issued for substitute consent	E.O'S	E.O'S	P.K	J.McL

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DRAWING TITLE: **Figure 3 - Project Location**

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DRAWING NUMBER: QS-000280-01-D460-017-003-000

N

KILBEG
TOORMACNEVIN
BOHABOY
FUNSHADAUN
COPPANAGH
DRUMMIN
BOLEYBEG
CULLENAGH
DRUMKEARY WEST
ALLYKEOLAUN
KNOCKAUNDARRAGH
BOLEYNEENDORRISH
REYNABRONE
DRUM
KYLENAGAPPA
KNOCKMOYLE WEST
KNOCKMOYLE EAST
DERRYBRIEN NORTH
KNOCKOURA
KNOCKDRUMMORE
BALLYCORBAN
MARBLEHILL
GORTEENAYANKA
LOUGHPARK
GORTNAKILLA
ROSSEESHAL
SILVERSTREAM
CAPPAGHCON WEST
KEELDERRY
R353
CLOGHVOLEY
BALLINLOUGH
TULLA
ACRES
SLATEFIELD
DERRYBRIEN WEST
Derrybrien
LAGGOO
REYRAWER
MOYGLASS
COMMONS WEST
BUNNAGLASS
DERREENNAMUCKA
DERRYBRIEN EAST
DERRYBRIEN SOUTH
DERRYWEE EAST
LOUGHATORICK NORTH
INCHAMORE
DERRYWEE WEST
TOORLEITRA
SCALP
LOUGHATORICK SOUTH
GORTAVEHA
SLIEVEANORE
LOUGHATORICK SOUTH
POLLAGOONA MOUNTAIN

Inset Map
Galway
Derrybrien Wind Farm Project

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0 1 2 3 4 km

Legend

Townland Boundaries
Overhead lines

Location of Wind Farm and Ancillary Works

Derrybrien Wind Farm Site
Derrybrien Wind Farm Site Entrance
Derrybrien Substation
Construction Compound (Hardstands)
Upgrade works to section of Black Road
Coillte track (turbary road) upgraded

Location of Grid Connection and Ancillary Works

Derrybrien - Agannygal 110kV Overhead Line
Agannygal Substation
Upgrade works to Access Road to Agannygal Substation
Connection works to Ennis-Shannonbridge 110kV OHL span

Location of works associated with peat slide

Site of Peat Slide
Barrages
Pre-existing Coillte Track
New Access Track Constructed
Borrow Pit / Quarry Adjacent to Barrage 1
Bridge Repairs (Private)
Bridge Repairs (Public)
Stepping Stones
Crooked Bridge

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Figure 4 - Project Works and Townlands

