REFERENCE DOCUMENTS for PROPOSED LARGER TURBINES AND MET MASTS AT UPPERCHURCH WINDFARM for EIAR 2021 and AA 2021

REFERENCE DOCUMENT 3 of 36

This document contains the following:

Upperchurch Windfarm (LA ref. 13/510003, ABP ref. PL 22.243040)

- **2013 Upperchurch Windfarm Response to Request for Further Information from Tipperary County Council (incl. Revised Natura Impact Statement)**
    - Cover Letter
    - Upperchurch Wind Farm Cumulative Impact Assessment
    - Revised Natura Impact Statement
    - Upperchurch Wind Farm Bat Survey
    - Upperchurch Windfarm Badger Sett Survey
    - Upperchurch Wind Farm Revised Noise & Vibration Impact Assessment
    - Upperchurch Wind Farm Ecological Management Plan
    - Preliminary Environmental Management Plan
    - Environmental Management Plan (Early Operational Phase)
    - Surface Water Management Plan
    - Reinstatement Programme - Decommissioning of Upperchurch Wind Farm
    - Revised Landscape and Visual Assessment
    - Answer to Q10 – Location of T22
    - Answer to Q11 – Health and Safety aspects of the turbine installation.

Ecopower Developments Limited, Sion Road Kilkenny Ireland
Tel: (056) 7750140 Email office@ecopower.ie

Planning Section
North Tipperary County Council
Civic Offices, Limerick Road
Nenagh
Co. Tipperary

27th November, 2013

Re: 13 /51/0003 - 22 No. wind turbines, overall height of up to 126.6 meters, 2 No. meteorological masts up to 80 meters in height with wind measuring equipment attached, access roads, electrical substation compound and control buildings and ancillary site works at Graniera / Shevry / Knockcurraghbola Commons / Knockmaroe / Grousehall / Cummer / Foilnaman / Gleninchnaveigh / Coumnageeha / Coumbeg / Knocknamena Commons / Glenbeg / Seskin, Upperchurch, Co.Tipperary.

A Chara,

Arising from your Request for Further Information, dated 28th February, 2013, I wish to submit the attached response. 6 hard copies and 10 soft copies(on CD) are submitted as arranged with Mary Devine, Planning Department, on Tuesday 26th.

Please note that an extension of time for submission of a response to Further Information was granted on 11th July, 2013. The RFI and Extension of Time to submit a response are attached in Appendix A.

Significant information is being submitted and therefore a further Planning Notice was placed in The Tipperary Star, dated 21/11/2013 and is also attached in Appendix A.

Pat Brett
for and on behalf of Ecopower Developments Limited

REFERENCE DOCUMENTS

APPENDIX A
Further Information 13/51/0003

'ag obair leis an bpobal'
'working with the community'

Comhairle Contae Thiobraid Árann Thuaidh
North Tipperary County Council

Fón/Phone: 067-44652
Facs/Fax: 067-44654
Gréasán/Web: www.tipperarynorth.ie
r-phost/email:
planning@northtippcoco.ie

An Rannóg Pleanála, Oifigí Cathartha, Bóthar Luimnigh,
An t-Aonach, Contae Thiobraid Árann
Planning Section, Civic Offices, Limerick Road, Nenagh, Co. Tipperary

Our Reference	Your Reference	Date
13/51/0003		11th July, 2013

<u>Re: PERMISSION for erect 22 no. wind turbines, overall height up to 126.6meters, 2 no. meteorological masts up to 80m in height with wind measuring equip attached, access roads, electrical substation compound & control buildings & ancillary site works. This application is for a 10 year permission. Application is accompanied by an EIS, which includes an Appropriate Assessment (Natura Impact Statement) at Graniera, Shevry, Knockcurraghbola Upperchurch Co. Tipperary</u>

Dear Sir/Madam,

I refer to your letter dated 5th July, 2013 regarding an extension of the time allowed to submit further information on the above mentioned file. I wish to inform you that the Planning Authority is agreeable to an extension of time under Article 33 (3) of the Planning and Development Regulations 2006 for this application.

Please be aware that the latest date for submission of the further information in now closing time on **27th November, 2013 at 4.00pm**. If all further information is not received by this date the application will be deemed withdrawn.

Please do not hesitate to contact Brian Clancy at 067-44656 should you have any queries.

Yours Faithfully,

For Director of Services

Ecopower Development Limited
Sion Road
Kilkenny
Co Kilkenny

'ag obair leis an bpobal'
'working with the community'

Comhairle Contae Thiobraid Árann Thuaidh
North Tipperary County Council

Fón/Phone: 067-44652
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planning@northtippcoco.ie

An Rannóg Pleanála, Oifigí Cathartha, Bóthar Luimnigh,
An t-Aonach, Contae Thiobraid Árann
Planning Section, Civic Offices, Limerick Road, Nenagh, Co. Tipperary

Our Reference	Your Reference	Date
13/51/0003		28th February, 2013

Please submit the following further information under Article 33 of Planning & Development Regulations 2001 to 2006:-

1. In regard to the submitted Natura Impact Statement and EIS the Planning Authority is not satisfied that the impacts upon the adjacent Slieve Felim to Silvermines Mountains SPA (Site Code: 004165) have been fully assessed and appropriate mitigation measures proposed.

   You are advised of the following detailed concerns which will require to be fully addressed:

   (a) As Hen Harriers from the adjacent Special Protection Area (SPA) use this site the development would result in the loss of potential foraging habitat for pairs breeding within the SPA (3 within 5KM) according to best scientific advice (Pierce et 2009). Therefore, it should be treated as if within the SPA and significant negative effects cannot be ruled out beyond a reasonable scientific doubt. Such ex situ affects on the SPA have to be considered under Article 6 of the Habitats Directive. Nesting pairs are often now having to travel some distance to forage successfully (O'Donoghue pers communicae). Males have been found over 15km and females over 7km from the nest during the breeding season foraging (UCC/Coford). This has not been taken account of in the submissions. A full assessment of the suitable habitat lost from within a 250m radius of the turbines will be required as this is the zone of displacement found by Pierce et al (which is the best scientific advice available. This should include any conifer plantation that would be suitable for Harrier foraging within the life time of the development; in order to do this the planting date/felling dates will have to be ascertained for the plantations within a 250m radius of proposed turbines and a figure arrived at of what would be available/suitable to Harriers during the operating lifetime of the windfarm. Any other suitable foraging habitat within 250m of turbines will also have to be included (eg scrub, wet grassland, acid grassland, wet heath blanket bog etc). The creation of an equivalent area of new and equivalent alternative habitat suitable for foraging should then be considered as mitigation for that lost through potential displacement. Direct loss of habitat outside the 250m radius should be included in the calculations and side casting, peat/mineral soil deposition areas, bunds etc).

   (b) A full Cumulative Impact Assessment upon the SPA has not been carried out. Some of the nearby wind farm projects have been listed (but only within 10km and the one proposed – ref. 12/51/0385 - adjacent to the site is left out) but no qualitative or quantitative assessment has been carried out on the potential effects on the SPA (eg on harrier foraging areas, disturbance etc). Other factors have to be included also (eg. afforestation in the SPA post designation). The 250m displacement effect means overlap with the SPA. This is required. The items requiring consideration at (a) above shall also be taken into account in the cumulative assessment that is required.

2. The Bat survey work and report is incomplete. The Eurobats "*Guidelines for consideration of bats in wind farm projects*" shall be followed especially with regard to survey and mitigation and the necessary additional information submitted.

3. A full survey for badger sett/setts shall be conducted and report submitted. A Badger Derogation Licence would be required from the National Parks and Wildlife Service for works within 50m (breeding season) or 30m (non breeding season).

4. Section 4.1 of the Environmental Impact Assessment notes that noise levels at houses H2, H5, H7 and H9 may be exceeded having regard to the guidance contained in the DECLG Wind Energy Planning Guidelines (published 2006). It should be noted that wind turbines in proximity to these dwellings should have an appropriate noise reduced mode to mitigate such impacts.
Taking the above into account you are advised to submit a revised Noise & Vibration Impact Assessment (Operational Phase & Construction Phase), which shall also address the following issues;
(i) Results of a site-specific study identifying and quantifying potential vibration impacts as relates to proposed construction works e.g. borrow-pit blasting, etc.
(ii) Implementation of best practice procedures e.g. early warning system/NSL's, etc.
(iii) NSL shall not be differentiated on owners/occupiers 'financial interests' with 'dwellings' only differentiated on the basis of habitation potential e.g. *dwelling in dilapidated state (roof falling in) would clearly not qualify.*
(iv) Potential cumulative effects from proposed adjacent developments e.g. Plan Ref: 12510385.
(v) Proposals in relation to intended, defined, operating mode of each specific turbine (submit list).
(vi) In-depth, identification and consideration of potential noise/vibration and associated effects (dust) with outline of specific mitigation measures as per BS5228.

5. You are advised that a preliminary Ecological Management Plan (EcMP) in relation to the construction and operational phases of all relevant aspects of the proposed development shall be submitted. The plan shall deal with the management and implementation methodology associated with all relevant ecological issues, constraints and proposed mitigation measures/propositions as identified in the EIS and documents submitted as part of this application. In addition, the Plan shall include for specific proposals in relation to the intended removal of ~360m of hedgerow and its replacement taking into account optimisation on species connectivity (bats, birds, mammals etc), hedgerow species type, variation and quantity etc.

6. Please submit a preliminary Environmental Management Plan (EnvMP) in relation to the proposed construction and operational phases of all relevant aspects of the proposed development. Such plan shall deal with the management and implementation methodology associated with all relevant environmental: issues, constraints and proposed mitigation measures/propositions as identified in the EIS and documents submitted as part of this application. In addition please submit a Surface Water Management Plan (inclusive of annotated drawings) in relation to all relevant aspects (e.g. bridge crossings, borrow pit etc) of the proposed development including potential impacts that may arise upon the downstream Lower River Suir SAC.

7. Please submit a Reinstatement/Restoration & Aftercare programme for the wind farm, providing for example: removal of turbines, substation, foundations, roads and ancillary works etc (itemise and describe precisely) and also detailed proposals for landscaping & screening [scheme] of the site. The scheme shall also provide for the replacement and renewal of any hedgerows damaged and / or removed in the course of the construction phase and transportation of materials to/from the site and shall include a timescale for implementation. The programme shall include proposals for:-
(i) The satisfactory recycling or reuse of waste materials;
(ii) The replacement of topsoil so as to render the land suitable for agricultural use or other use consistent in appearance/utilisation of the surrounding land; and
(iii) The grading of any surface levels and the restoration of natural surface and subsoil drainage and the seeding and planting of the site.
Note: The above shall be accompanied with fully annotated drawings, colour coded, indicating extent and type of intended restoration works.
*Note: 'Reinstatement' shall include Landscaping Works and Earthworks Restoration, as required.
(b) Based on the above programme, please submit a detailed estimate of the restoration/aftercare/landscaping costs of the proposed development including costs in relation to the removal of turbines, foundations, etc. Such estimate shall indicate proposed works description, associated quantities with applied labour/plant costs and all shall be certified by an indemnified, independent, Charted Quantity Surveyor. The developer should note that such estimate may be utilised by the Planning Authority in order to determine a fair and satisfactory amount of Restoration Bond required.

(c) Taking the above into account you are advised to submit revised proposals in relation to the proposed borrow-pits, post-excavation, taking into account:-
- Provision of appropriate side-slopes/base-slope conducive to restoration afteruse e.g. agriculture, forestry, ecological etc.
- Surface water ponding.

8. In relation to the proposed site compound please submit the following information::
(a) design proposals in relation to the proposed site compound i.e. layout drawing: parking area, refuelling area/facilities, offices, sanitary facilities, drinking water supply etc.
(b) proposals (design details) in relation to the provision of sanitary facilities etc facilitating maintenance personnel over the long term life of the development.
Note: If it is intended not to provide long term facilities then a statement outlining reasons for same is required.

9. The visual impact assessment contained in the submitted EIS does not take account of the potential impacts that may arise from the adjoining wind farm proposed under application reference 12/51/0385. You are therefore advised to submit a revised visual impact assessment including revised photomontages.

10. As set out in Section 10.13 of the County Development Plan 2010 in Table 10.9 Exclusion and Separation Zones the boundary setback distance for wind turbines is stated to be 1.5times the turbine height. In this regard you are advised that turbine T22 is less than the necessary distance from the boundary of the landholding and therefore the proposal should be revised to take account of this.

11. With regard to wind farm development in general, it has been noted that an increasing number of [international] turbine installations have proved problematic in that under certain conditions, the structure can become unstable. Such 'conditions' have, in general, been attributed to high winds, human (design) error, un-designed-for dynamic loads and those resulting from basically, taller and larger turbines. Taking such issues into consideration and their applicability to the current turbine proposals i.e. high turbines and large mass ($345m^3$) of concrete foundations and notwithstanding the isolated locale of the development, suggests that the H&S aspect of the turbine installations, need to be considered. Accordingly, you are requested to submit an Turbine Design Assessment which shall address the structural design issues as outlined above and possible issues relating adverse conditions (eg. ice formation on the blades), in particular, you are requested to refer to quality control methodology utilised in order to ensure effective and consistent concrete strength in such [large] concrete placements.

12. In the event of significant information being submitted you are requested to submit a further notice in the stated newspaper and in the format set out on the attached and display new site notice (see attached).

Prior to the submission of further information you are advised to contact the Planning Authority so as to allow of discussion of the implications of the above.

Your application will not be further processed until confirmation of the above is received.
<u>Note:-</u> (1) Where Maps, Drawings, Plans or Documents are required, *<u>ten copies</u>* have to be submitted.
(2) Where new newspaper notice is required, full page of newspaper should be submitted within 14 days of date of publication of same.

tribute to Sean.
Many thanks to Dr. James Moloney and Elizabeth and the doctors, nurses and staff of Clonmel Hospital who took such good care of Sean during his short illness and to Fr. Pat Hayes, Chaplin for his comforting words.
We would like to thank Fr. Breen, Fr. Tierney, Fr. Purcell, Fr. Woods and Fr. Cunningham who officiated at the funeral mass and provided the family with much needed support. Thanks also to our Sacristan, Noreen. Thanks to Margaret Heaphy and Cecilia Maher for the lovely singing and music and thanks to the staff and pupils of Ballycahill N.S..
Thanks to O'Dwyer Undertakers for their kindness and professional handling of the funeral arrangements. Also thanks to all who looked after the grave.
Thanks to Brian O Farrell and staff for the beautiful meal and to Sean Treacy's G.A.A. Club for the kind use of their facilities.
As it would be impossible to thank everyone individually, we trust that this acknowledgement will be accepted by all as a token of our sincere gratitude and appreciation.
The Holy Sacrifice of the Mass will be offered for your intentions.
Sean's Months Mind Mass will be celebrated in Ballycahill Church on Saturday, 23rd November at 6.00p.m.

We hope this acknowledgement will be accepted by all with our gratitude and appreciation.
Masses will be offered for your intentions
Month Mind Mass for daddy Joseph Neary will be celebrated in the Church of the Assumption, Urlingford on Sunday 24th November at 11.30am

the above roads should be made in writing and should reach:
Marcus O'Connor, Director of Roads & Water Services, North Tipperary County Council, Civic Offices, Limerick Road, Nenagh
or
Michael Ryan, Town Clerk, Thurles Town Council, Slievenamon Road, Thurles not later than 12.00 p.m. on Thursday 28th November 2013

TEMPORARY CLOSING OF ROAD ROADS ACT 1993 – 2007 (SECTION 75 OF THE ROADS ACT 1993) ROADS REGULATIONS 1994.

NOTICE IS HEREBY GIVEN that North Tipperary County Council and Thurles Town Council propose to make an order closing the following roads in Thurles Town to the public: -

ROAD TO BE CLOSED	**(1)Mathew Avenue/Castle Avenue** from its junction with the R498 Parnell Street to its junction with R660 Friar Street/The Colmyard road (Holycross Road).
ALTERNATIVE ROUTES:	**(1)Northern Traffic** (heading towards R660 Holycross road) via turning right off the R498 Castlemeadows road onto the Bohernanave road and on towards R660 The Colmyard road (Holycross Road). **(2) Western Traffic** (from Holycross heading towards the R498 Nenagh Road & N62 Templemore road) via turning left off the R660 The Colmyard road (Holycross Road) onto the Bohernanave road and on towards the R498 Castlemeadows road. **(3)Southern Traffic** (from Butlers Avenue & Iona Avenue heading towards the R498 Nenagh Road & N62 Templemore road) via turning left off Butlers Avenue onto the R660 The Colmyard road (Holycross Road) and turn right onto the Bohernanave road and on towards the R498 Castlemeadows road.
PERIOD OF CLOSURE:	The above road closure will be in place from 6am on Monday 6th January 2014 to 6pm on Friday 14th February 2014. Local and business access will be maintained and it is anticipated that this road will be re-opened at weekends.

The purpose of the road closure is to facilitate works associated with the Watermain Rehabilitation Works (Contract No.2) in Thurles Town

Any objection which a person may have to the proposal to close the above road should be made in writing and should reach:
Marcus O'Connor, Director of Roads & Water Services, North Tipperary County Council, Civic Offices, Limerick Road, Nenagh
or
Michael Ryan, Town Clerk, Thurles Town Council, Slievenamon Road, Thurles not later than 12.00 p.m. on Thursday 28th November 2013
Website: www.tipperarynorth.ie
"Ag obair leis an bpobal – Working with the Community"

PLANNING NOTICES

NORTH TIPPERARY COUNTY COUNCIL

Graniera / Shevry / Knockcurraghbola Commons / Knockmaroe / Grousehall / Cummer / Foilnaman / Gleninchnaveigh / Coumnageeha / Coumbeg / Knocknamena Commons / Glenbeg / Seskin, Upperchurch, Co.Tipperary.