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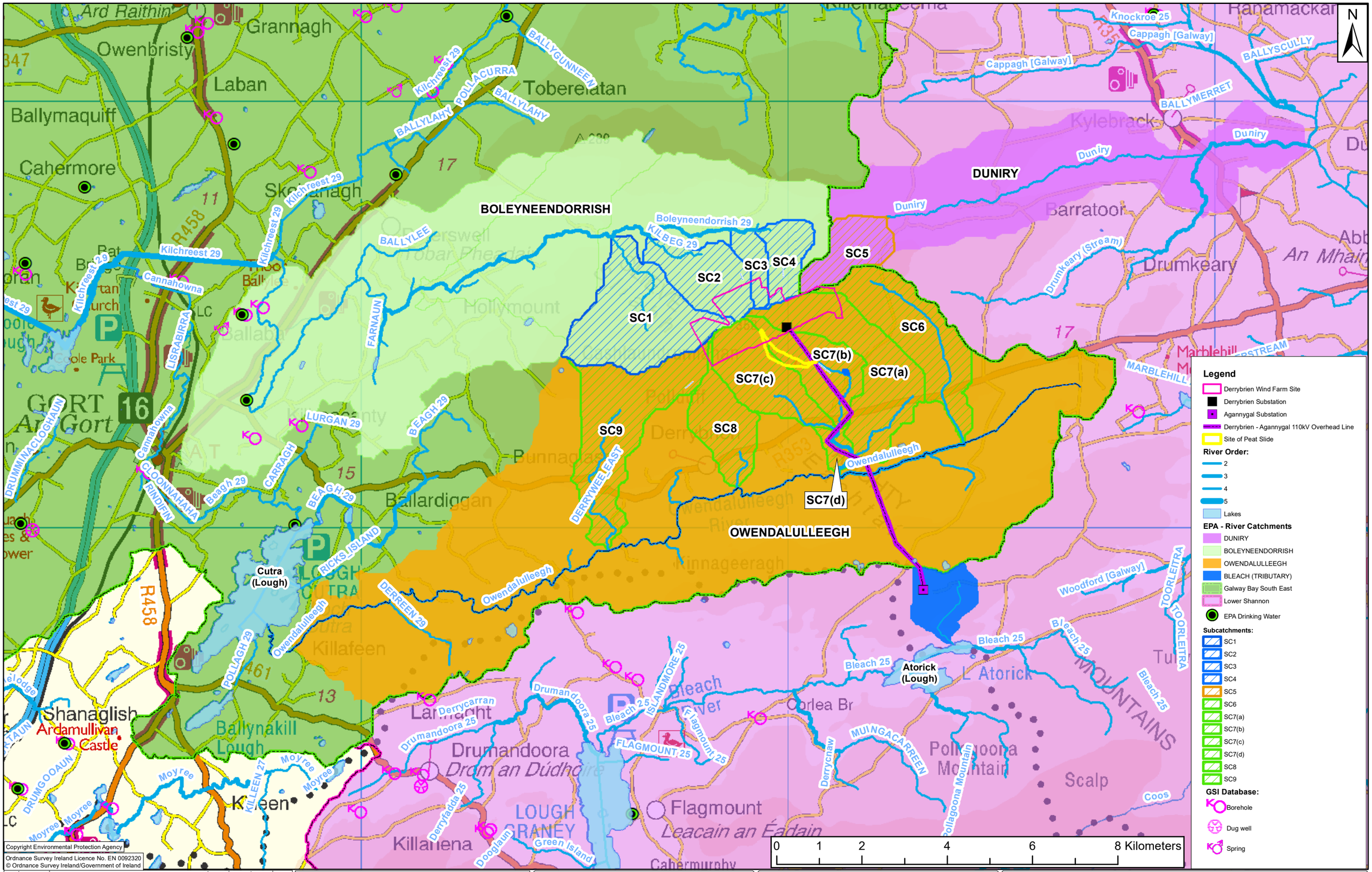

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Figure 5 - Hydrological and Hydrogeological Context