Ecopower Developments Ltd. Sion Road, Kilkenny intends to submit Further Information/Revised Plans to North Tipperary County Council in relation to Further Information Planning Reference Number 13/51/0003. The development applied for consisted of the erection of 22 No. wind turbines, overall height of up to 126.6 meters, 2 No. meteorological masts up to 80 meters in height with wind measuring equipment attached, access roads, electrical substation compound and control buildings and ancillary site works at Graniera / Shevry / Knockcurraghbola Commons / Knockmaroe / Grousehall / Cummer / Foilnaman / Gleninchnaveigh / Coumnageeha / Coumbeg / Knocknamena Commons / Glenbeg / Seskin, Upperchurch, Co.Tipperary. The application is for a 10 year permission under Section 41 of the Planning and Development Act 2000.
The Further Information/Revised Plans in relation to the application have been furnished to the Planning Authority, and are available for inspection or purchase at a fee not exceeding the reasonable cost of making a copy at the offices of the Authority during public opening hours.
A submission or observation in relation to the Further Information/Revised Plans may be made in writing to the Planning Authority within a period of FIVE weeks, beginning on the date of receipt by the Authority of the Further Information on payment of the prescribed fee of 20 Euro.
Signed: Pat Brett, Ecopower Developments Ltd.

NORTH TIPPERARY COUNTY COUNCIL

We, John and Margaret Butler wish to apply to the above County Council for full Planning Permission for a two storey dwelling house, domestic garage, septic tank, percolation area and entrance at Ballyroan, Borrisoleigh, Thurles. Previous planning permission 10510340.
This planning application may be inspected or purchased at a fee not exceeding the reasonable cost of making a copy, at the offices of the Planning Authority during its public opening hours and that a submission or observation in relation to the application may be made in writing to the planning authority on payment of the prescribed fee within the period of five weeks beginning on the date of receipt by the authority of the planning application.

REFERENCE DOCUMENTS

13 /51/0003 – response to RFI dated 28th February, 2013

Q1.*In regard to the submitted Natura Impact Statement and EIS the Planning Authority is not satisfied that the impacts upon the adjacent Slieve Felim to Silvermines Mountains SPA (Site Code: 004165) have been fully assessed and appropriate mitigation measures proposed,*
You are advised of the following detailed concerns which will require to be fully addressed:

(a) As Hen Harriers from the adjacent Special Protection Area (SPA) use this site the development would result in the loss of potential foraging habitat for pairs breeding within the SPA (3 within. 5KM) according to best scientific advice(Pierce et 2009). Therefore, it should be treated as if within the SPA and significant negative effects cannot be ruled out beyond a reasonable scientific doubt. Such ex situ affects on the SPA have to be considered under Article 6 of the Habitats Directive. Nesting pairs often now having to travel some distance to forage successfully (O'Donoghue pers communicae). Males have been found over 15km and females over 7km from the nest during the breeding season foraging (UCC/Coford). This has not been taken account of in the submissions. A full assessment of the suitable habitat lost from within a 250m radius of the turbines will be required as this is the zone of displacement foundby Pierce et al (which.is thebest scientific advice available). This should include anyconifer plantation that would be suitable for Harrier foraging within the life time of the development; in order to do this the planting date/felling dates will have to be ascertained forthe plantations within a 250m radius' of proposedturbines and a figure arrived at of whatwould be available/suitable to Harriers during the operating lifetime of thy windfarm. Anyother suitable foraging habitat within 250m ofturbines will also have included (eg scrub, wet grassland, acid grassland, wet heath blanketbog etc.). The creation of an equivalent area ofnew and equivalent alternativehabitat suitable for foraging should thenbe considered asmitigation for that lost through potential displacement. Direct loss of habitat outside the 250mradius should be included in the calculations and side casting, peat/mineral soil-deposition areas, bunds etc).

(b) A full Cumulative Impact Assessment upon the SPA has not been carried out. Some of thenearby wind farm projects have been listed (butonly within 10kmand the one proposed -ref.12/51/0385 - adjacent to the site is left out) but no qualitative or quantitative assessment hasbeen carried out on the potential effects on the SPA (eg on harrier foraging areas, disturbance etc.). Other factors have to be included also (eg. afforestation in the SPA post designation). The 250m displacementeffect means overlap with theSPA. This is required. The items requiringconsideration at (a) above shall alsobe taken into account in the cumulative assessment that isrequired.

The **Answer** to **Q.1 (a)** is contained in the Ecological Management Plan - **Answer to Q5** which includes;

- Ecological Management Plan - Hen Harrier Habitat Area, Individual Field photographs, management measures and restrictions - National Parks and Wildlife Service Farm Plan Scheme - Landowner consent letters - Hen Harrier Habitat Area Matrix - Consent Letters for Habitat compensation areas (Tab 5)

Answer to **Q1. (b)** follows (over);

- Response to RFI 1(b): Upperchurch Wind Farm **Cumulative Impact Assessment** which includes **Revised Natura Impact Assessment**

REFERENCE DOCUMENTS

13 /51/0003 – response to RFI dated 28th February, 2013

Further Information 13/51/0003 (22 No. wind Turbines at Upperchurch)

Malachy Walsh and Partners
Engineering and Environmental Consultants

Response to RFI 1(b): Upperchurch Wind Farm Cumulative Impact Assessment

15388

November 2013

Job number	Revision	Prepared by	Checked by	Status	Date
15388-6008	C	JA, MK	JK	Final	26th November 2013

MWP ENVIRONMENT AND PLANNING

Table of Contents

Appendices:

Appendix A: Figures

Appendix B: Revised Natura Impact Statement

1 Introduction

1.1 Request for Further Information

In response to the submission of the planning application for Upperchurch Wind Farm (Planning Ref.: 13/51) a Request for Further Information (RFI) was issued from North Tipperary County Council (NTCC). This report addresses Item 1(b), which has been reproduced hereunder:

"*A full Cumulative Impact Assessment upon the SPA has not been carried out. Some of the nearby wind farm projects have been listed (but only within 10km and the one proposed – ref. 12/51/0385 – adjacent to the site is left out) but no qualitative or quantitative assessment has been carried out on the potential effects on the SPA (e.g. on harrier foraging areas, disturbance etc). Other factors have to be included also (e.g. afforestation in the SPA post designation). The 250m displacement effect means overlap with the SPA. This is required. The items requiring consideration at (a) above shall also be taken into account in the cumulative assessment that is required*."

1.2 Site Description

The proposed Upperchurch Wind farm site is located in north Co. Tipperary, approximately 1.9 km west of the village of Upperchurch and a further 18 km west of Thurles town. The study area is made up of four sections with an overall area of 12 km².

The surrounding local landscape is dominated by 'Pasture' with 'Forestry, 'Bog', 'Other Agricultural Land' and 'Other' land located to the south of the proposed wind farm site (Corine Landcover database).

The four sections of the site are located on a series of small hills or drumlins that reach elevations of between 363mOD and 411mOD, where the peaks are generally at heights of 100m above the intervening lower terrain. The highest peak is that of Knockmaroe, at an elevation of 411mOD.

The area originally would have had a shallow peat land cover but most of it has been reclaimed by deep ploughing and converted to pasture. The remaining peat areas are used mainly for commercial forestry. Some rock outcropping occurs, most notably at the northeast part of the site.

1.3 Designated Areas

Upperchurch Wind Farm lies close to the *Slievefelim to Silvermines Mountains SPA* (Site Code 004165). This SPA held four confirmed pairs and one possible pair of hen harrier in 2005 (NPWS, site synopsis[1], 2007). Hen harrier is listed on Annex I of the EU Birds Directive and is a Red Data Book species (Whilde, 1993). Hen harrier was formerly listed as being of High Conservation Concern by BirdWatch Ireland (Newton et al., 1999), but is currently listed as of Medium Conservation Concern (Lynas et al. 2007).

1.4 Project Description

It is proposed to construct the windfarm, which comprises of 22 turbines, at a location situated approximately 1.9 km west of the village of Upperchurch. The turbines are numbered T01 to T22 and are arranged in four clusters as follows:

[1] NPWS (National Parks & Wildlife Service) 2007. Slievefelim to Silvermines SP Site Synopsis. http://www.npws.ie/media/npwsie/content/images/protectedsites/sitesynopsis/SY004165.pdf

- T01 to T08 are arranged around two hills at Shevry;
- T09 to T16 are arranged around the hill at Knocknamena;
- T17 to T21 are arranged around two hills at Knockmaroe and Foilnaman; and
- T22 is a single turbine on the northeast side of the hill at Knockcurraghbola.

Turbines will have hub heights of up to 85m and a maximum tip height of up to 126.60m. Construction of an electrical substation compound and installation of associated equipment and laying of electrical cable between turbines and the substation compound will be required. The wind farm will require the construction of 8km of new roads (5m width) and the widening and upgrading of 3.9km of existing farm roads. Prior to construction, clear-felling of approximately 4.35ha of conifer plantation will be required to facilitate the construction of the proposed windfarm and associated infrastructure.

The proposed Upperchurch Wind Farm is not located within the *Slievefelim to Silvermines Mountains SPA*, nor does it lie within, or overlap with, the the 250m buffer zone along the edge of the SPA. <u>The nearest turbine to the SPA, T21, lies 490m from its eastern edge.</u>

1.5 Summary of Hen Harrier Activity at Upperchurch Wind Farm

Both winter and breeding bird hen harrier surveys were conducted at Upperchurch Wind Farm (for further details see Chapter 6, Ecology, of the EIS). Hen harrier surveys included a total of ninety (90) hours observation from 3 vantage points for the winter survey and seventy two (72) hours observation from the same vantage points for the summer bird survey. Following the receipt of the RFI and in addition to those survey hours, further breeding surveys were undertaken in July and August 2013 providing an additional 24 observational hours. The main findings of the surveys in relation to hen harrier are summarised here:

- There was a sighting of an adult male in January 2011, during a transect survey, hunting low (<10m) in a westerly direction over improved agricultural grassland at the northeast of the site, in the townland of Glenbeg.

- In July 2011, there was a sighting of an adult female hunting low (<10m) in the second rotation forestry at Shevry, just east of VP-1 in the townland of Shevry.

- There was no evidence of hen harriers breeding at the study site in the summer of 2011.

- The randomness and low number of hen harrier observations during the vantage point surveys in 2010 and 2011 suggests that the proposed windfarm site at Upperchurch is used infrequently by hen harriers.

- In July 2013, there was one adult female hen harrier sighting from VP-1.

- There was no evidence of hen harriers breeding at the study site in the summer of 2013.

1.6 Ecological Management Plan

In response to Item 5 of the RFI an Ecological Management Plan (EcMP) for Upperchurch Wind Farm has been developed that provides a framework for ecological management and enhancement. Management objectives include:

- Requirement for a suitably qualified ecologist to oversee the implementation of the plan over lifetime of the wind farm.
- Creation of an area of new and alternative habitat suitable for foraging hen harrier to be considered as mitigation for that lost through potential displacement.
- Measures to protect breeding birds.
- Measures to protect bats.
- Measures to protect habitats and water quality during stream crossing works.
- Enhancement of site for aquatic invertebrates.
- Replacement of all removed hedgerow and replanting with native species.
- Enhancement of keyhole fell areas to restore wet habitat types as appropriate.

1.6.1 Creation of Area of New and Alternative Habitat Suitable for Foraging Hen Harrier

Item 1(a) of the RFI requested, "*The creation of an equivalent area of new and equivalent alternative habitat suitable for foraging should then be considered as mitigation for that lost through potential displacement*." In response the project has developed a plan that provides suitable mitigatory habitat for foraging hen harrier to offset any loss of potential foraging habitat within a 250m displacement zone of the Upperchurch turbines.

The creation of new and alternative habitat has been achieved through a plan of measures that are based on those set down in the NPWS Hen Harrier Scheme for farmers. This scheme has now finished, however, it is now proposed to develop a very similar scheme in the Upperchurch area, which is set out in detail in the Ecological Management Plan (EcMP) accompanying this RFI. Participating landowners will be compensated for implementing a set of habitat improvement measures for foraging hen harrier. The objective of the plan is create, improve and maintain suitable agricultural land as hen harrier foraging habitat to offset any potential loss associated with the proposed windfarm. These measures include:

- 123ha of habitat will be managed to increase the area of hen harrier foraging habitat. Measures set down to achieve this include:
    - Rush management to control coverage and increase suitability for foraging habitat
    - 2,085m increase in hedgerow
    - 3ha enclosures of native scrub and trees
    - Lines of electric fence with plastic fliers so that they are more visible to the hen harrier
    - Enhance riparian corridor:
        - 1220m of woody scrub species
        - Erect fencing to make stockproof and exclude access to river by livestock.

The following restrictions will apply to landowners within the Upperchurch hen harrier habitat scheme:

- Limited spreading of fertiliser (every 4-5 years).
- Limited spreading of lime (every 4-5 years).
- No burning.
- No excavation of drains or reclaiming heath or bog.

- No removal of hedgerows.
- No recreational off-roading with vehicles.
- No use of poisons or stupefying baits
- No new forestry plantation.

In addition to this hen harrier workshops will be delivered by the project ecologist at the initiation of the scheme. It is proposed that all landowners participating in the plan as well as those involved in the windfarm development will attend a series of hen harrier workshops, as required, which will be developed and delivered by the project ecologist. A suitably qualified representative from NPWS will be invited to deliver part of the workshop. The aim of the workshop will be to advise landowners on the importance of the conservation of the hen harrier and the proper and full implementation of the plan, and to fully explain the measures and the restrictions set down in the plan. Further detail is provided in the EcMP accompanying the Upperchurch Wind Farm RFI.

1.7 Cumulative Impact upon SPA, with Other Wind Farms and Forestry

In its request for a cumulative impact assessment, North Tipperary County Council (NTCC) sought an assessment of the potential impact upon the SPA at the outset. It was requested that all windfarm projects be considered and that the impact of other factors such as afforestation in the SPA post-designation be assessed. This has been addressed in the following section while other potential cumulative effects have been assessed in a subsequent section (see 1.8).

1.7.1 Cumulative Impact upon SPA

NTCC have requested that a cumulative impact assessment upon the SPA be carried out. In response a cumulative impact assessment on the SPA has been undertaken and is presented in this section.

The Upperchurch Wind Farm including a buffer zone of 250m radius around the turbines does not overlap with the SPA; the nearest turbine is 490m to the boundary of the *Slieve Felim to Silvermines Mountains SPA* (see Map 3, Appendix A). Four of the turbines are located within 1km of the SPA, three turbines lies between 1km and 2km while the remaining turbines are located a distance of over 2km from the SPA.

In the RFI it states, "*The 250m displacement effect means overlap with the SPA. This* [cumulative impact assessment] *is required*." It is clear from Map 3 (Appendix A) that the closest turbine lies 490m, or just under 0.5km, from the SPA, therefore, it can be argued that a cumulative impact assessment on the SPA is not required because the nearest turbine lies outside of the 250m buffer zone. However, in order to satisfy the request a cumulative impact assessment has been completed.

The study area for the assessment includes the *Slieve Felim to Silvermines Mountains SPA* as well as a distance of 250m outside of the SPA.

Again, it is important to emphasise that the proposed Upperchurch Wind Farm will not affect the number of turbines within the SPA or within the 250m buffer zone surrounding the SPA boundary.

Table 1 below details the wind farm projects within the *Slievefelim to Silvermines Mountains SPA* and within the 250m buffer zone from its boundary. Of the 45 turbines within the SPA, 16 are proposed, 16 are permitted and 13 are operational. The Upperchurch Wind Farm is outside the SPA with the nearest turbine being 490m and the majority of turbines are located between 1-2km from the edge of the SPA (see Map 3, Appendix A).

Table 1. Details of the wind farm projects within the SPA

Wind Farm	Owner	Status	No. turbines	No. turbines within SPA & 250m buffer zone	No. turbines outside SPA
Garracummer	Bord Gais	Operating	17	7*	10
Knockstanna	Airtricity	Operating	5	5	0
Bunkimalta	ESB/Coillte	Proposed	16	16	0
Knockmeale	Templederry Windfarm Ltd	Operating	2	1	1
Castlewaller	Castlewaller Woodland Partnership	Permitted	16	16	0
			56	**45**	**11**

* Two of the seven turbines lie outside the SPA but within the 250m buffer zone

Conifer plantation is considered to provide suitable foraging habitat during the open canopy stage, between years 2-10 of planting. Therefore, conifer plantation is only suitable for 20% or 8 years of its estimated 40 year rotational cycle and is thus considered to provide suitable habitat on a short-term basis. The provision of suitable conifer plantation habitat thus only coincides with a portion, and not all, of the lifetime of a windfarm. Marginal or semi-natural habitats, which are permanently open (i.e. not subject to the rotational cycles of conifer plantations), are considered suitable hen harrier foraging habitats over the lifetime of the windfarm.

Table 2. Details of the Upperchurch Wind Farm

Wind Farm	No. turbines within SPA & 250m buffer zone	Habitat types within 250m displacement zones of use to hen harrier	Short-term suitable foraging areas, conifer plantation (ha)	Area of suitable conifer plantation over project lifetime (ha)	Permanently suitable foraging areas, semi-open & marginal habitats (ha)
Upperchurch	0	Conifer plantation, acid grassland, wet grassland, upland blanket bog, wet heath	108ha	11ha	84ha

Table 2 above details the habitat types and areas within Upperchurch Wind Farm that are suitable on a short-term and permanent basis. At Upperchurch there is a mix of permanently open habitats (acid grassland, wet grassland, bog, heath) and conifer plantation (suitable on a short-term basis). **Error! Not a valid bookmark self-reference.** below details the habitat types and areas of the wind farms within the *Slievefelim to Silvermines Mountains* SPA and the 250m buffer zone that are suitable on short-term and permanent basis (see Map 1, Appendix A). At Garracummer, Bunkimalta and Castlewaller the displacement zones are dominated by conifer plantation. The 5 turbines at

Knockastanna support bog and wet grassland that can be considered as suitable foraging habitat through the lifetime of the wind farm (i.e. permanently suitable). Knockmeale supports less than 1ha of suitable foraging habitat.

Table 3. Details of the wind farm projects within the SPA and buffer zone (information sourced from relevant wind farm planning application documentation, note Planning Ref. (PR) quoted)

Wind Farm	No. turbines within SPA & 250m buffer zone	Habitat types within 250m displacement zones of use to hen harrier	Conifer plantation (ha)	Area of suitable conifer plantation available over project lifetime (ha)	Permanently suitable foraging areas, semi-open & marginal habitats (ha)
Garracummer	7	Conifer plantation	106	44	20
Knockstanna	5	Upland blanket bog, wet grassland	6		46
Bunkimalta (P.R. 13510035)	16	Conifer plantation, upland blanket bog, wet grassland	274	163	27
Knockmeale	1	Agricultural grassland, wet grassland	0	0	1
Castlewaller (P.R. 11510251)	16	Conifer plantation	288	48	0
	45		**674**	**255**	**84**

It is estimated that of the 674ha within the displacement zones of the turbines within the SPA and 250m SPA buffer zone, 255ha of this is likely to be suitable as hen harrier foraging habitat over the lifetime of the wind farms. When combined with the 84ha of permanently open habitat this increases to a total area of 339ha of suitable hen harrier foraging habitat within the displacement zones. Should hen harrier avoid the 250m displacement zones around turbines and foraging habitat is lost as a result, there is potential for cumulative impacts to arise within the SPA. Upperchurch Wind Farm will not contribute to any habitat loss within the SPA or associated 250m buffer zone, however, hen harrier are known to use the site though infrequently and the loss of approximately 95ha of potentially suitable hen harrier habitat may result in a cumulative effect. The potential losses of foraging habitat for the hen harrier associated with the Upperchurch Wind Farm will be fully mitigated by the creation of areas of suitable foraging habitat (see EcMP for further detail). Therefore, it is considered that impact of Upperchurch Wind Farm will be neutral and it will not contribute to a significant cumulative impact upon the *Slieve Felim to Silvermines Mountains SPA*.

The two largest wind farms within the SPA, the proposed Bunkimalta (Planning Ref. 13510035) and the permitted Castlewaller (Planning Ref. 11510251), which make up 74% of wind farms within the SPA, have acknowledged the potential for potential cumulative effects for foraging hen harrier. To remedy this, both have provided for the creation of equivalent areas of suitable foraging habitat.

Mitigation habitat that is the creation of equivalent areas of suitable foraging habitat has been proposed by the applicants for the Bunkimalta and Castlewaller Wind Farm projects. The Bunkimalta project proposes to create an equivalent area of open canopy forest over the lifetime of the wind farm. Bunkimalta and Castlewaller are the largest of the wind farm projects within the SPA and they have the greatest coverage of forestry. Therefore, as a full mitigation programme involving the provision of equivalent areas of suitable foraging habitat is proposed for the Bunkimalta and Castlewaller projects it can be concluded that the net impact of these projects on the SPA is neutral and therefore the SPA should not be adversely affected.

In summary, the provision of mitigatory habitat for most of the turbines within the SPA and at Upperchurch Wind Farm coupled with the fact that Upperchurch wind farm lies outside the SPA and the associated 250m buffer zone, a cumulative impact effect with the SPA is not expected to arise.

1.7.2 Cumulative Impact of Other Wind Farms

The cumulative impact assessment area for the assessment of in-combination effects with other wind farms is made up of an area of 15km from the outer turbines of the Upperchurch Windfarm as well as the *SlieveFelims to Silvermines Mountains SPA* in addition to a buffer of 3km on the western edge of the SPA. The total area of this assessment area is 106,915ha. This differs from the SPA assessment area which was confined to the SPA and the surrounding 250m buffer zone.

There are a number of permitted and existing wind farms in the assessment area, as detailed in Table 4 below and Map 2 (Appendix A). Of the 45 turbines within the SPA, 16 are proposed, 16 are permitted and 13 are existing and operating. The Upperchurch Wind Farm is outside the SPA with the nearest turbine being a distance of 490mm; most turbines are located at distances greater than 1km and 2km from the edge of the SPA (see Map 3, Appendix A). The remaining 101 turbines within the study area are outside the SPA and within 15km of the Upperchurch Wind Farm. Most of these are located to the southeast of Upperchurch Wind Farm.

Table 4. Wind Farms within 15km of the proposed wind farm (wind farms with turbines with the SPA have been bolded for clarity)

	Wind Farm	Owner	Status	No. turbines	Distance from nearest UWF turbine - KM	No. turbines within SPA	No. turbines outside SPA	Distance of nearest turbine from SPA - KM
1	Upperchurch	Ecopower Developments	Proposed	22	0	0	22	0.5
2	**Garracummer**	**Bord Gais**	**Operating**	**17**	**2.8**	**5**	**12**	**0**
3	**Knockstanna**	**Airtricity**	**Operating**	**5**	**8**	**5**	**0**	**0**
4	Cappawhite	ESB	Permitted	18	8.5	0	18	3.7
5	Glencarbry	Ecopower Developments	Permitted	11	4.5	0	11	3.4
6	Glenough	ABO Wind	Operating	14	3.2	0	14	2.7
7	Hollyford	Viridian	Under construction	3	3.7	0	3	3.1
8	Turraheen	Ecopower Developments	Proposed	3	5.6	0	3	5.5
9	Milestone	ABO Wind	Proposed	5	0.4	0	5	1.3
10	**Bunkimalta**	**ESB/Coillte**	**Proposed**	**16**	**9.5**	**16**	**0**	**0**
11	**Knockmeale**	**Templederry Windfarm Ltd**	**Operating**	**2**	**7.8**	**1**	**1**	**0.03**
12	**Castlewaller**	**Castlewaller Woodland Partnership**	**Permitted**	**16**	**14**	**16**	**0**	**0**
13	Ballinlough	Jaroma Windfarm Ltd	Operating	3	12.7	0	3	9.2
14	Curraghgraigue	Aeolus Energy Ltd	Operating	6	9.4	0	6	2.4
15	Ballinveny	North Tipperary Windpower Ltd	Operating	3	12.8	0	3	11.9
				144		**43**	**101**	

A GIS and autocad software have been used to map and estimate abundances for potentially useful hen harrier foraging habitat such as conifer plantation (suitable on a short-term basis during its open canopy stage) and marginal and semi-natural habitats, which are useful over the 25 year lifetime of the wind farm. The results of this analysis are presented in the following tables and have been used to undertake the assessment (see Map 2, Appendix A).

Table 5. Temporarily and permanently suitable foraging habitat within the assessment area

	Wind Farm	**No. turbines within SPA & 250m buffer zone**	**Habitat types within 250m displacement zones of use to hen harrier**	**Area of conifer plantation within 250m displacement zones (ha)**	**Area available conifer plantation within 250m displacement zones (ha) over lifetime of windfarm**	**Permanently suitable foraging areas, semi-open & marginal habitats (ha)**
1	Upperchurch	0	Conifer plantation, acid grassland, wet grassland, upland blanket bog, wet heath	11	11	84
2	Garracummer	7	Conifer plantation	106	44	77
3	Knockstanna	5	Upland blanket bog, wet grassland	6	4	46
4	Cappawhite	0	Conifer plantation, wet grassland, bog/heath	234	92	93
5	Glencarbry	0	Conifer plantation, wet grassland, acid grassland, wet heath mosaic	135	44	17
6	Glenough	0	Conifer plantation, wet grassland, wet heath, acid grassland	90	18	29
7	Hollyford	0	Conifer plantation, wet grassland, wet heath, acid grassland, heath/bog cutover	5	0	19
8	Turraheen	0	Conifer plantation, wet grassland, bog/grassland mosaic, bog, wet heath	16	14	12
9	Milestone	0	Conifer plantation, wet grassland, wet heath	15	15	10

10	Bunkimalta	16	Conifer plantation, upland blanket bog, wet grassland	163	163	27
11	Knockmeale	1	Agricultural grassland, wet grassland	0	-	1
12	Castlewaller	16	Conifer plantation	48	48	0
13	Ballinlough	0	-	-	-	-
14	Curraghgraigue	0	Conifer plantation	1	0	0
15	Ballinveny	0	Conifer plantation	7	7	0
		45		**788**	**451**	**415**

Table 5 above presents all of the wind farms within the assessment areas. The total area of conifer plantation within the 205m displacement zones is 788ha, however, this does not reflect the fact that the plantation canopy will be closed for 80% of 4/5 of its rotational cycle. Therefore, this figure is a considerable overestimation. Following an analysis of the amount of area of available conifer plantation for foraging hen harrier over the lifetime of the Upperchurch Wind Farm this has been reduced to 451ha within the 250m displacement zones.

Table 6 below presents the corine landcover analysis, which was used in the assessment. Based on an analysis of the definitions of the landcover classifications habitats that are considered to provide potentially suitable forging habitat include transitional woodland-scrub, coniferous forestry, peat bog, moor and heath and natural grassland. It has been estimated that a total of approximately 22,000ha of potentially suitable hen harrier habitat occurs within the assessment area.

Table 6. Corine landcover estimates within the assessment area

Landcover type	Area (ha)	Potentially suitable hen harrier foraging area (ha)	Class as a % of the Zone
Pasture	73,169	-	68%
Transitional Woodland-Scrub	**9,092**	**9,092**	**9%**
Coniferous Forestry	**7,536**	**7,536**	**7%**
Agricultural	7,271	-	7%
Peat Bog	**4,562**	**4,562**	4%
Un-Irrigated Land	2,427	-	2%
Complex Cultivation	984	-	1%
Natural Grassland	**521**	**521**	0%
Broadleaf Forestry	409	-	0%
Discontinuous Urban	398	-	0%
Moor and Heath	**304**	**304**	0%
Inland Marsh	240	-	0%
		22,015	100.0%

When taken into context of the total area of potentially suitable available landcover of ~ 22,000ha for foraging hen harrier, the Upperchurch project will potentially affect 95ha (see Table 2), which is less than 0.5%. The other wind farm projects within the assessment area will potentially affect 451ha of useful conifer plantation and 415ha of open habitat giving a total of 866ha (see Table 5). When taken in context of the 22,015ha of available land this constitutes less than 4% of the total suitable landcover. The presence of the other windfarms may result in a cumulative effect; however, it is unlikely to be significant.

Mitigatory habitat has been proposed for Upperchurch Wind Farm through the provision of areas of suitable foraging habitat (nearest turbine is 490m from edge of SPA, therefore outside 250m buffer zone around SPA) the net impact is considered neutral. It is not anticipated that Upperchurch Wind Farm will contribute in a significant way to a cumulative effect.

Furthermore, mitigatory habitat has been proposed to offset loss of potential foraging habitat for the two largest wind farms, Bunkimalta and Castlewaller. Mitigatory habitat has also been proposed for Milestone Wind Farm (P.R. 12510385), which lies within the vicinity of Upperchurch Wind Farm but like Upperchurch is located outside of the SPA.

1.7.3 <u>Cumulative Impact of Forestry</u>

The *Slievefelim to Silvermines Mountains SPA* is an extensive upland site and approximately half of the site is afforested, including both first and second rotation plantations and clear fell areas. Roughly one-quarter of the site is unplanted blanket bog and heath, with both wet and dry heath present. The remainder of the site is largely rough grassland that is used for hill farming while some stands of deciduous woodland also occur, especially in the river valleys.

A considerable portion of the forestry within the SPA was planted pre-2000 and much of the current crop is in its second 40 year rotation. Of the total area of land within the assessment area (that is the 15km around the windfarm + SPA + 3km area surrounding SPA) 14,862ha or 13.9% of the forestry within the greater assessment area was planted prior to the year 2000. The significance of this is that that area may be of value to hen harrier for a portion of the lifetime of Upperchurch Wind Farm, which is planned for construction in 2017. It is only pre-thicket or open canopy conifer plantation during the years 2-10, or often years 3-9, that are considered to be of use to the hen harrier. Most of the forestry planted post-2000 will already be past the pre-thicket stage and the canopy will have closed.

From examination of a number of evidence sources in particular aerial photography and analysis presented in the planning documentation submitted in support of other wind farms in the region, it is expected that the area of available suitable forestry for hen harrier foraging will decrease over the lifetime of the Upperchurch Wind Farm. The expected reduction is mainly due to the impending closure of open canopy young second rotation forestry, which occurs 10 years after planting. This will likely result in a reduction in potential foraging habitat for the hen harrier within the SPA and influence future population trends.

According to the National Hen Harrier Survey (Ruddock, 2012) a significant decrease in population has been recorded since the previous national survey in 2005. It is considered that forest maturation is considered partly responsible for this due to a shift in the age structure to more mature closed canopy. It is worth noting that one of the principal threats to nesting hen harrier is predators such as crows and foxes (pers. comm. Barry O'Donoghue).

With the creation of an area of hen harrier foraging habitat as part of the Upperchurch project, it is expected that the hen harrier will use this area while forestry lands within the SPA come under pressure. With the EcMP in place the potential impact of the Upperchurch Wind Farm will be neutral, and may even be considered positive. It is not anticipated that the project when considered with forestry will result in a significant cumulative impact.

1.8 Other Cumulative Effects

1.8.1 Cumulative disturbance effects

Cumulative disturbance effects can occur during the construction phase in particular, due to noise, visual intrusion or disturbance effectively amounting to habitat loss arising from the effect of displacement from more than one wind farm development. Disturbance is short term and may occur during construction. Disturbance effects may be non-linear where birds may tolerate a certain level of disturbance up to a threshold (SNH, 2012).

Observations of a female hen harrier during a breeding season survey at Glencarbry Windfarm Extension in summer 2011, while the western-most turbine turbine at Glenough wind farm was undergoing construction, indicated no disturbance effect. The bird was first observed over mature conifer plantation and circled north over improved agricultural grassland, to within 300m of the construction area (pers. obs.). Glencarbry wind farm and Glenough wind farm are 4.5km and 3.2 km to the south of the proposed Upperchurch wind farm, respectively (pers. obs. 2011).

It is not expected that cumulative disturbance effects, which are temporary in nature, will be significant.

1.8.2 Cumulative Collision Effects

Cumulative collision effects can arise as a result of a number of wind farm developments in an area as well as changes in behaviour of bird species in response, making them more / less likely to collide (King et al., 2009). In practice, most birds take avoidance action to avoid a wind farm or wind turbine structure and alter their flight lines (SNH, 2012). Information on collision is limited, because as mentioned it can rarely be assumed that all collisions are detected, due to scavenging, as well as surveyor bias.

The evidence to date indicates that the effects are extremely species and site specific. Not all species are equally sensitive to collision. Large birds such as raptors and wildfowl are considered to be at greater risk of collision due to their flight behaviour and mobility (Percival, 2003). Percival notes that in Ireland, wind farms are most likely to have a serious negative impact on birds in areas of high concentrations of seabirds, wintering wildfowl or breeding raptors. There is no evidence of breeding raptors at Upperchurch Wind Farm with the nearest known nest recorded roughly 4km to the southeast of the Upperchurch site bordering the Glenough windfarm to the southeast of the site.

There is no known hen harrier flight paths between foraging and roosting areas associated with the Upperchurch project.

Observations at the Glenough wind farm in 2012 and 2013 indicated that potential hen harriers collision was unlikely as the majority of flying adults and juveniles were recorded below 35m i.e. below turbine blade height (Cork Ecology 2012, 2013).

All observations of hen harrier during breeding and winter surveys at Upperchurch in 2011 and 2013 were recorded below 35m.

The main collision risk to hen harrier occurs where nests are located within 500m of a turbine. A risk to fledglings that are not as aerially skilled as adults may result in a collision risk.

At Glenough wind farm, there is an historic hen harrier nest site, c. 300m from the nearest turbine and another c. 2.5km from the nearest turbine. In 2012, during a post-construction survey, two fledged young were observed at the nest site, 2.4km from the nearest turbine. In 2013, two fledged young were observed at the nest site, 300m from the nearest turbine (Cork Ecology 2012, 2013). As already stated, Glenough wind farm is 3.2km from the nearest turbine at the proposed Upperchurch wind farm.

Post-construction monitoring at a wind farm site in Co. Galway indicated that most observations were of hen harrier foraging at less than 10m above ground, although birds were also recorded at rotor height. Between 10 and 11 pairs of hen harriers bred within 5km of the win farm site boundary, during each year of monitoring (Madden and Porter 2007).

It is not expected that collision of hen harrier with turbines at Upperchurch will occur due to the low flying height of foraging hen harriers together with the absence of recorded nests within the vicinity of the project.

1.8.3 Cumulative Barrier Effects

Cumulative barrier effects occurs where birds alter their migration flyways or local flight paths, to avoid wind farm developments, resulting in increased energy expenditure as birds have to fly longer distances and could result in disruption. Barrier effects depend on species, type of bird movement, flight height, turbine layout, wind force and direction (King at al., 2009).

There is a strong relationship between cumulative barrier effects and cumulative displacement effects, particularly after construction has taken place. It will depend on the number of wind farms and the number of turbines in these wind farms, within the vicinity of the proposed wind farm at Upperchurch. It will also depend on the quality of hen harrier habitats available within these wind farms and in the surrounding area.