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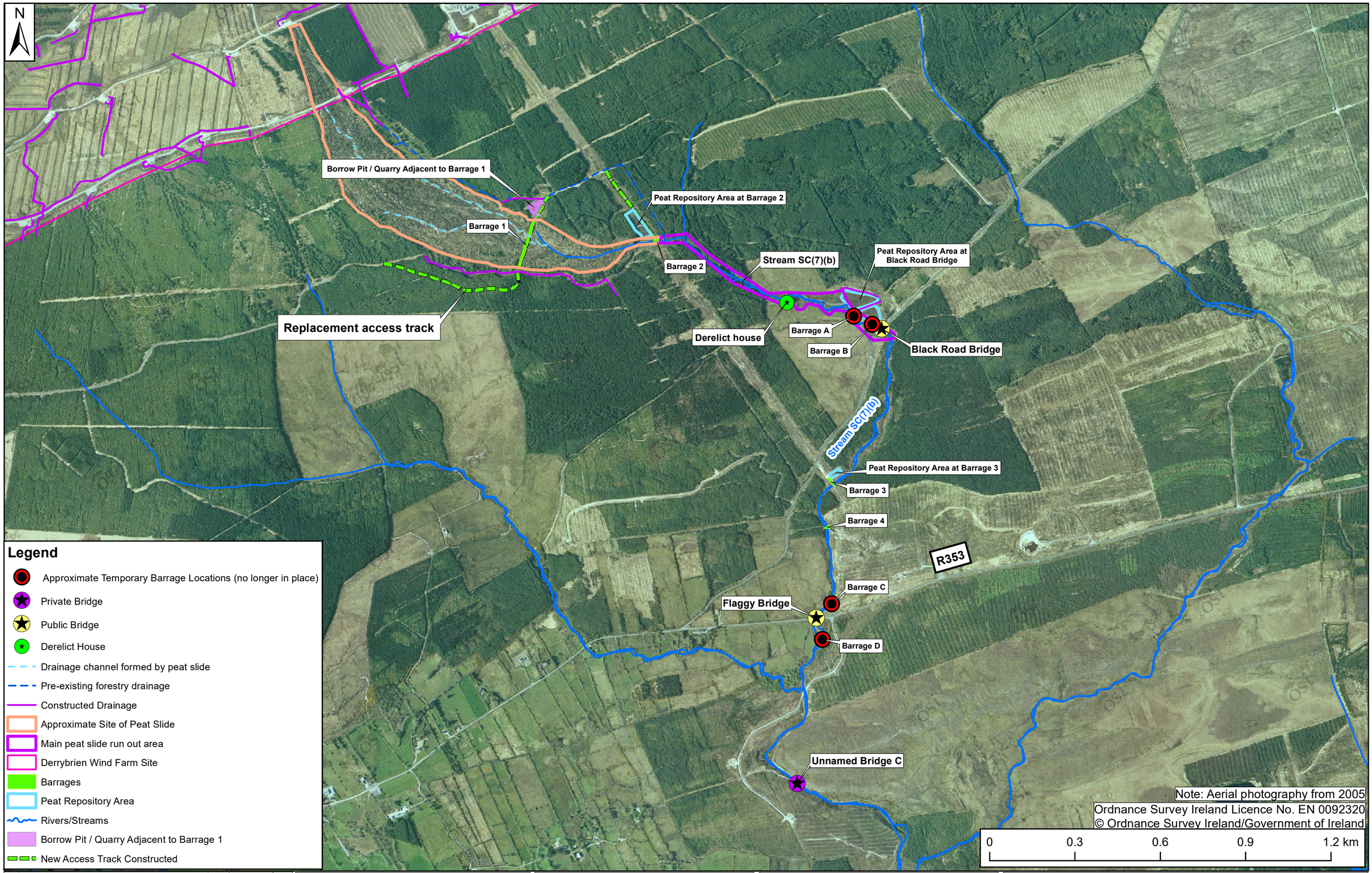

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Figure 6 - Location of and Approximate Extent of Peat Slide and Main Peat Slide Run Out Area