At a 71 turbine wind farm site in Co. Galway, within the Slieve Aughty SPA, there were numerous sightings of hen harrier. Monitoring commenced in 2004, prior to the erection of turbines and continued in 2006 and 2007, when the wind farm was in full operation. Most observations were of hen harrier foraging at less than 10m over the bog. Birds regularly passed within 50m of turbines, with one bird foraging within 10m of a turbine base. The behavioural observations indicated that birds passed between turbines or along lines of turbines, and no sudden movements were seen that suggested alarm or hesitation (Madden and Porter 2007).

At the 14 turbine wind farm at Glenough, the levels of hunting recorded during the post-construction monitoring, indicated that there was suitable hunting habitat both within the wind farm and in the immediate surrounding area, and that the presence of turbines did not act as a barrier to foraging hen harrier (Cork Ecology 2013).

The turbines at Upperchurch are well spread and the site is not considered a bird migration route. Other wind farms in the region are well spread and spaced from one another and most turbines are at a minimum of 300-400m apart.

In summary it is not expected that the Upperchuch Wind Farm proposal will contribute a significant cumulative barrier effect with other windfarms.

1.8.4 *Cumulative Impact of Agriculture*

The area within and surrounding the proposed wind farm at Upperchurch is currently intensively farmed and is primarily improved agricultural grassland. This habitat is deemed unsuitable for foraging hen harrier. It is one of the main habitats associated with the 250m buffer displacement zone around the turbines. If the wind farm was granted permission, it is likely that farming would continue within these buffer zones.

It is expected that the quota for milk will be removed in 2015 and under Harvest 2020[2] milk production is expected to increase by 50% by 2020. Existing marginal land such as that surrounding the SPA and within 15km of the wind farm may be subject to improvement in an effort to increase the amount of available high quality agricultural grassland and meet the 2020 target for milk production. If this occurs on a significant level it is likely to result in the reduction of future hen harrier foraging habitat and may have a knock-on effect on future population trends.

The proposed Ecological Management Plan prepared as part of this RFI proposes the management of approximately 124ha of land outside the SPA. This will have the effect of securing this land for hen harrier foraging habitat over the lifetime of the wind farm whose construction is likely to coincide with the early years of the removal of the milk quota. With the Ecological Management Plan in place the potential impact of the Upperchurch Wind Farm will be neutral, and may even be considered positive. A significant cumulative effect with agriculture is not antipated.

1.9 Hen Harrier Habituation to Wind Farm Development

Certain bird species are known to habituate to the presence of wind farms (Spaans et al., 1998 a & b). In Pierce-Higgins et al., (2012) following temporary disturbance during construction, upland bird populations became habituated to operational wind farms. This conclusion was based on a 3 year period of wind farm operation. The main finding of this study for breeding bird populations suggests that the main effects of wind farms may be through disturbance displacement during construction. The turbines at Upperchurch are carefully sited and well spread; it is likely that hen harriers will habituate to the wind farm to a degree over its lifetime.

At Garracummer wind farm, there were no observations of hen harrier nesting behaviour during the construction phase in 2011/2012, although there was hen harrier breeding activity observed in the 5km hinterland, during the construction phase. However, there was a significant increase in raptor activity during post-construction monitoring at the site in 2013 (pers. comm. BGE, 29/11/2013). Garracummer wind farm is 2.8km from the nearest turbine at Upperchurch wind farm and is within 5km of the wind farm at Glenough.

As already mentioned with regard to the 14 turbine wind farm at Glenough, the levels of hunting recorded during the post-construction monitoring, indicated that there was suitable hunting habitat both within the wind farm and in the immediate surrounding area, and that the presence of turbines did not act as a barrier to foraging hen harrier (Cork Ecology 2013).

[2] http://www.agriculture.gov.ie/agri-foodindustry/foodharvest2020/

1.10 Conclusion

This cumulative impact assessment was prepared in response to a Request for Further Information (RFI) issued from South Tipperary County Council (NTCC).

At the outset it is important to point out that the nearest turbine to edge of the SPA is a distance of 490m. In the RFI it states, "*The 250m displacement effect means overlap with the SPA. This* [cumulative impact assessment] *is required*." It is clear from Map 3 (Appendix A) that the closest turbine lies 490m, or just under 0.5km, from the SPA, therefore, it can be argued that a cumulative impact assessment on the SPA is not required because the nearest turbine lies outside of the 250m buffer zone. However, in order to satisfy the request a cumulative impact assessment has been completed.

There are 43 proposed, permitted or operational turbines within the SPA and 2 more turbines within the 250m buffer zone around the SPA. Within the SPA and the 250m buffer zone, there will be a loss of conifer plantation and open habitats, which could reduce the amount of available suitable foraging habitat for hen harrier within the SPA and may result in potential cumulative effects. However, the provision of mitigatory habitat for most of the turbines within the SPA and at Upperchurch Wind Farm coupled with the fact that Upperchurch wind farm lies outside the SPA and associated 250m buffer zone, a cumulative impact effect with the SPA is not expected to arise.

It is expected that the area of available suitable forestry for hen harrier foraging will decrease over the lifetime of the Upperchurch Wind Farm. The expected reduction is mainly due to the impending closure of open canopy young second rotation forestry within the SPA, which occurs 10 years after planting. This will likely result in a reduction in potential foraging habitat for the hen harrier within the SPA. With the creation of an area of hen harrier foraging habitat as part of the Upperchurch project, it is expected that the hen harrier will use this area while forestry lands within the SPA comes under pressure. With the EcMP in place the potential impact of the Upperchurch Wind Farm will be neutral, and may even be considered positive. It is not anticipated that the project when considered with forestry will result in a significant cumulative impact.

Following the preparation of the plan to create hen harrier foraging habitat and the cumulative impact assessment report, the original Natura Impact Statement has been revised and updated (see Appendix B, attached).

2 References

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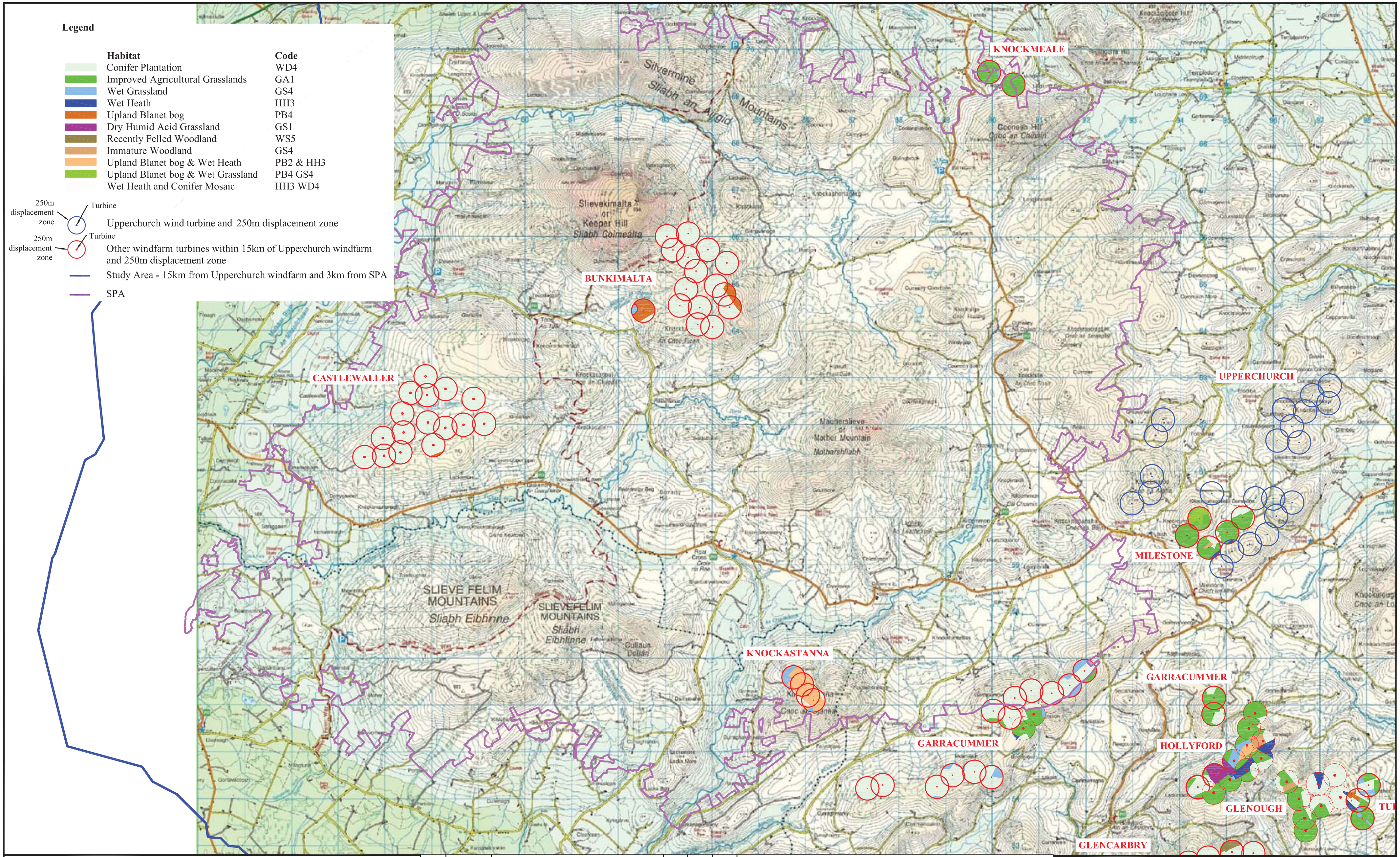
REFERENCE DOCUMENTS

Appendix A

Figures

REFERENCE DOCUMENTS



Legend

Habitat	Code
Conifer Plantation	WD4
Improved Agricultural Grasslands	GA1
Wet Grassland	GS4
Wet Heath	HH3
Upland Blanet bog	PB4
Dry Humid Acid Grassland	GS1
Recently Felled Woodland	WS5
Immature Woodland	GS4
Upland Blanet bog & Wet Heath	PB2 & HH3
Upland Blanet bog & Wet Grassland	PB4 GS4
Wet Heath and Conifer Mosaic	HH3 WD4

250m displacement zone — Turbine — Upperchurch wind turbine and 250m displacement zone

250m displacement zone — Turbine — Other windfarm turbines within 15km of Upperchurch windfarm and 250m displacement zone

Study Area - 15km from Upperchurch windfarm and 3km from SPA

SPA

Rev.	Date	Description	by	ch'd	app
B	27.11.13	Issued For RFI	JK	MK	MK
A	26.11.13	Issued For RFI	JK	MK	MK

Client: Ecopower Developments Ltd

Project: Upperchurch Wind Farm

Title: Map 1

Malachy Walsh and Partners
Consulting Engineers
Cork | Tralee | London | Limerick

Scales (A3)	NTS	
Drawn	JK	26.11.2013
Checked	MK	26.11.2013

Drg. No. 15388 - SK02

Rev. B

Habitat within 250m of turbines within 15km of Upperchurch Windfarm

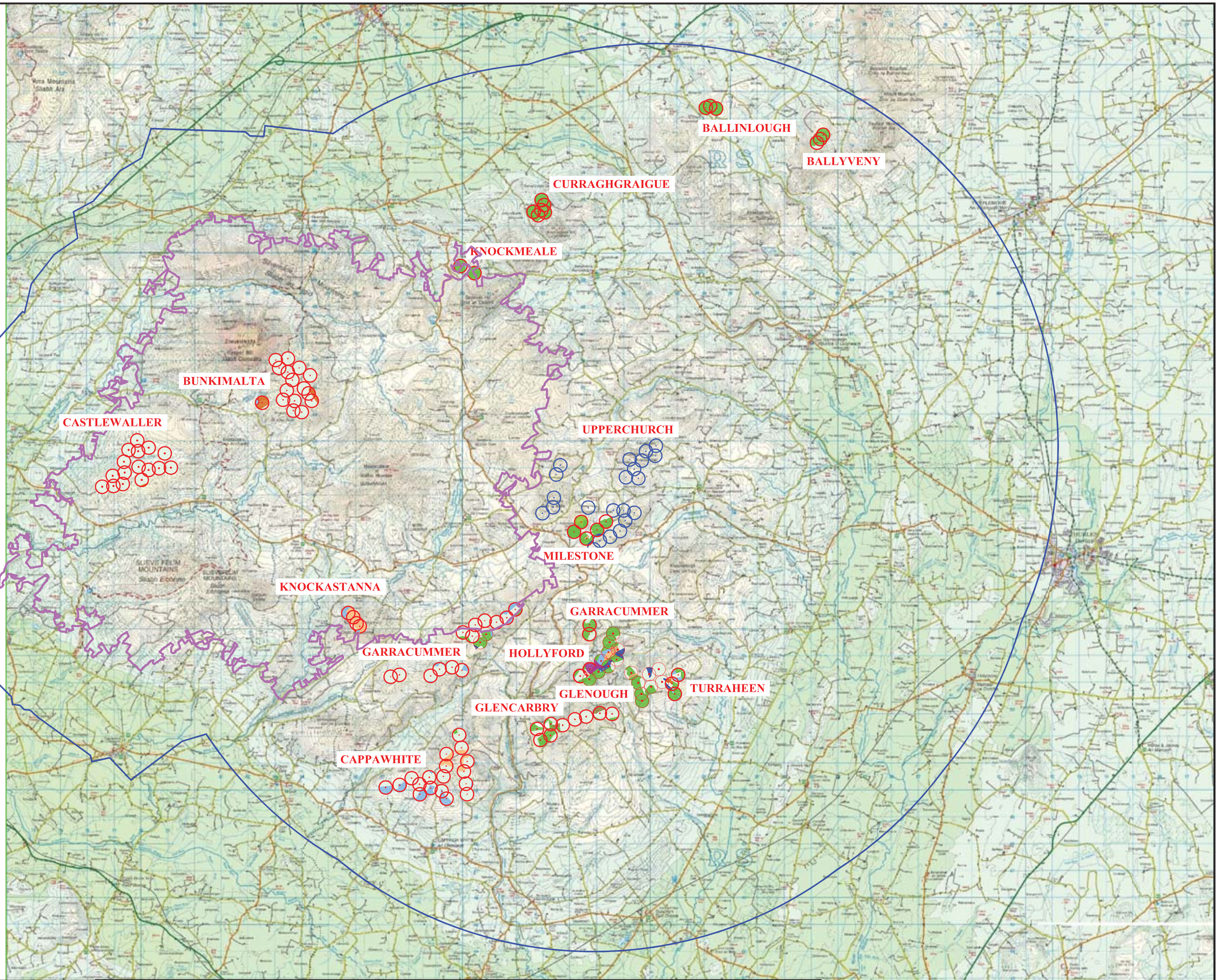
Habitat	Code
Conifer Plantation	WD4
Improved Agricultural Grasslands	GA1
Wet Grassland	GS4
Wet Heath	HH3
Upland Blanet bog	PB4
Dry Humid Acid Grassland	GS1
Recently Felled Woodland	WS5
Immature Woodland	GS4
Upland Blanet bog & Wet Heath	PB2 & HH3
Upland Blanet bog & Wet Grassland	PB4 GS4
Wet Heath and Conifer Mosaic	HH3 WD4

Upperchurch wind turbine

Other windfarm turbines within 15km of Upperchurch windfarm

Study Area - 15km from Upperchurch windfarm and 3km from SPA

SPA



Rev.	Date	Description	by	ch'd	app
A	26.11.13	Issued For RFI	JK	MK	MK

Client: Ecopower Developments Ltd

Project: Upperchurch Wind Farm

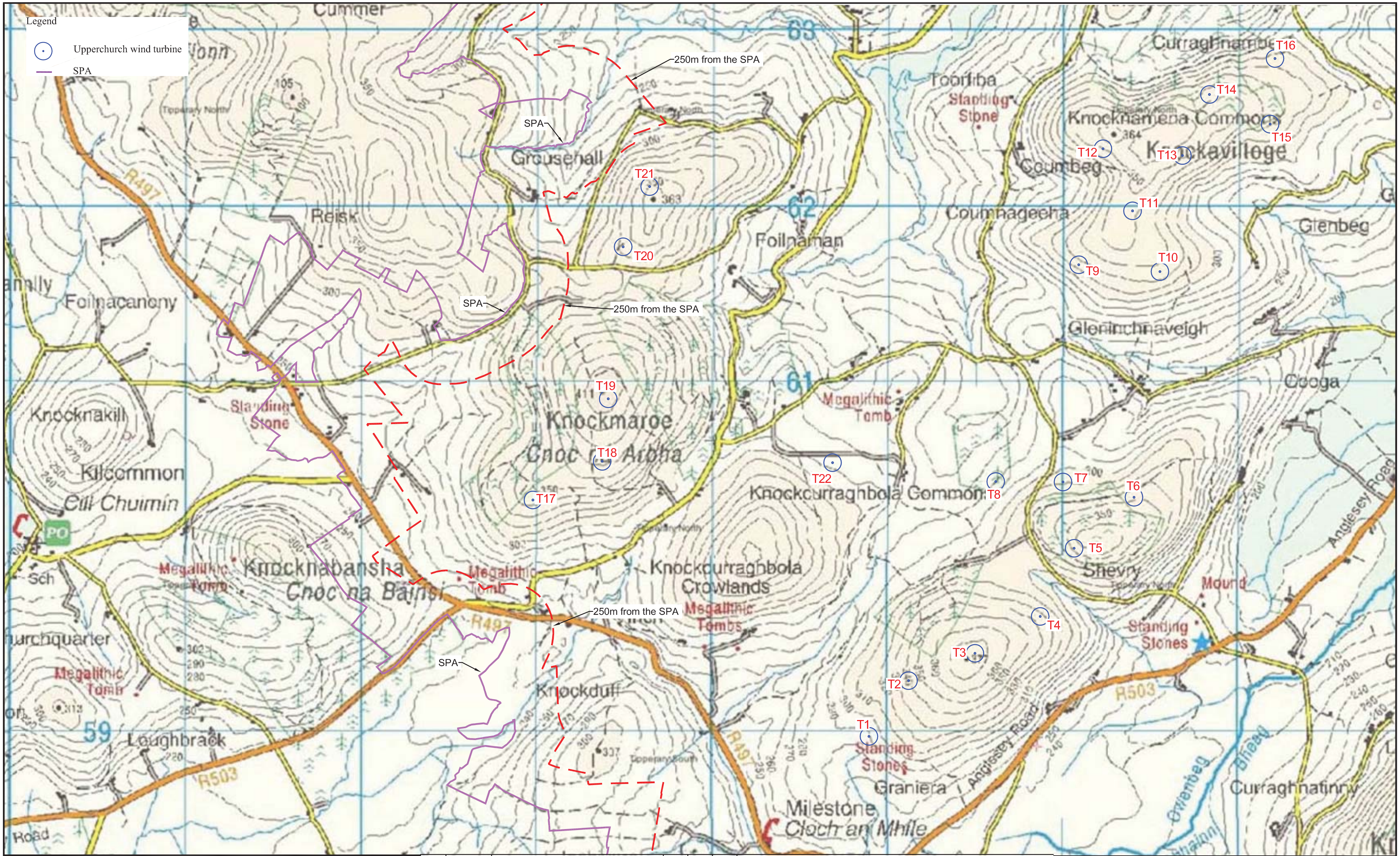
Title: Map 2

Malachy Walsh and Partners
Consulting Engineers
Cork | Tralee | London | Limerick

Scales (A3)	NTS	
Drawn	JK	26.11.2013
Checked	MK	26.11.2013

Drg. No. 15388 - SK03

Rev. A



Rev.	Date	Description	by	ch'd	app
B	27.11.13	Issued For RFI	JK	MK	MK
A	26.11.13	Issued For RFI	JK	MK	MK

Client
Ecopower Developments Ltd

Project
Upperchurch Wind Farm

Title
Map 3

Malachy Walsh and Partners
Consulting Engineers
Cork | Tralee | London | Limerick

Scales (A3)	NTS	
Drawn	JK	26.11.2013
Checked	MK	26.11.2013

Drg. No. 15388 - SK04

Rev. B

REFERENCE DOCUMENTS

REFERENCE DOCUMENTS

Appendix B

Revised Natura Impact Statement

REFERENCE DOCUMENTS

Malachy Walsh and Partners
Engineering and Environmental Consultants

Revised Natura Impact Statement

Upperchurch Windfarm

14708

December 2012

Job number	Revision	Prepared by	Checked by	Status	Date
14708 - 6005	Rev C	CON	JK	Final	26th November 2013

MWP ENVIRONMENT AND PLANNING

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1 Introduction

1.1 Background

Member States are required to designate Special Areas of Conservation (SACs) and Special Protected Areas (SPAs) under the EU Habitats and Birds Directives, respectively. SACs and SPAs are collectively known as Natura 2000 sites. An 'Appropriate Assessment' (AA) is a required assessment to determine the likelihood of significant impacts, based on best scientific knowledge, of any plans or projects on Natura 2000 sites. A screening for AA determines whether a plan or project, either alone or in combination with other plans and projects, is likely to have significant effects on a Natura 2000 site in view of its conservation objectives.

This AA screening has been undertaken to determine the potential for significant impacts of a proposal to construct a 22 turbine windfarm, 1.9 km west of Upperchurch and a further 18 km west of Thurles in county Tipperary, on nearby Sites with European conservation designations (i.e. Natura 2000 Sites). The purpose of this assessment is to determine, the appropriateness, or otherwise, of the proposed project in the context of the conservation objectives of such sites. For clarity of nomenclature this proposal will be described, hereinafter, as the Upperchurch Windfarm.

This Screening for Appropriate Assessment has been undertaken by Malachy Walsh and Partners ecologists.

Assessment of potential impacts on other species of national and community interest does not fall within the scope of this report.

An Environmental Impact Statement has also been carried out in association with the proposed windfarm.

1.2 Legislative Context

The Habitats Directive (92/43/EEC) seeks to conserve natural habitats and of wild fauna and flora by the designation of SACs and the Birds Directive (79/409/EEC) seeks to protect birds of special importance by the designation of SPAs. It is the responsibility of each member state to designate SPAs and cSACs, both of which will form part of Natura 2000, a network of protected sites throughout the European Community.

An Appropriate Assessment is required under Article 6 of the Habitats Directive where a project or plan may give rise to significant effects upon a Natura 2000 Site, and paragraphs 3 and 4 state that:

6(3) Any plan or project not directly connected with or necessary to the management of the site but likely to have a 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 site's 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.

6(4) If, in spite of a negative assessment of the implications for the site and in the absence of alternative solutions, a plan or project must nevertheless be carried out for imperative reasons of overriding public interest, including those of a social or economic nature, the Member State shall take all compensatory measures necessary to ensure that the overall coherence of Natura 2000 is protected. It shall inform the Commission of the compensatory measures adopted. Where the site concerned hosts a priority natural habitat type and/or a priority species, the only considerations which may be raised are those relating to human health or public safety, to beneficial consequences of primary importance for the environment or, further to an opinion from the Commission, to other imperative reasons of overriding public interest.

The current assessment was conducted within this legislative framework and also the recent DoEHLG (2009) guidelines. As outlined in these, it is the responsibility of the proponent of the project developer to provide a comprehensive and objective Screening for Appropriate Assessment, which can then be used by the competent authority in order to conduct the Appropriate Assessment (DoEHLG, 2009).

1.3 Stages of AA

A Screening for Appropriate Assessment (AA) has been prepared by Malachy Walsh and Partners, to determine the likelihood of significant impacts, if any, of the proposal to construct a 22 turbine windfarm and all associated works located 1.9km west of Upperchurch village and a further 18km west of Thurles in County Tipperary, on nearby sites with European conservation designations (i.e. Natura 2000 sites). A Natura Impact Statement (NIS) has also been undertaken and is presented in this report after the screening stage.

The AA process is a four-stage process to complete the AA, with issues and tests at each stage. An important aspect of the process is that the outcome at each successive stage determines whether a further stage in the process is required. This proposal has proceeded as far as Stage 2 only.

The first stage of the AA process and that undertaken to determine the likelihood of significant impacts of this proposal is:

Stage 1: Screening.

The second stage of the AA process assesses the impact of the proposal (either alone or in combination with other projects or plans) on the integrity of the Natura 2000 site with respect to the conservation objectives of the site and its ecological structure and function. A Natura Impact Statement was prepared for this proposed development. A Natura Impact Statement

containing a professional scientific examination of the proposal is required and includes any mitigation measure to avoid, reduce or offset negative impacts:
Stage 2: Natura Impact Statement (NIS).

If the outcome of Stage 2 is negative i.e. adverse impacts to the sites cannot be scientifically ruled out, despite mitigation, the plan or project should proceed to Stage 3 or be abandoned. This stage examines alternative solutions to the proposal:
Stage 3: Assessment of alternative solutions.

The final stage is the main derogation process examining whether there are imperative reasons of overriding public interest (IROPI) for allowing a plan or project to adversely affect a Natura 2000 site where no less damaging solution exists:
Stage 4: Assessment where no alternative solutions exist and where adverse impacts remain.

In summary, the purpose of the Screening stage is to determine the necessity or otherwise for a NIS. Screening for AA examines the likely effects of a project or plan, alone and in combination with other projects or plans, upon a Natura 2000 site and considers whether it can be objectively concluded that these effects will not be significant. If it is determined during screening that the proposal may have a significant effect on a Natura 2000 site then a NIS will need to be prepared. A Screening exercise has been undertaken and concluded that a NIS was required. The Screening is outlined in section 2 below as it now forms part of the overall NIS. The NIS is presented in Section 3 below.

1.4 Screening Steps

This Screening for AA, or Stage 1 of AA, has been undertaken in accordance with the European Commission Methodological Guidance on the provision of Article 6(3) and 6(4) of the ‘Habitats’ Directive 92/43/EEC (EC, 2001) and the European Commission Guidance ‘Managing Natura 2000 sites’ (EC, 2000).
Screening for AA involves the following:
Establish whether the plan is necessary for the management of a Natura 2000 site;
Description of the Plan;
Identification of Natura 2000 sites potentially affected;
Identification and description of individual and cumulative impacts likely to result from the plan;
Assessment of the significance of the impacts identified above on site integrity; and
Exclusion of sites where it can be objectively concluded that there will be no significant effects.

Stage 1, Screening, examines whether or not likely effects upon a Natura 2000 site will be significant and determines whether the AA process for the proposed windfarm needs to proceed to Stage 2.

1.5 Assessment Methodologies

1.5.1 In house Consultation with Design Engineers

Consultation with the client, Ecopower Developments, and with Malachy Walsh and Partners' in-house engineering team was conducted on an ongoing basis in order to formulate a project design which would avoid, by design and at source, any construction activities that could initiate potential water quality impacts. As a consequence, all aspects of the construction of the proposed windfarm and its layout adopted an avoidance by design approach. An example of this aspect of the avoidance by design approach is the fact that the windfarm roads and the turbine sites for the most part were located on the least ecologically sensitive areas found during the site investigation in order to minimise potential impacts. In addition, it was decided to remove if possible, from the projects design, all elements that could impinge on the conservation interests of the nearby Lower River Suir cSAC and the Lower River Shannon cSAC located downstream thereby avoiding impacts at source.

1.5.2 Desk Study

A desk study was carried out to collate available information on the proposal site's natural environment. This comprised a review of the following publications and datasets:
OSI Aerial photography and 1:50000 mapping;
National Parks and Wildlife Service (NPWS);
BirdWatch Ireland;
Teagasc soil area maps (NBDC website);
Geological Survey Ireland (GSI) area maps;
Environmental Protection Agency (EPA) water quality data;
Shannon River Basin District (ShRBD) datasets (Water Framework Directive);
South Eastern River Basin District (SERBD) datasets (Water Framework Directive); and
National Biodiversity Centre (NBDC) (on-line map-viewer).

1.5.3 Ecological Site Surveys

1.5.3.1 *Habitat surveying, mapping and evaluation*

Field surveys were conducted by ecologists during the month of June 2012. Habitats were categorised according to the Heritage Council's '*A Guide to Habitats in Ireland'* (Fossitt, 2000) to level 3.

The habitat mapping exercise had regard to the 'Best Practice Guidance for Habitat Survey and Mapping' (Smith *et al.* 2011) published by the Heritage Council. Laminated A3 aerial photography was used together with a GPS to accurately enable field navigation. Habitat categories, characteristic plant species and other ecological features and resources were recorded on waterproof field sheets.

Scientific and common names for plants follow Parnell *et al*. (2012) and Blamey *et al*. (1996), respectively. Habitat boundaries and associated attribute data were mapped using desk-based GIS software, namely ArcView 9.2.

1.5.3.2 *Water quality and aquatic habitat assessment*

In order to to collect baseline water quality data and in order to conduct fisheries and riparian habitat evaluations, a programme of biological and physico-chemical water quality assessments were undertaken in the waterways draining the area of the proposed windfarm. Streams in the vicinity of the proposed development were surveyed by an ecologist on the 11th of June and 22nd of August, 2012. A total of six sampling points were strategically identified at locations within the catchment areas of the proposed Upperchurch Windfarm site in order to assess and give an indication on the water quality in the immediate area surrounding the proposed windfarm site.

Biological water quality monitoring refers to Q Value system of ranges where the relationship between water quality and the in-stream macroinvertebrate community is described in numerical terms. A Q value of 5 indicates very high water quality while a Q value of 1 indicates poor water quality. Kick sampling, where the river bed is disturbed using the foot immediately upstream of a kick net, which collects the sample, was conducted at five sampling stations just downstream of the study area. Macroinvertebrate samples were returned to the laboratory where species within each kick sample were identified to genus level. Differing macroinvertebrate species are assigned to a group according to its tolerance of or sensitivity to water pollution. A river is then assigned a Q value based on these groupings. Table 1, below indicates the relationship between Q values and water quality.

Table 1: Relationship between biotic index (Q-value) and water quality.

Biotic Index	EPA Water Quality	Water Framework Directive Ecological Status	Quality Status
Q5	Good	High	Unpolluted Waters
Q4-5	Fair - Good	High	
Q4	Fair	Good	
Q3-4	Doubtful - Fair	Moderate	Slightly Polluted Waters
Q3	Doubtful	Poor	Moderately Polluted Waters
Q2-3	Poor - Doubtful	Poor	
Q2	Poor	Bad	Seriously Polluted Waters
Q1-2	Bad - Poor	Bad	
Q1	Bad	Bad	

1.5.3.3 *Ornithological surveys*

Winter Hen Harrier Survey 2010/2011

Field surveys were undertaken at the proposed site in order to examine the usage and activity of hen harriers at the site during the winter of 2010/2011.

Vantage Point Observations

Vantage point observations were carried out in order to assess the level of raptor activity and purpose at the development site. These observations were carried out in accordance with NPWS hen harrier survey guidelines. Three (3) vantage point locations were selected in order to obtain maximum visibility of the site and habitats outside the site boundary.

Vantage point watches were of six (6) hours duration and the three vantage points were watched for a total of eighteen (18) hours per site visit. During the course of the survey from November 2010 to March 2011 the site was watched for a total of ninety (90) hours. The locations of the vantage points are illustrated in Figure 6-7 at the end of this report.

Summer Hen Harrier Survey 2011

Vantage Point Observations

Vantage point observations were carried out in order to assess the level of raptor activity and purpose at the development site during the summer of 2011. These observations were carried out in accordance with NPWS hen harrier survey guidelines. The vantage point locations chosen for the summer hen harrier survey remained the same as those chosen for the winter hen harrier survey.

Vantage point watches were of six (6) hours duration and the three vantage points were watched for a total of eighteen (18) hours per site visit. During the course of the summer survey from April to July 2011 the site was watched for a total of seventy two (72) hours. The locations of the vantage points are illustrated in Figure 6-7 at the end of this report.

Transect surveys

Winter Transect counts were undertaken on 19th January and 16th March 2011 at five locations across the site and their locations are illustrated in Figure 6-8 at the end of this report. Transect counts were undertaken on 19th May and 12th July 2011 at the same five locations as the winter bird survey.

1.5.3.4 *Otter survey*

A survey for signs of otters, including scat and evidence of otter holts, was carried out in conjunction with the programme of water quality assessments described above and during the ecological site visits.

1.5.4 Assessment of Potential Impact Significance

Once the potential impacts that may arise from the proposal are identified the significance of these is assessed through the use of key indicators:

Habitat loss;

Habitat alteration;
Habitat or species fragmentation;
Disturbance and/or displacement of species; and
Water quality and resource.

In line with the EPA Guidelines (EPA, 2002), the following terms are defined when quantifying duration:
Temporary: up to 1 year;
Short-term: from 1-7 years;
Medium-term: 7-15 years;
Long-term: 15-60 years; and
Permanent: over 60 years.

The criterion for confidence levels of the predicted likely impacts are given here in Table 1 as recommended by IEEM, (2006) and NRA, (2009).

Table 2: Confidence levels of predictions of likely impacts as outlined in NRA (2009) and IEEM (2006).

Confidence level category	
Near certain	>95% chance of occurring as predicted
Probably	50-95% chance of occurring as predicted
Unlikely	5-50% chance of occurring as predicted
Extremely unlikely	<5% chance of occurring as predicted

The impact significance criteria follow EPA guidance (EPA, 2002).

Table 3: Significance of impact (EPA, 2002).

Significance of Impacts	**Definition**
Imperceptible Impact	An impact capable of measurement but without noticeable consequences.
Slight Impact	An impact which causes noticeable changes in the character of the environment without affecting its sensitivities.
Moderate Impact	An impact that alters the character of the environment in a manner that is consistent with existing and emerging trends.
Significant Impact	An impact which, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment.
Profound Impact	An impact which obliterates sensitive characteristics.

2 Stage 1 Screening

2.1 Management of Natura 2000 Site

The proposal is not connected with or necessary to the conservation management of a Natura 2000 site.

2.2 Description of Project

2.2.1 Brief Project Description

In this revision of the NIS for the RFI it is important to note that T22 has been moved 110m to the south. It is in the same habitat type, however, and it is now a distance of 419m (previously 458m) from the nearest watercourse and 2.1km (previously 2.0km) to the Slievefelim to Silvermines SPA.

It is proposed to construct the 22 turbine windfarm at a location situated approximately 1.9 km west of the village of Upperchurch and a further 18 km west of Thurles in County Tipperary. The turbines are numbered T01 to T22 and are arranged in four clusters as follows:

T01 to T08 are arranged around two hills at Shevry;
T09 to T16 are arranged around the hill at Knocknamena;
T17 to T21 are arranged around two hills at Knockmaroe and Foilnaman; and
T22 is a single turbine on the northeast side of the hill at Knockcurraghbola.

The individual clusters occur within a series of small hills or drumlins and are distributed over an area of 12km^2. The hills are at elevations of between 363mOD and 411mOD and the peaks are generally at heights of 100m above the intervening lower terrain. The highest peak is that of Knockmaroe at an elevation of 411mOD (Grid Ref: R193372 160945). All of the proposed wind turbine locations are on elevated sloping ground with good natural drainage to the streams in the surrounding valley.

2.2.2 Purpose of the Project Proposal

The purpose of the project is to generate electricity from wind energy and to export to the national grid. It will produce pollution free electricity with the capacity to provide power, generating 150 million kWh, for up to 23,070 homes.