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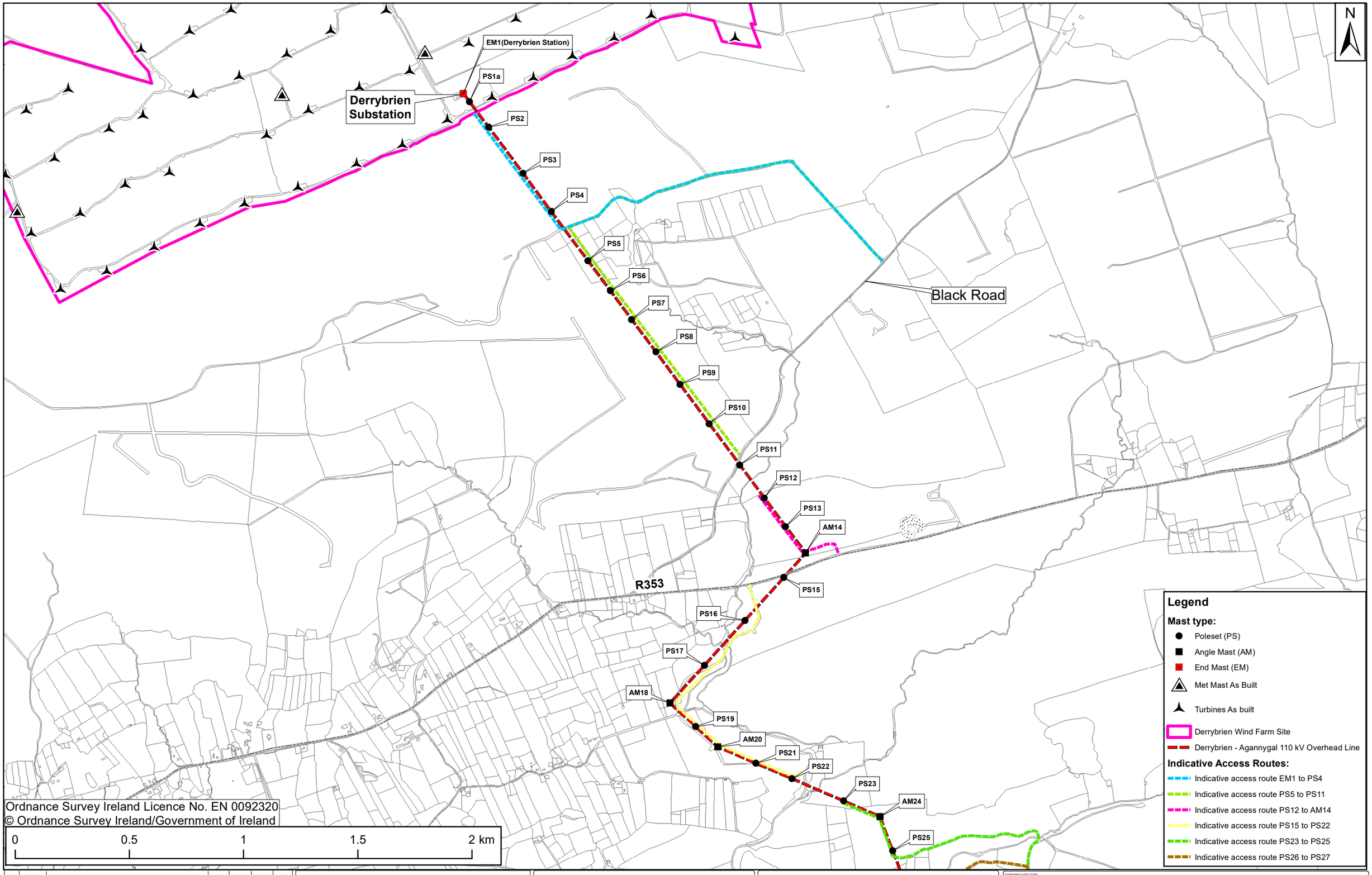

REV	DATE	REVISION DESCRIPTION	DRN	PROD	VER	APP
0	06/08/20	Issued for substitute consent	E.O'S	E.O'S	P.K	J.McL

PURPOSE OF ISSUE - PRELIMINARY UNLESS INDICATED

CLIENT APPROVAL ☐ PLANNING ☒ TENDER ☐ CONSTRUCTION ☐ AS-BUILT ☐

Energy for generations

Engineering and Major Projects,
One Dublin Airport Central,
Dublin Airport, Cloghran,
Co. Dublin, K67 XF72, Ireland.

Tel: 353 1 703 8000 **Web:** www.esb.ie

Engineering and Major Projects is a division of ESB.

CLIENT: **Gort Windfarms Ltd**

PROJECT: **Derrybrien Wind Farm Project**

CONTRACT

PRODUCTION UNIT: **Civil & Environmental Engineering**

DRAWING TITLE:

Figure 7.1 - Derrybrien - Agannygal OHL - Indicative Decommissioning Access Routes (Sheet 1 of 2)

DRAWN	PRODUCED	VERIFIED	APPROVED	APPROVAL DATE
E.O'Shea	E.O'Shea	P.Kavanagh	J.McLoughlin	06/08/2020

CLIENT REF.	NO. OF SHEETS	SIZE	SCALE
00-00	1/2	A3	1:15,000

DRAWING NUMBER: **QS-000280-01-D460-017-007-000**

N

PS22
PS23
AM24
PS25
PS26
PS27
PS28
PS28a
PS29
INT30
PS31
PS32
PS33
AM34
PS35
PS36
PS37
AM38
PS39
PS40
EM41
Agannygal Substation
EM1 (Agannygal - Shannonbridge OHL)
EM1 (Agannygal - Ennis OHL)