2.2.3 Description of the Site

The principal land uses within the greater area are pasture (dairy farming and dry cattle) and some blocks of conifer plantation occur within the site. The surrounding local landscape is a mixture of predominantly improved agricultural grassland, acidic grassland, upland blanket bog with some of this habitat forming mosaics with wet heath.

An ecological survey, conducted as part of the EIS associated with the proposed windfarm, determined that the habitats listed at Table 4, below, comprise the habitats in the area of the proposed windfarm.

It was clear from the ecological survey that the extent of upland blanket bog habitat within the site boundary and the greater geographical area was larger historically. Both the quality and extent of this habitat has been significantly reduced by peat-cutting and agricultural land management practises including drainage, grazing, fertilisation and reseeding. There is evidence of peat harvesting in the past with small areas of this habitat occurring within limited sections of the site where peat banks of up to 1.3 m can be seen.

The soil composition within the turbine cluster areas is, variously comprised of mosaics of 'Surface water Gleys / Ground water Gleys acidic' ,'Lithosols / Regosols', 'Podzols Peaty', 'Shallow Peaty Gleys' and 'Acid Brown Earths/ Brown Podzolics'. Bedrock at the location is 'Silurian Metasediments and Volcanics' with some rock outcropping, most notably at the northeast part of the site.. The Corine Landcover classes 'Pasture', 'Bog', 'Other' and 'Forestry' are the dominant types in the area around the windfarm and in the greater geographical area extending away from the proposal site[1].

Three first order streams situated adjacent to the proposed windfarm site drain into streams that form the upper reaches of the Turraheen, Owenbeg, Clodiagh and Aughvana Rivers. The first three of these rivers form part of the South Eastern River Basin District and ultimately join the River Suir to the southeast. The Aughvana River, which forms part of the Shannon River Basin District, joins the Mulkear River and ultimately flows into the River Shannon to the east of Limerick City.

The site drains to the different rivers as follows:

Suir Catchment

The area around turbines T01 and T02 drains towards the west to an unnamed tributary of the Turraheen River.

The area around turbines T03, T04, T05 and T06 drains to the southeast to the Owenbeg River and its tributaries.

The area around turbines T07, T08 and T09 drains to the north to the streams that form the upper reaches of the Clodiagh River.

The area around turbines T10, T11, T13 and T15 drains to the south and southeast to tributaries of the Owenbeg River.

The area around turbines T12, T14 and T16 drain to the west and north to the Clodiagh River.

The areas around turbines T19, T20, T21 and T22 drain in different directions to unnamed tributaries of the Clodiagh River to the north.

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[1] Data in this paragraph from http://maps.biodiversityireland.ie/#/Map [accessed 06/09/2012]

Shannon Catchment

The area around turbines T17 and T18 drains south to an unnamed tributary of the Aughvana River. This is the only part of the overall site that forms part of the Shannon River Basin District.

2.2.4 Ecological description of the proposed Upperchurch Windfarm Site

2.2.4.1 *Terrestrial Ecology*

Habitat surveys were conducted by ecologists during the month of June 2012. Habitats were categorised according to the Heritage Council's 'A Guide to Habitats in Ireland' (Fossitt, 2000) to level 3. A total of 13 habitats types were identified within the proposed Upperchurch Windfarm EIS study area. The predominant habitats within the site are improved agricultural grassland and conifer plantation.

See Volume 2 Chapter 6 Figure 6-4 A, B and C for a habitat map of the proposed Upperchurch Windfarm site. Site photographs of habitats are presented in Appendix 6-1, Volume 3. Table 4, below, lists the habitats recorded during the habitat survey with a qualitative description.

Table 4 Summary list of habitats recorded with spatial description

Habitat (code)	Evaluation
Improved Agricultural Grassland (GA1)	There is an extensive cover of Improved Agricultural Grassland throughout the site. The habitat is not species rich (as per agricultural grassland) but is of value to species which forage within it.
Coniferous Plantation (WD4)	There are 5 stands of conifer plantation within the study area planted on heath/upland blanket bog habitat. The dense growth within this habitat means there is very little light penetration reducing the diversity of plant species at ground level. Some areas have been felled and replanted. The younger stands have much more diverse vegetation undergrowth.
Wet Grassland (GS4)	This habitat is common in the lower lying areas and along margins of streams of the site. The wet grassland habitat has been modified by the building of drains around the field boundaries, reseeding and the application of fertiliser. While generally species poor the habitat is considered to be of some ecological value.
Wet Heath (HH3)	An area to the west of T2 in the south eastern section is classified as wet heath. This area was dominated by bell heather and purple moor-grass. This area would be subject to cattle grazing. Peat depth is low, approximately 0.3m. Formed due to peat extraction.
Acid Grassland (GS3)	This habitat occurs mainly outside of the enclosed grassland farm areas in areas where no reclamation has taken place but is extensively grazed by cattle. This habitat occurs to the south east of turbines T3 and T4 and on steep slopes to the northwest of turbine T21.
Upland Blanket Bog (PB2)	Upland blanket bog is one of the least dominant habitats within the study area. The habitat has been degraded by previous peat extraction, land reclamation, conifer plantation, grazing and drainage.
Eroding/Upland River (FW1)	There are 3 small, first order streams within the study area. These streams are quite small. Extensive man made drainage features drain into these habitats to dry out the surrounding low lying landscape.
Hedgerow (WL1)	There is a network of hedgerows along the improved grassland field boundary throughout the site.
Drainage Ditches	Man-made features extending around the boundaries of lower lying

Habitat (code)	Evaluation
(FW4)	agricultural fields and conifer plantation within the study area. Many are large with some vegetation.
Spoil and Bare Ground (ED2)	The forestry and farm roads within the site fall into this habitat category and are dominated by compact gravel which is naturally occurring to the area
Buildings and Artificial Surfaces (BL3)	Habitat of very low ecological value.
Treelines (WL2)	There are some small sections of treelines within the study area which mostly occur along tree-lined roads.
Neutral Grassland (GS1)	One section of this habitat near turbine T22.

2.2.4.2 *Aquatic Ecology*

A water quality assessment was undertaken of the waterways draining the proposed windfarm site to provide baseline water quality, fisheries and riparian habitat data. Watercourses in the vicinity were surveyed by an ecologist on the 11th of June and the 22nd August 2012.The survey results will provide a baseline for future monitoring to ensure that the existing water and habitat quality of watercourses within and adjacent to the site are maintained during the construction and operational phase of the proposed windfarm development.

The study area is situated on hills or drumlins with a number of streams that support the upper reaches of the Owenbeg, Clodiagh and Turraheen River catchments which drain to the Suir. Tributaries of the Clodiagh River drain the northern and central locations of the site while the southern and eastern portion of the site are drained by tributaries of the Owenbeg and Turraheen Rivers. The westerly cluster comprised of turbines T17 and T18 is drained by an unnamed tributary of the Aughvana River and is the only part of the overall site that forms part of the Shannon River Basin District.

A total of six sampling points were strategically identified at locations within the catchment area of the proposed Upperchurch Windfarm site in order to assess and give an indication on the water quality in the immediate area surrounding the proposed site.Table 5 below details the Grid References and Q value of each sampling station on which the survey was undertaken.

Table 5 List of Sampling Stations with Q values

Sampling Station	Grid Reference	Location	Q Value
1	97973 61082	Unnamed stream (east of site) which flows to the Owenbeg River	Q3
2	97336 59293	Owenbeg river (east of site)	Q4
3	94363 59329	Unnamed stream (southern section of the site) which flows to the Turraheen River	Q4
4	95056 62330	Unnamed stream (central area of site) which flows to the Clodiagh River	Q4
5	94623 63001	Unnamed stream (northern section of the site) which flows to the Clodiagh River	Q4-5
6	93464 59759	Unnamed stream (southern section of the site) which flows to the Aughvana River	Q3

2.2.4.3 *Physiochemical water quality*

Table 2-6: Physiochemical water quality recorded at the Upperchurch site, Co. Tipperary.

Parameter	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Salmonid Regulations S.I. No. 293 of 1988	Surface Water Regulations S.I. No. 272 of 2009
pH	7.5	7.6	7.2	7.7	7.6	7.7	>6 & <9	
Alkalinity, mg/L as CaCO3	72.5	62.9	91.1	81.0	56.6	119		
Temperature	11.28	11.98	10.03	12.29	12.46	12.10		

Parameter	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Salmonid Regulations S.I. No. 293 of 1988	Surface Water Regulations S.I. No. 272 of 2009
Suspended solids mg/L	3	2	6	<2	<2	18	<25	
BOD (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0	1.4	<5	<2.2
Nitrate(mg/L) NO3-N	1.08	0.73	2.07	1.23	0.65	1.95		
Nitrite (mg/L)NO2-N	<0.005	<0.005	<.005	<.005	<.005	0.01	<0.05	
Sulphate (mg/L)	5.14	4.85	5.70	4.78	4.56	4.36		
MRP, mg/L P	0.01	0.01	0.01	0.02	0.01	0.06		≤0.035
Total phosphorous P (mg/L)	0.09	<0.04	0.16	0.06	0.04	<0.04		
Total dissolved phosphorous P (mg/L)	0.09	<0.04	0.12	0.06	0.04	<0.04		
Particulate phosphorous (mg/L)	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04		
Ammonia	0.03	0.02	<0.02	0.03	0.02	<0.02	≤ 1	
Ammonia (unionised)	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	≤ 0.02	
Metals								
Iron (mg/L)	0.251	0.146	0.025	0.089	0.110	0.16		
Aluminium (mg/L)	0.019	0.042	0.023	0.037	0.024	0.05		

Physiochemical water quality testing was undertaken on the 11th of June and 22nd of August 2012 at the same location as the Q value sampling to establish the baseline water quality of watercourses immediately downstream of the proposed windfarm.

Dissolved oxygen levels were >11mg/L in all the watercourses that were surveyed, indicating that all of the surface waters in the catchment areas had levels of oxygen capable of supporting healthy salmonid populations as per the Salmonid Water Regulations (SI No. 293 of 1988) .The pH levels at all sampling stations ranged between 7.5 and 7.7. These fall within the range >6 and <9 required under the Salmonid Water Regulations (S.I. No. 293 of 1988), required for balanced and healthy fish populations in the Salmonid Regulations.

Levels of unionised ammonia and nitrite recorded were within the thresholds specified in the Salmonid Regulations (S.I. No. 293 of 1988).Similarly the BOD levels were low with sites 1 through 5 inclusive, recording <1.0mg/L BOD and site 6 recording the highest levels; 1.4mg/L BOD. All sites were in compliance with the Salmonid Water Regulations.

Ortho-phosphate (MRP) levels were similar across sampling sites with 0.01mg/L levels recorded at sites 1, 2, 3 and 5 with site 4 recording 0.2mg/L and site 6 recording the highest levels of 0.06mg/L. Sites 1 through 5 levels are below the levels recommended in the Surface Water Regulations (S.I. No. 272 of 2009) meeting the requirements of the regulation, however site 6 exceeds the ≤0.035 recommended levels.

The suspended solid levels were low for streams 1 through 5, with levels recorded ranging from 2mg/L to 6mg/L. The value at sampling station 6 was the highest at 18 mg/L. All streams were in compliance with the threshold of <25mg/l required under the Salmonid Water Regulations (S.I. No. 293 of 1988).

2.2.5 Characteristics of the Project (Construction Phase)

2.2.5.1 *Size, scale, area, land-take*

The proposed windfarm site does not require land take from a Natura 2000 or Ramsar site. The proposed windfarm site is made up of four sections distributed in separate clusters over an overall area of approximately 12km^2. The total proposed site footprint is 110,210 m^2

2.2.5.2 *Resource requirement*

It is estimated that a total of 17,020m^3 of material will be required for the widening of existing tracks and the construction of new access tracks for the proposed development. It is estimated that construction of the hardstand areas will involve a total volume of 31,100m^3 of imported stone material. It is proposed to source the materials from at local registered quarries.

An average of 345m^3 of imported concrete will be required for each base.

2.2.5.3 *Transportation requirements*

New and upgrading of existing access tracks will be required to facilitate construction and turbine traffic during the construction, operational and decommissioning phases.

It is proposed that the turbine components will be delivered either from Dublin port or Foynes port. If the components are delivered from Dublin Port they will be transported west along the M7 to the Nenagh by-pass and turn onto the R498 at Knockalton Upper. If the turbine components are delivered from Foynes Port they will be transported east on the M7 to the Nenagh by-pass and turn right on the R498 at Knockalton Upper. The traffic will then travel the R498 into Thurles and turnaround at the Tipperary Institute roundabout and travel back up the R498 for 2.5km in order to effect the turn left onto the R503 after the Racecourse. The vehicles will travel west along the R503 for 17.1km and turn left onto the proposed Upperchurch Windfarm site entrance at an existing field gate at Graniera. The turbine deliveries and construction traffic will also use entrances from the local roads at Knockmaroe, Knockcurraghbola Commons, Shevry, Grousehall and Knocknamena Commons. It is expected that construction materials will be transported along a similar route.

2.2.5.4 *Equipment requirement*

In association with the above materials the following is a non-exhaustive typical list of plant and equipment that may be required for construction:

30-50T Excavators;

Low ground pressure excavators (Bogmaster);

Mobile cranes for construction;

Rebar/shuttering/precast units/conc pipes/box culverts;

Cranes (1 main, 1 assist) Erection 120t to 800t;
Dump trucks;
Tractors and trailers;
Double contained fuel bowsers;
12t Rollers;
Crushers;
Screener;
Diesel powered generators; and
Water bowsers.

2.2.5.5 *Excavation requirements*

Implementation of the development will result in the removal of soil, subsoil and rock in parts of the site in order to facilitate the construction of access roads, the upgrade of existing farm roads, the substation compound, crane hard standings and turbine bases. This soil will be reused within the construction site for backfilling around turbine bases and for landscaping post construction.

The volumes of material to be excavated are summarised in Table 7**Error! Reference source not found.**.

Table 7 Volumes of material to be excavated

Element	Topsoil (m^3)	Peat (m^3)	Subsoil (m^3)
Turbine T01	540	-	4,281
Turbine T02	527	-	3,832
Turbine T03	481	-	2,160
Turbine T04	540	-	4,281
Turbine T05	-	570	5,318
Turbine T06	540	-	4,281
Turbine T07	545	-	4,433
Turbine T08	518		3,255
Turbine T09	545	-	4,433
Turbine T10	507	-	3,160
Turbine T11	498	-	2,725
Turbine T12	550	-	4,798
Turbine T13	540	-	4,281
Turbine T14	-	520	3,603
Turbine T15	520	-	3,603
Turbine T16	518	-	3,255
Turbine T17	505	-	2,928
Turbine T18	505	-	2,928
Turbine T19	498	-	2,725
Turbine T20	518	-	3,255
Turbine T21	505	-	2,928
Turbine T22	507	-	3,160
New roads	13,050	900	0
Widened roads	2,070	360	0
Sub-totals (m^3)	25,527	2,855	79,623
Total (m^3)	107,500		

2.2.5.6 *Emissions during the lifetime of the project*

Air pollutants from construction vehicles, plant, machinery or generators may include emissions of SO_2, NO_x, CO_2, and PM_{10} (particulates). Any traffic generated by the construction phase will be temporary and of short duration and may cause a temporary, slight, negative impact within the site.

There are no air pollutants or emissions associated with the operational phase of the windfarm. As a result there will be a neutral impact on the local area during the operational phase. The operation of the windfarm will have a positive impact on the national air and climate environment however, through the provision of pollution-free electricity.

2.2.5.7 *Waste Management*

From a waste management perspective the project can be divided into three phases
Construction;
Operation/Maintenance; and
Decommissioning.

Construction phase waste may consist of hardcore, stone, concrete, steel reinforcement, shuttering timber and unused oil and diesel. This waste will be collected at the end of the construction phase and taken off site to be reused, recycled and disposed of in accordance with best practice procedures at an approved facility. Waste from toilets will be taken from site on a regular basis by approved contractors and disposed of in an authorised facility in accordance with best practice. Plastic waste will be taken for recycling by approved contractor and disposed or recycled at an approved facility.

Wastes arising during the operating phase of the project include but are not limited to lubricating oils, cooling oils and packaging from spare parts. The containment and disposal of such oils will be carried out in a safe manner by an approved contractor. Such operations will be carried out in accordance with the Waste Management (Hazardous Waste) Regulations, 1998. The remaining wastes will all be removed from site and reused, recycled or disposed of in an authorised facility in accordance with best practice.

Wastes generated during the decommissioning phase will be taken off site and disposed of appropriately.

2.2.5.8 *Timescales*

Once construction commences, it is estimated that the windfarm could be constructed within 8 months.

2.2.6 Description of construction

The first priority of the construction phase will be to construct the access road network, and associated drainage network, and upgrade the existing roads and the spine roads in particular so that they are capped with limestone or similar quality stone to reduce the potential for road degradation. Vehicular movements will be restricted to the footprint of the proposed development, particularly with respect to the newly constructed access roads.

The development is characterised by the following civil engineering works which will be undertaken to provide the necessary infrastructure to complete the windfarm:

Construction of a temporary site compound;
Construction of the access tracks and associated drainage;
Construction of stream crossing;
Construction of the turbine foundations;
Construction of the hard stand areas for the turbine assembly and erection;
Turbine and ancillary equipment transport to the site;
Turbine erection;
Construction of the electrical control building; and
Laying of electrical cables.

2.2.6.1 *Temporary site compound*

A temporary site compound will be used at the site during the construction period for the safe storage of supplies and equipment, and the provision of toilet facilities (with temporary holding tank) and canteen facilities for construction staff. The holding tank will be emptied on a regular basis and taken to a wastewater treatment facility by a contractor with the appropriate waste collection permit. The compound and associated facilities will be removed on completion of construction and the area will be appropriately reinstated.