Legend

Mast type:

- Poleset (PS)
- Intermediate Mast (INT)
- Angle Mast (AM)
- End Mast (EM)
- Derrybrien - Agannygal 110 kV Overhead Line

Indicative Access Routes:

- Indicative access route PS15 to PS22
- Indicative access route PS23 to PS25
- Indicative access route PS26 to PS27
- Indicative access route PS28 to PS31
- Indicative access route PS32 to AM34
- Indicative access route PS35 to PS37
- Indicative access route AM38 to EM41
- 110 kV Overhead Line
- 400 kV Overhead Line
- Agannygal Substation

0 0.25 0.5 1 1.5 2 Kilometers

REV	DATE	REVISION DESCRIPTION	DRN	PROD	VER	APP
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PURPOSE OF ISSUE - PRELIMINARY UNLESS INDICATED

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PROJECT: Derrybrien Wind Farm Project

CONTRACT

PRODUCTION UNIT: Civil & Environmental Engineering

DRAWING TITLE:
Figure 7.2 - Derrybrien - Agannygal OHL - Indicative Decommissioning Access Routes (Sheet 2 of 2)

DRAWN	PRODUCED	VERIFIED	APPROVED	APPROVAL DATE
E.O'Shea	E.O'Shea	P.Kavanagh	J.McLoughlin	06/08/2020

CLIENT REF.	NO. OF SHEETS	SIZE	SCALE
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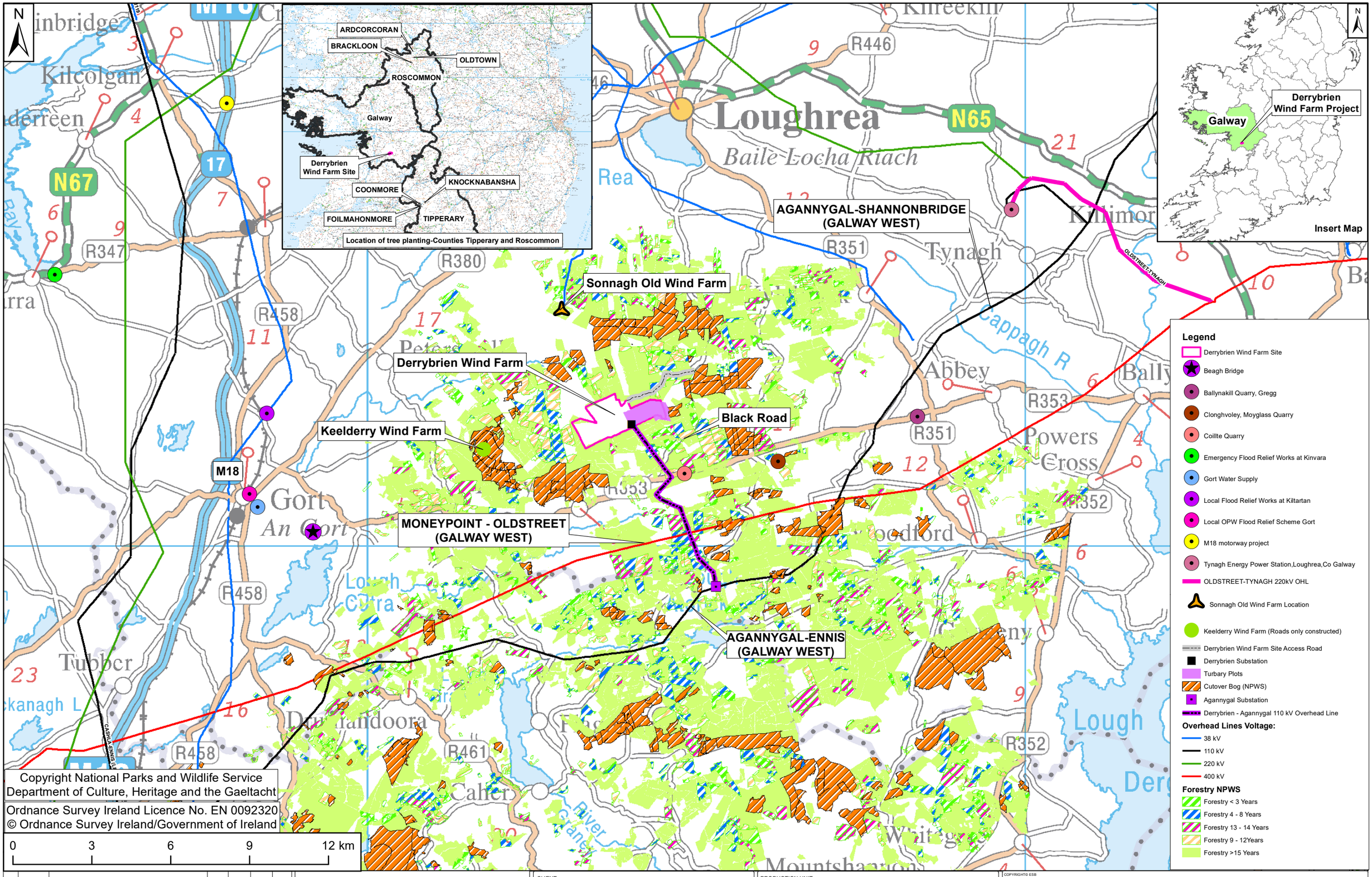
DRAWING NUMBER: QS-000280-01-D460-017-008-000



REV	DATE	REVISION DESCRIPTION	DRN	PROD	VER	APP
0	29/07/20	Issued for substitute consent	E.O'S	E.O'S	P.K	JmL

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PROJECT: Derrybrien Wind Farm Project

CONTRACT

PRODUCTION UNIT: Civil & Environmental Engineering

DRAWING TITLE:

Figure 8 - Location of Projects/Activities considered for cumulative impact assessments

DRAWN	PRODUCED	VERIFIED	APPROVED	APPROVAL DATE
E.O'Shea	E.O'Shea	P.Kavanagh	J.McLoughlin	06/08/2020

CLIENT REF.	NO. OF SHEETS	SIZE	SCALE
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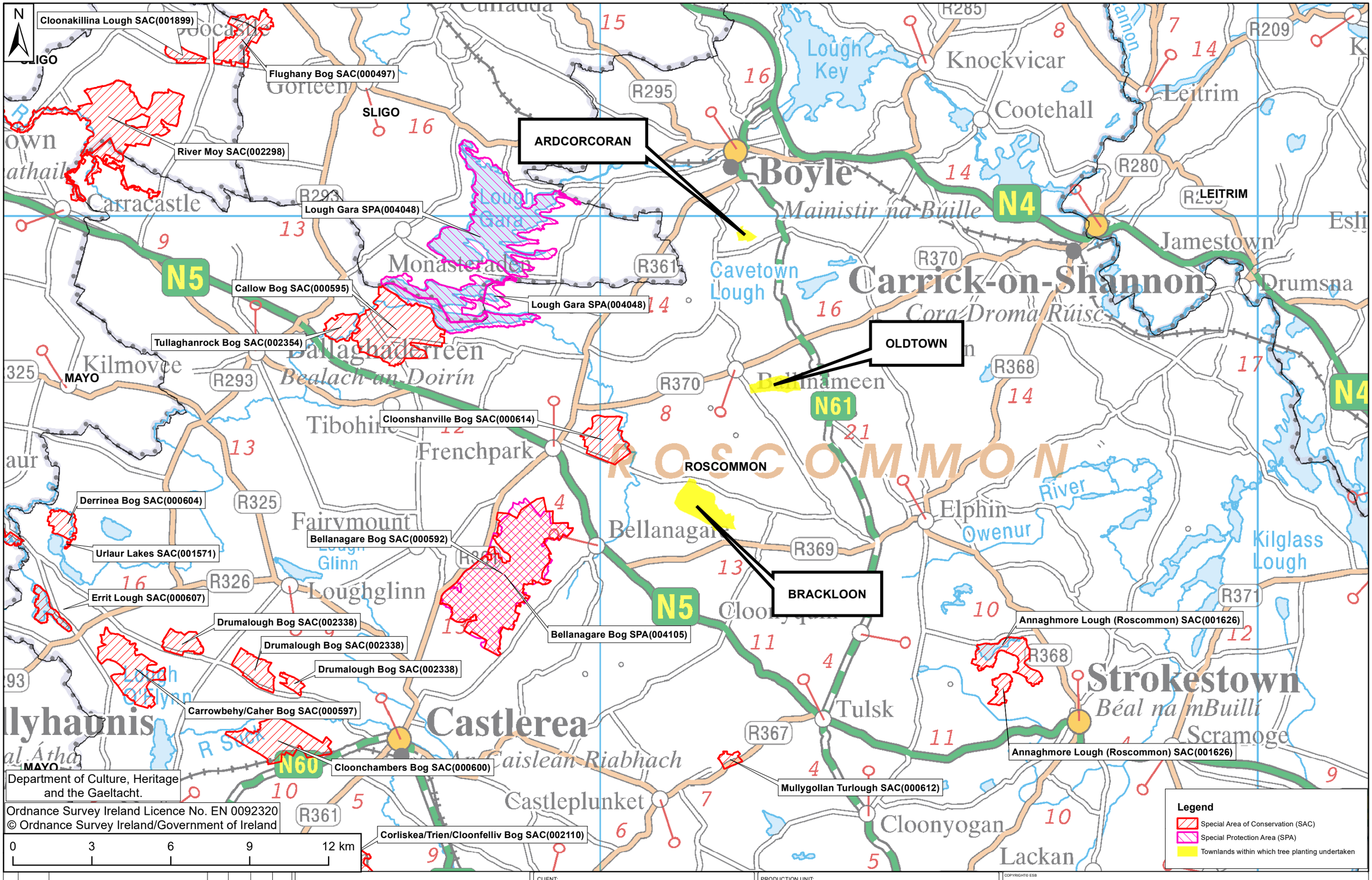
DRAWING NUMBER: QS-000280-01-D460-017-009-000



Department of Culture, Heritage and the Gaeltacht.

Legend

- Special Area of Conservation (SAC)
- Special Protection Area (SPA)
- Townlands within which tree planting undertaken

REV	DATE	REVISION DESCRIPTION	DRN	PROD	VER	APP
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PROJECT: Derrybrien Wind Farm Project

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PRODUCTION UNIT: Civil & Environmental Engineering

DRAWING TITLE: **Figure 9 - Location of tree planting in lieu of forestry felled for Project - County Roscommon**

DRAWN	PRODUCED	VERIFIED	APPROVED	APPROVAL DATE
E.O'Shea	E.O'Shea	P.Kavanagh	C.Hamilton	06/08/2020