2.2.6.2 *Access Roads*

The construction phase of this project will require deliveries of material and turbines to the site. The access roads to the turbines and the site substation will consist of both existing tracks and newly constructed roads.

Importation of stone from local quarries for the construction of access roads and hard standings.
Construction of 8.0 km of 5.00m wide new roads; and
Widening and upgrading of 3.9 km of existing farm roads (average 2m widening).

All new roads will be excavated, built up with suitable material and capped with suitable material.

2.2.6.3 *Drainage*

Site drainage has been considered in the Sediment and Erosion Plan detailed in Appendix 15.2 Volume 3. of the EIS. This plan has been prepared to prevent sediment runoff and control erosion during the construction phase of the project. The plan has also been designed to minimise disturbance to the current hydrological regime and to minimise suspended sediment loading to watercourses during construction. Access tracks will be provided with drainage ditches to collect surface water runoff from the tracks and to ensure that road foundations are protected from standing water. Surface water drains will also be provided around hardstandings, foundations and the compound. Upslope drains will be constructed so as to keep clean water separate from runoff that may be contaminated by sediment. This is standard practice in the control of sediments in windfarm construction. Sediment traps will be used to ensure that all water discharged is clean.

2.2.6.4 *Clearfelling*

Prior to construction, clear-felling of approximately 4.35 ha area of conifer plantation will be required to facilitate the construction the proposed windfarm and associated infrastructure.

2.2.6.5 *Wind Turbine foundations and hardstands*

Excavation for the construction of 22 turbine bases with a minimum depth of 2.00m and 225m^2 plan area and hardstands with and excavation depth of 0.60m and 1,040m^2 plan area;

Each wind turbine will have a reinforced concrete base pad foundation with a central upstand above the base, which will support the tower. The foundation pad will bear onto rock or other such suitable bearing stratum.

The turbine foundations be backfilled with the materials removed during excavation. The surface vegetation and topsoil layer will be removed and stored adjacent to the foundation site, whilst excavation of the foundation progresses. This stored material will be used during reinstatement of the foundation area following the construction of each wind turbine foundation.

Erection of 23 turbines with hub heights of up to 85m and maximum tip height of up to 126.60m. Once erected the wind turbines will operate automatically, requiring visits on a periodic basis only. These visits, primarily for turbine servicing, will typically be made using four-wheel drive vehicles which will keep to access roads.

2.2.6.6 *Sub-station and grid connection*

Construction of an electrical substation compound and installation of associated equipment and laying of electrical cable between turbines and the substation compound will be required. The substation compound will measure 64m x 41m. The cabling from the proposed turbines of the Upperchurch Windfarm will link to the proposed sub-station on site. The cables linking the turbine transformers will be located underground to reduce visual impact. A trench of at least 1m deep and 0.5m wide will accommodate these cables.

2.2.7 Operation, decommissioning and restoration

The windfarm will have a projected commercial lifespan of 20-25 years during which time it will produce pollution free electricity with the capacity to provide power, generating 150 million kWh, for up to 23,070 homes. There will be maintenance during the operating period with operating and maintenance personnel typically using four-wheel drive vehicles to visit the site. The system may be readily upgraded at the end of its commercial life, or alternatively decommissioned.

If it is decided to decommission the windfarm at the end of its lifespan, the turbines, transformers, meteorological monitoring mast and substation will be dismantled and removed from the site following consultation with North Tipperary County Council. All associated hardstand areas will be remediated to match the surrounding landcover at the time. An environmental assessment will be undertaken at that time to ascertain whether or not it would be more or less environmentally damaging to remove or keep in place the underground cables and access tracks. All materials removed from the site will be treated in accordance with best practice waste management procedures and will be in consultation with North Tipperary County Council.

2.2.8 Identification of other projects or plans

There are a number of existing windfarms to the west and south of the site. These are listed at Table 8, below.

Table 8: Neighbouring Windfarms in the vicinity existing and permitted.

Wind farm	Number of Turbines	Distance and direction from proposed site	Status
Knockastanna, Co Limerick	4	8.1km S	Operating
Mienvee	1	9km SW	Operating
Garracummer	15	3.5km SW	In Construction
Falleennafinoga	2	5.5km S	In Construction
Hollyford	3	5.5km S	Permitted
Glencarbry	9	6.3kn S	Permitted
Glenough	14	3.2kn S	Operating
Cappagh White	18	8.5km S	Permitted
Curraghgraigue	6	9.5km N	Operating
Knockmeale	2	8.2km NW	Permitted
Knockastanna, Co Limerick	4	8.1km S	Operating

Other relevant projects and plans include:

Agriculture is one of the main land uses within the area. Land reclamation, drainage, reseeding, fertilisation, and intensive grazing has transformed the landscape of this area.

Forestry occurs within sections of the site**,** consisting of either mature or young conifer plantations. Felling has been carried out in sections and has been replanted with the youngest observed at the location of Turbine 22 standing at 1.5 meters high.

2.3 Identification of Natura 2000 sites

2.3.1 Zone of impact influence

The screening stage of AA involves compiling a 'long list' of European sites within a zone of potential impact influence for later analysis which may or may ultimately not be impacted upon by the proposal. All Natura 2000 sites within 15km of the proposal location will be characterised in the context of the rationale for designation and qualifying features, in accordance with NPWS guidance. Following this, the potential impacts associated with the proposal will be identified before an assessment is made of the likely significance of these impacts. Finally, in the conclusion of the screening stage, the Natura 2000 sites within 15km whose integrity will not be adversely impacted will be ruled out. If screening indicates sites will be affected it will be necessary to proceed to Stage 2, Appropriate Assessment for a more detailed assessment.

2.3.2 Identification of Natura 2000 and Ramsar sites

Adopting the precautionary principle in identifying potentially affected European sites, it has been decided to include all cSACs and SPAs/Ramsar sites, within a 15km radius of the proposed windfarm site. The Convention on Wetlands of International Importance especially as Waterfowl Habitat, more commonly known as the Ramsar Convention, was ratified by Ireland in 1984. Ramsar sites are also subject to AA screening. Although not specifically required, it would be considered best practice to include Ramsar sites (classified under the Ramsar Convention 1971) in the appropriate assessment process[2].

Table 9 below lists all designated cSACs and classified SPA sites (referred to as designated sites from hereon in) within 15km of the proposal site including their proximity.

Table 9: Designated conservation sites within a 15km radius of proposal site

No.	Designated Site	Site Code	Proximity of site to nearest point of designated site
1	Slievefelim to Silvermines Mountains SPA	004165	Adjacent to the western boundary of turbines T17 to T21.
2	Anglesey Road cSAC	002125	2.55km south west of the proposed windfarm site.
3	Lower River Shannon cSAC	002165	2.7km west of the site boundary (T17 to T21).
4	Lower River Suir cSAC	002137	2.8km east of the proposed windfarm site and approximately 4.1km downstream.
5	Bolingbrook hill SAC	002124	6.9km north west of the site

[2] EPA, A Note on Waste Water Discharging Licence Appropriate Assessments

No.	Designated Site	Site Code	Proximity of site to nearest point of designated site
			boundary (T17 to T21).
6	Keeper Hill SAC	001197	10.7km north west of the site boundary (T17 to T21).
7	Silvermines mountains West SAC	002258	11.25km north west of the site boundary (T17 to T21).
8	Kilduff, Devilsbit Mountain SAC	000934	13.35km north east of the site boundary (T9 to T16)
9	Philipston Marsh SAC	001847	13.6km south west of the site boundary (T1 to T8).

2.3.3 Characteristics of Natura 2000 and Ramsar sites

Table 10, below, characterises the cSACs, SPA and Ramsar sites that lie within 15km of the proposal site by listing the qualifying features and other conservation interests (information pertaining to designated sites is from site synopses, conservation objectives and other information available on www.npws.ie and on the Ramsar website). The qualifying Features of Interest are the primary reasons for the European sites designation, for instance the endangered species that occupy the SAC; rare habitats that occur there; or threatened birds that breed or over-winter in the SPA.

Table 10: Designated conservation sites with qualifying Features of conservation Interest

Designated Site	Site Code	Features of Interest
Slievefelim to Silvermines Mountains SPA	004165	Hen Harrier (*Circus cyaneus*) [A082]
Anglesey Road cSAC	002125	Species-rich *Nardus* grasslands, on siliceous substrates in mountain areas (and submountain areas, in Continental Europe) [6230]

Lower River Shannon cSAC	002165	Freshwater pearl mussel (*Margaritifera margaritifera*) [1029] Sea lamprey (*Petromyzon marinus*) [1095] Brook lamprey (*Lampetra planeri*) [1096] River lamprey (*Lampetra fluviatilis*) [1099] Salmon (*Salmo salar*) [1106] Sandbanks which are slightly covered by sea water all the time [1110] Estuaries [1130] 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 colonizing mud and sand [1310] Spartina swards (Spartinion maritimae) [1320] Atlantic salt meadows (Glauco-Puccinellietalia maritimae) [1330] Bottle-nosed dolphin (*Tursiops truncatus*) [1349] Otter (*Lutra lutra*) [1355] Mediterranean salt meadows (*Juncetalia maritimi*) [1410] Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation [3260] Molinia meadows on calcareous, peaty or clavey-silt-laden soils (*Molinion caeruleae*) [6410] Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae) [91E0]
Lower River Suir cSAC	002137	Freshwater pearl mussel (*Margaritifera margaritifera*) [1029] White-clawed crayfish (*Austropotamobius pallipes*) [1092] Sea lamprey (*Petromyzon marinus)* [1095] Brook lamprey (*Lampetra planeri*) [1096] River lamprey (*Lampetra fluviatilis*) [1099] Allis shad (*Alosa alosa*) [1102] Twaite shad (*Alosa fallax fallax*) [1103] Salmon (*Salmo salar*) [1106] Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) [1330] Otter (*Lutra lutra*) [1355]

Designated Site	Site Code	Features of Interest
		Mediterranean salt meadows (*Juncetalia maritimi*) [1410] Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation [3260] Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels [6430] Old sessile oak woods with *Ilex* and Blechnum in British Isles [91A0] Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae) [91E0] *Taxus baccata* woods of the British Isles [91J0]
Bolingbrook hill SAC	002124	Northern Atlantic wet heaths with *Erica tetralix* [4010] European dry heaths [4030] Species-rich *Nardus* grasslands, on siliceous substrates in mountain areas (and submountain areas, in Continental Europe) [6230]
Keeper Hill SAC	001197	Northern Atlantic wet heaths with *Erica tetralix* [4010] Species-rich *Nardus* grasslands, on siliceous substrates in mountain areas (and submountain areas, in Continental Europe) [6230] Blanket bog (*active only) [7130]
Silvermines Mountains West SAC	002258	Northern Atlantic wet heaths with *Erica tetralix* [4010] European dry heaths [4030] Species-rich *Nardus* grasslands, on siliceous substrates in mountain areas (and submountain areas, in Continental Europe) [6230] Blanket bog (*active only) [7130]
Kilduff, Devilsbit Mountain SAC	000934	European dry heaths [4030] Species-rich *Nardus* grasslands, on siliceous substrates in mountain areas (and submountain areas, in Continental Europe) [6230]
Philipston Marsh SAC	001847	Transition mires and quaking bogs [7140] Alkaline fens [7230]

Conservation Objectives of the sites outlined in Table 10 above are included in Appendix 1.

2.3.4 Conservation Objectives

According to the Habitat's Directive, the *conservation status of a natural habitat* will be taken as 'favourable' when:

its natural range and areas 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 as defined below.

According to the Habitat's Directive, the *conservation status of a species* means the sum of the influences acting on the species concerned that may affect the long-term distribution and abundance of its populations. The *conservation status* will be taken as 'favourable' when:

population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats, *and*
the natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future, *and*
there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.
These conservation objectives are of a wide-ranging nature and most of the conservation objectives developed by NPWS for Natura 2000 sites area are adapted from these and are published on line by the NWPS as 'Generic Conservation Objectives' documents. The available documents are included in Appendix 2. Site specific Conservation Management Plans have been developed for some sites listed at Table 10, above, namely Bolingbrook Hill, Keeper Hill and Kilduff, Devilsbit Mountain SACs and these documents are published on line at www.npws.ie.
Figures 2 and 3 at the end of this chapter show the Natura 2000 Sites located within 15 km of the proposed development site. No Ramsar Sites were recorded within 15 km of the proposed development. Natural Heritage Areas (NHAs) and proposed Natural Heritage Areas (pNHAs) have been omitted from the list as they outside the scope of the Appropriate Assessment. The potential impact to these sites is discussed in Ecology chapter of the main EIS document Chapter 6, Volume 2.

2.3.5 Identification of Potential Impacts

Potential impacts are identified in this section. Only those features of the development that have the potential to impact on qualifying features, conservation interests and conservation objectives of the identified Natura 2000 sites are considered.

Description of elements of the project likely to give rise to impacts on Natura 2000 sites.	• Use of plant machinery and associated fuels and oils. • Increased levels of disturbance due to human activities during the construction phase. • Waste generation during construction phase. • Excavations for turbine bases, roads etc. • Extension of the existing road network footprint and associated drainage. • Near and in stream works required for road network stream crossings. • Felling of 4.35 ha. of pre-thicket and post thicket conifer plantation
Describe any likely direct, indirect or secondary impacts of the project (either alone or in combination with other plans or projects) on Natura 2000 sites by virtue of: • *Size and scale;* • *Land-take;* • *Distance from Natura 2000 Site or key features of the Site;* • *Resource requirements;* • *Emissions;* • *Excavation requirements;* • *Transportation requirements;* • *Duration of construction, operation etc.; and* • *Other.*	• Construction phase excavations to be conducted within the catchment of a headwater of an SAC designated for the protection of riparian habitats and species have the potential to initiate point source pollution events. • Soil exposed during construction phase could potentially be transferred via surface water runoff to water courses. • Construction of road network, and its associated drainage network, introduces a potential pollution pathway enabling the transfer of pollutants to ground and surface water during construction and operational phases. • Fugitive noise from construction phase activity and human presence could create disturbance impacts on animal species present within the zone of impact influence. • **Movement of plant and machinery**: Most of the traffic movement within the site will be over existing excavated tracks. • **Ground stability**: The approach to and method of excavation of rock and earth materials is very important for ground stability. Interference with the existing ground stability conditions by inappropriate excavation methods such as continuous vehicular movement over excavated soil must be mitigated by appropriate construction methods. • **Storage, Stockpiles and Waste Generation**: Of significance during the construction phase of the

	project is the handling of excavated materials, their storage and re-use. There is potential for negative direct and indirect short-term minor impact on ground stability and negative direct and indirect short-term moderate to significant impact on water quality, for example slope failure due to excessive loading (surcharge) > 1m in height and the resultant release of peat washings and suspended solids to the surface water system. • **Use of Fuels and Oils:** The plant equipment that will be used during the construction stage is run on hydrocarbons. This implies that mobile equipment will require regular refuelling from a fuelling station, which is likely to be stored on site or will be supplied by a truck / tanker that will be scheduled to re-fuel the plant directly. This poses the potential for spillage and leakage of hydrocarbons from plant equipment and associated transfer stations during the construction phase of this project.
Describe any likely changes to the site arising as a result of: • *Reduction of habitat area;* • *Disturbance of key species;* • *Habitat or species fragmentation;* • *Reduction in species density;* • *Changes in key indicators of conservation value; and* • *Climate change.*	• Due to the alteration of the environment rainwater falling on the development footprint will follow a new drainage regime. • Detrimental water quality impacts could cause significant changes in the water quality influencing the conservation status of the aquatic habitats and designated species creating disturbance or displacement impacts.
Describe any likely impacts on the Natura 2000 site as a whole in terms of: • *Interference with the Key relationships that define the structure of the site; and* • *Interference with key relationships that define the function of the site.*	Detrimental water quality impacts could cause significant interference with the key relationships that define the structure and function of the site.
Describe from the above those elements of the project, or combination of elements, where the above impacts are likely to be	The combined elements of the construction phase could potentially create significant impacts in aquatic habitats in streams adjacent to the site and in the Natura 2000 site to which they drain.

significant or where the scale of magnitude of impacts is not known.	

2.4 Assessment of Significance of Potential Impacts

This section considers the list of sites identified in section 2.3 above. The magnitude/extent, probability and duration of significant impacts affecting these sites are examined in the following sections.

It is considered that the proposed windfarm development does not include any element that has the potential to significantly alter the favourable conservation status of species and habitats for which certain Natura 2000 sites, and considered in this document, are designated. It is considered that these sites are outside the zone of impact influence of the proposed windfarm and that the conditions required to initiate a potential 'source-pathway-target' vector connecting the proposed windfarm to these designated sites will not be created. It is further considered that no potential impact pathway connects these designated sites to the location of the proposed works and, therefore, it is objectively concluded that no impact on these sites is reasonably foreseeable as a result of the proposed windfarm. These sites are listed below and will not be considered further in this document.

Anglesey Road cSAC (002125)
Bolingbrook hill SAC (002124)
Kilduff, Devilsbit Mountain SAC (000934)
Silvermines mountains West SAC (002258)
Keeper Hill SAC (001197)
Philipston Marsh SAC (001847)

Therefore, the assessment of significance of potential impacts that follows focuses on the remaining designated sites. These sites are:

Lower River Shannon cSAC (002165)
Lower River Suir cSAC (002137)
Slievefelim to Silvermines Mountains SPA (004165)

The potential for significant impacts on the remaining three Natura 2000 Sites arising from the proposal was determined based on a number of indicators including:

Habitat loss;
Habitat alteration;
Habitat or species fragmentation;
Disturbance and/or displacement of species;
Water quality and resource.