CLIENT REF.	NO. OF SHEETS	SIZE	SCALE
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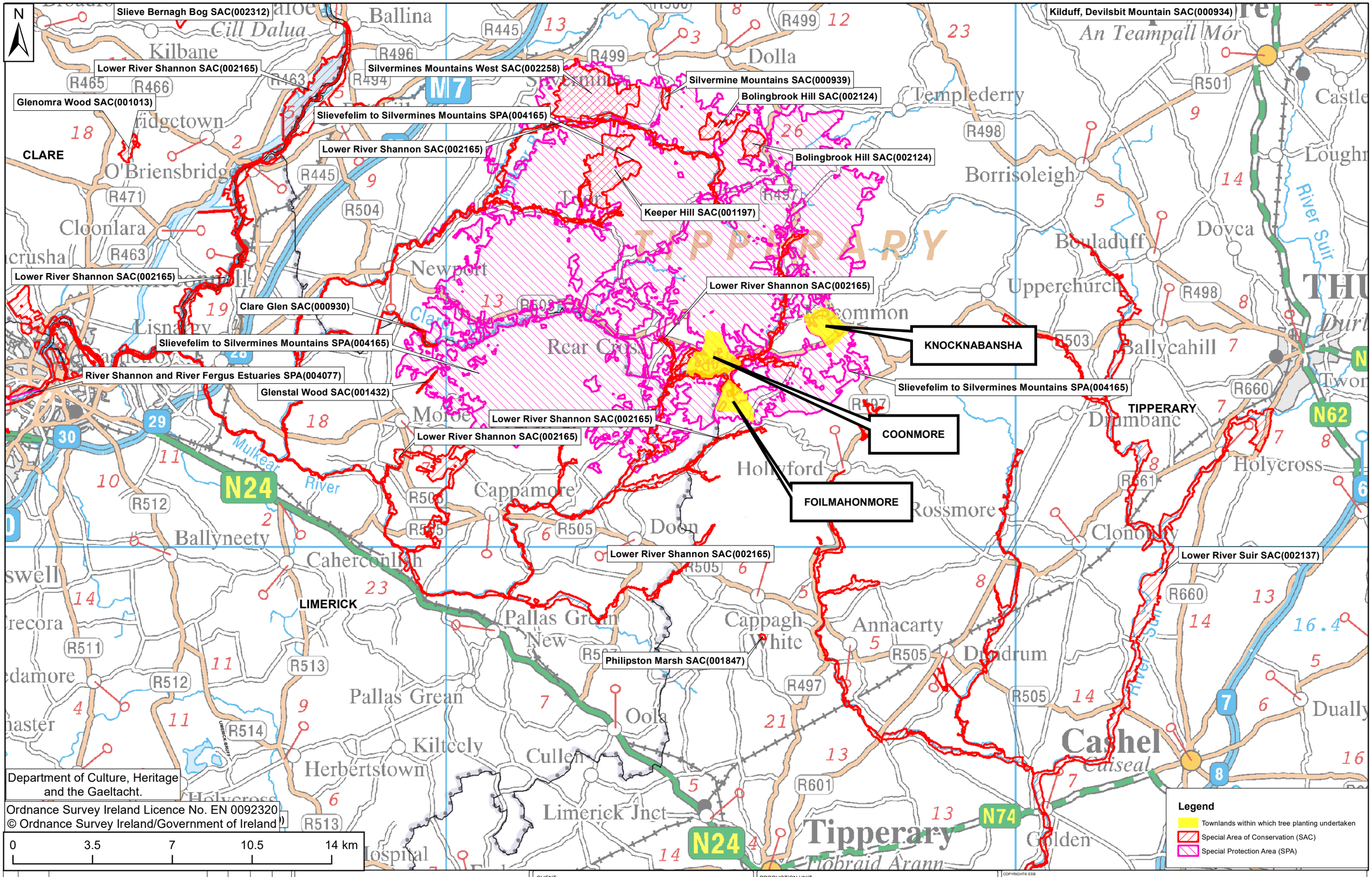
DRAWING NUMBER: QS-000280-01-D460-017-010-000



Department of Culture, Heritage and the Gaeltacht.

0 3.5 7 10.5 14 km

Legend

- Townlands within which tree planting undertaken
- Special Area of Conservation (SAC)
- Special Protection Area (SPA)

REV	DATE	REVISION DESCRIPTION	E.O'S DRN	E.O'S PROD	P.K VER	C.H APP
0	29/07/20	Issued for substitute consent				

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Tel: 353 1 703 8000 Web: www.esb.ie
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CLIENT: Gort Windfarms Ltd

PROJECT: Derrybrien Wind Farm Project

CONTRACT

PRODUCTION UNIT: Civil & Environmental Engineering

DRAWING TITLE: **Figure 10 - Location of tree planting in lieu of forestry felled for Project - County Tipperary**

DRAWN	PRODUCED	VERIFIED	APPROVED	APPROVAL DATE
E.O'Shea	E.O'Shea	P.Kavanagh	C.Hamilton	06/08/2020

CLIENT REF.	NO. OF SHEETS	SIZE	SCALE
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DRAWING NUMBER: **QS-000280-01-D460-017-011-000**