2.4.1 Habitat Loss and Alteration

The proposal considered in this document does not require any land take from any Natura 2000 or Ramsar site. It is considered that no significant habitat loss or alteration impacts, within any of the designated sites considered in this document, are reasonably foreseeable as a result of the proposal considered in this document. Indirect impacts on aquatic habitats are assessed in section 2.4.3 below.

2.4.2 Habitat or Species Fragmentation

Bearing in mind the size, scale and duration of the proposed windfarm and its location relative to the relevant designated sites, it is considered that no significant habitat or species fragmentation impacts are reasonably foreseeable within any of the designated sites considered in this document,as a result of the proposal considered in this document.

2.4.3 Disturbance and/or displacement of species

The species, for which the Natura 2000 sites are designated, can be separated into Aquatic, Terrestrial/Riparian and Avian categories as follows:

2.4.3.1 *Aquatic*

Sea lamprey (P. marinus) [Lower River Suir cSAC and Lower River Shannon cSAC]
Brook lamprey (L. planeri) [Lower River Suir cSAC and Lower River Shannon cSAC]
River lamprey (L. fluviatilis) [Lower River Suir cSAC and Lower River Shannon cSAC]
Salmon (S.salar) [Lower River Suir cSAC and Lower River Shannon cSAC]
Freshwater pearl mussel (M. margaritifera) [Lower River Suir cSAC and Lower River Shannon cSAC]
White-clawed crayfish (A. pallipes) [**Lower River Suir cSAC**]
Allis shad (Alosa alosa) [**Lower River Suir cSAC**]
Twaite shad (A. fallax fallax) [**Lower River Suir cSAC**]
White-clawed crayfish (*A. pallipes*) [***Lower River Suir cSAC***]
Bottle-nosed dolphin (*T. truncatus*) [1349] [***Lower River Shannon*** **cSAC**]
Aquatic species are considered further in section 2.5.4 Water Quality.

2.4.3.2 *Terrestrial/Riparian*

Otter (L. lutra) [Lower River Suir cSAC and Lower River Shannon cSAC]

2.4.3.3 *Avian*

Hen harrier (Circus cyaneus) [Slievefelim to Silvermines Mountains SPA]

There is the potential that some of the species maybe impacted by the proposed development and this will be considered further in the Natura Impact Statement.

2.4.4 Water Quality

The proposed site drains into streams that form the upper reaches of the Turraheen, Owenbeg, Clodiagh and Aughvana Rivers. The first three of these rivers form part of the South Eastern River Basin District and ultimately join the River Suir [The Lower River Suir cSAC (Site Code:002137)]to the southeast. The Aughvana River, which forms part of the Shannon River Basin District, joins the Mulkear River and ultimately flows into the River Shannon [Lower River Shannon cSAC (Site Code:002165)]. The watercourses both within and adjacent to the site boundary are tributaries of both the Lower River Suir and the Lower River Shannon cSAC.

No work will take place within 50m buffer zones of watercourses, except at clear span bridges or culverts and associated road construction. A total of three first order streams occur within the site boundary. One stream/river crossing will be required approximately 254 m to the north of Turbine 4. All construction method statements will be prepared in consultation with Inland Fisheries Ireland.

Roadside drainage will be an integral part of the proposed Upperchurch Windfarm considered in this document. The construction of new roads and the upgrading and widening of existing farm roads will comprise of an integrated set of drainage and sediment control measures which will allow pollution control attenuation prior to discharge across ground rather than to surface water, thereby preventing water runoff from entering watercourses directly.

While the water quality in the Lower River Suir cSAC and the Lower River Shannon cSAC is not in itself a feature of qualifying interest of the SACs it is the case that adverse impacts to their water chemistry could have indirect impacts on the conservation interests of the site; for example by affecting the distribution and density of white-clawed crayfish and the Fresh water pearl mussel or the distribution and density of salmonids which in turn could, potentially, affect the availability of prey for otter.

2.4.4.1 *Lower River Suir cSAC (Site Code: 002137)*

Most of the Upperchurch site is within the South Eastern River Basin District and drains to the Owenbeg River and ultimately to the River Suir. The River Suir Catchment covers a large area of 3,546km^2, which represents approximately 4% of the land area of the island of Ireland. The catchment includes extensive lowland areas, particularly along the major river valleys such as those of the Suir, the Aherlow, the Multeen and the Anner; and upland areas including parts the Comeragh Mountains, the Knockmealdown Mountains and the Galtee Mountains, rising to an altitude of 919m at Galtymore.

A number of fish species listed under Annex II of the EU Habitats Directive occur within the Suir catchment. These include Atlantic salmon (*S.salar*). All three lamprey species: sea lamprey (*Petromyzon marinus*), river lamprey (*Lampreta fluviatilis*) and brook lamprey (*Lampetra planeri*), which are likely to occur throughout much of the catchment. Allis shad

(*Aloso aloso*) and twaite shad (*Alosa fallax fallax*) which occur in Waterford Harbour and tidal sections of the lower River Suir at least as far upstream as Carrick-on-Suir.

A number of protected invertebrates also occur within the Suir catchment which include the freshwater pearl mussel (*Margaritifera margaritifera*) and the White clawed crayfish (*A. pallipes*).

A fishery survey of the River Suir Catchment and Management Recommendations was prepared by the Regional Fisheries Board on behalf of the SE Region Fisheries Board in 2006. The major objective of the assessment was to establish the status of fish stocks in relation to the ecology of the Suir and its tributaries, and to use this data to generate focused management programmes. The Suir is recognised as a premier brown trout angling fishery and also a major salmon fishery. In 2005 the Suir was ranked as the 4th best salmonid river in Ireland, based on angling returns (CFB, 2006).

2.4.4.2 *Lower River Shannon cSAC (Site Code: 002165)*

The south western boundary of the proposed Upperchurch is within the Shannon River Basin District and drains to the Aughvana River and ultimately to the Mulkear River which is part of the Lower River Shannon cSAC.

The Lower River Shannon cSAC is a very large site stretching along the Shannon valley from Killaloe to Loop Head/ Kerry Head, a distance of some 120 km. 4 species of fish listed on Annex II of the EU Habitats Directive are found within the site. These are Sea Lamprey (*Petromyzon marinus*), Brook Lamprey (*Lampetra planeri*), River Lamprey (*Lampetra fluviatilis*), and Salmon (*Salmo salar*). The three lampreys and Atlantic salmon have all been observed spawning in the lower Shannon or its tributaries. Freshwater Pearl-mussel (*Margaritifera margaritifera*), a species listed on Annex II of the EU Habitats Directive, occurs abundantly in parts of the Cloon River.

2.4.4.3 *Conclusion*

With regard to the conservation interests of the Lower River Shannon cSAC and the Lower River Suir cSAC it is noted that there is the potential for an unmitigated impact as a result of the proposed development. This impact and proposed mitigations are discussed further in the Natura Impact Statement.

2.5 Conclusion of screening stage

In conclusion, to determine the potential impacts, if any, of the proposed windfarm on nearby Natura 2000/Ramsar sites, a screening process for AA was undertaken. The proposed development is within 15km of 9 Natura 2000 Sites. There are no Ramsar sites within 15km of the proposed development.

In concluding the above assessments of significance, it has been shown that there will be no potential impact to the following sites as a result of the proposed development:

Anglesey Road cSAC (002125)
Bolingbrook hill SAC (002124)
Kilduff, Devilsbit Mountain SAC (000934)
Silvermines mountains West SAC (002258)
Keeper Hill SAC (001197)
Philipston Marsh SAC (001847)
However, the proposed project could have potential negative ecological affects on three Natura Sites namely the *Lower River Shannon cSAC, Lower River Suir cSAC* and *Slievefelim to Silvermines Mountains SPA.*
Hence, the recommendation of the screening process is to proceed to Stage 2; Statement for Appropriate Assessment for three Natura 2000 Sites:
Lower River Shannon cSAC (Site code: 002165);
Lower River Suir cSAC (002137); and
Slievefelim to Silvermines Mountains SPA (004165)

3 Natura Impact Statement

3.1 Introduction

The main objective of Stage 2 of the Appropriate Assessment process is to consider the impact of the project or plan on the integrity of the Natura 2000 and Ramsar Sites, either alone or in combination with other projects, with respect to the conservation objectives of the sites and to identify and assess mitigation measures against any adverse effects the plan or project is likely to cause. Following the screening stage of the Appropriate Assessment, three Natura 2000 Sites were identified that may potentially be impacted by the proposed development are described below followed by further descriptions and details of the characteristics of the proposal. The potential impacts resulting from the unmitigated construction phase of the proposal, and from its operational phase, are then discussed in relation to the conservation objectives of the sites. Mitigation measures where appropriate are presented in below in Section 3.7.

3.1.1 Information sources

Information from the following sources was used to compile the Natura Impact Assessment:
Winter Bird Survey – November 2010 to March 2011 (Volume 2, Chapter 6);
Summer Bird Survey – April 2011 to August 2011 (Volume 2, Chapter 6);
Habitat survey of the site – conducted by ecologists during the month of June 2012 (Volume 2, Chapter 6);
Mammal survey conducted in conjunction with the habitat survey (Volume 2, Chapter 6);
The geotechnical stability assessment (Volume 3, Appendix 3-A);
National Biodiversity Centre Mapping System[3]
National Parks and Wildlife Services (NPWS); and
BirdWatch Ireland;
Publications that are used here and not referenced specifically include:
Lynas, P., Newton, S.F., and Robinson, J.A. (2007). The status of birds in Ireland: an analysis of conservation concern 2008-2013. Irish Birds, 8: 149-167.
Crowe, O., 2005. Ireland's Wetlands and their Waterbirds: status and distribution. BirdWatch Ireland.
Gibbons, D.W., Reid, J.B. and R.A. Chapman, 1993. The New Atlas of Breeding Birds in Britain and Ireland: 1988-1991. British Trust for Ornithology, 1993.
Dempsey, E and O' Clery, M. (2010). The Complete Field Guide to Ireland's Birds.
Commission of the European Communities (2003). Interpretation manual of European Union Habitats-EUR 25. DG Environment-Nature and Biodiversity. Brussels.

[3] Available at : http://maps.biodiversityireland.ie/#/Home [accessed on various dates July, August 2012]

3.2 Description of the Project

A detailed description of the characteristics is outlined at section 2.2.5 above and further detail is presented in Chapter 2 of the EIS.

3.3 Characteristics of Natura 2000 Sites

The NPWS site synopses of the Natura 2000 Sites are provided below to describe the site in more detail. The dates on which the site synopses were written are included at the end of each synopsis.

3.3.1 The Lower River Shannon candidate Special Area of Conservation (cSAC) (Site code: 002165) site synopsis (NPWS)

This very large cSAC stretches along the Shannon valley from Killaloe to Loop Head/ Kerry Head, a distance of some 120 km. The site thus encompasses the Shannon, Feale, Mulkear and Fergus Estuaries, the freshwater lower reaches of the River Shannon (between Killaloe and Limerick), the freshwater stretches of much of the Feale and Mulkear catchments and the marine area between Loop Head and Kerry Head. The Shannon and Fergus flow through Carboniferous limestone as far as Foynes, but west of Foynes Namurian shales and flagstones predominate (except at Kerry Head, which is formed from Old Red Sandstone). The eastern sections of the Feale catchment flow through Namurian Rocks and the western stretches through Carboniferous Limestone. The Mulkear flows through Lower Palaeozoic Rocks in the upper reaches before passing through Namurian Rocks, followed by Lower Carboniferous Shales and Carboniferous Limestone. The Mulkear River itself, immediately north of Pallas Green, passes through an area of Rhyolites, Tuffs and Agglomerates. Rivers within the subcatchment of the Feale include the Galey, Smearlagh, Oolagh, Allaughaun, Owveg, Clydagh, Caher, Breanagh and Glenacarney. Rivers within the sub-catchment of the Mulkear include the Killeenagarriff, Annagh, Newport, the Dead River, the Bilboa, Glashacloonaraveela, Gortnageragh and Cahernahallia.

The Shannon and Fergus Estuaries form the largest estuarine complex in Ireland. They form a unit stretching from the upper tidal limits of the Shannon and Fergus Rivers to the mouth of the Shannon estuary (considered to be a line across the narrow strait between Kilcredaun Point and Kilconly Point). Within this main unit there are several tributaries with their own 'sub-estuaries' e.g. the Deel River, Mulkear River, and Maigue River. To the west of Foynes, a number of small estuaries form indentations in the predominantly hard coastline, namely Poulnasherry Bay, Ballylongford Bay, Clonderalaw Bay and the Feale or Cashen River Estuary. Both the Fergus and inner Shannon estuaries feature vast expanses of intertidal mudflats, often fringed with saltmarsh vegetation. The smaller estuaries also feature mudflats, but have their own unique characteristics, e.g. Poulnasherry Bay is stony and unusually rich in species and biotopes. Plant species are typically scarce on the mudflats, although there are some Eel-grass beds (Zostera spp.) and patches of green algae (e.g. Ulva sp. and Enteromorpha sp.). The main macro-invertebrate community, which has been noted from the inner Shannon and Fergus estuaries, is a Macoma- Scrobicularia-Nereis community. In the transition zone between mudflats and saltmarsh, specialised colonisers of mud predominate: swards of Common Cord-grass (Spartina anglica) frequently occur in the upper parts of the estuaries. Less common are swards of Glasswort (Salicornia europaea agg.). In the innermost parts of the estuaries, the tidal channels or creeks are fringed with species such as Common Reed (Phragmites australis) and Club-rushes (Scirpus maritimus, S. tabernaemontani and S. triquetrus). In addition to the nationally rare Triangular Club-rush (Scirpus triquetrus), two scarce species are found in some of these creeks (e.g. Ballinacurra Creek): Lesser Bulrush (Typha angustifolia) and Summer Snowflake (Leucojum aestivum).

Saltmarsh vegetation frequently fringes the mudflats. Over twenty areas of estuarine saltmarsh have been identified within the site, the most important of which are around the Fergus Estuary and at Ringmoylan Quay. The dominant type of saltmarsh present is Atlantic salt meadow occurring over mud. Characteristic species occurring include Common Saltmarsh Grass (Puccinellia maritima), Sea Aster (Aster tripolium), Thrift (Armeria maritima), Sea-milkwort (Glaux maritima), Sea Plantain (Plantago maritima), Red Fescue (Festuca rubra), Creeping Bent (Agrostis stolonifera), Saltmarsh Rush (Juncus gerardi), Long-bracted Sedge (Carex extensa), Lesser Seaspurrey (Spergularia marina) and Sea Arrowgrass (Triglochin maritima). Areas of Mediterranean salt meadows, characterised by clumps of Sea Rush (Juncus maritimus) occur occasionally. Two scarce species are found on saltmarshes in the vicinity of the Fergus Estuary: a type of robust Saltmarsh-grass (Puccinellia foucaudii), sometimes placed within the compass of Common Saltmarsh-grass (Puccinellia maritima) and Hard-grass (Parapholis strigosa). Saltmarsh vegetation also occurs around a number of lagoons within the site. The two which have been surveyed as part of a National Inventory of Lagoons are Shannon Airport Lagoon and Cloonconeen Pool. Cloonconeen Pool (4-5 ha) is a natural sedimentary lagoon impounded by a low cobble barrier. Seawater enters by percolation through the barrier and by overwash. This lagoon represents a type which may be unique to Ireland since the substrate is composed almost entirely of peat. The adjacent shore features one of the best examples of a drowned forest in Ireland.

Aquatic vegetation in the lagoon includes typical species such as Beaked Tasselweed (Ruppia maritima) and green algae (Cladophora sp.). The fauna is not diverse, but is typical of a high salinity lagoon and includes six lagoon specialists (Hydrobia ventrosa, Cerastoderma glaucum, Lekanesphaera hookeri, Palaemonetes varians, Sigara stagnalis and Enochrus bicolor). In contrast, Shannon Airport Lagoon (2 ha) is an artificial saline lake with an artificial barrier and sluiced outlet. However, it supports two Red Data Book species of Stonewort (Chara canescens and Chara cf. connivens).

Most of the site west of Kilcredaun Point/Kilconly Point is bounded by high rocky sea cliffs. The cliffs in the outer part of the site are sparsely vegetated with lichens, Red Fescue, Sea Beet (Beta vulgaris), Sea Campion (Silene maritima), Thrift and Plantains (Plantago spp.). A rare endemic Sea Lavender (Limonium recurvum subsp. pseudotranswallinum) occurs on cliffs near Loop Head. Cliff-top vegetation usually consists of either grassland or maritime heath. The boulder clay cliffs further up the estuary tend to be more densely vegetated, with swards of Red Fescue and species such as Kidney Vetch (Anthyllis vulneraria) and Bird's-foot Trefoil (Lotus corniculatus).

The site supports an excellent example of a large shallow inlet and bay. Littoral sediment communities in the mouth of the Shannon Estuary occur in areas that are exposed to wave action and also in areas extremely sheltered from wave action. Characteristically, exposed sediment communities are composed of coarse sand and have a sparse fauna. Species richness increases as conditions become more sheltered. All shores in the site have a zone of sand hoppers at the top and below this each of the shores has different characteristic species giving a range of different shore types in the cSAC. The intertidal reefs in the Shannon Estuary are exposed or moderately exposed to wave action and subject to moderate tidal streams. Known sites are steeply sloping and show a good zonation down the shore. Well developed lichen zones and littoral reef communities offering a high species richness in the sublittoral fringe and strong populations of Paracentrotus lividus are found. The communities found are tolerant to sand scour and tidal streams. The infralittoral reefs range from sloping platforms with some vertical steps to ridged bedrock with gullies of sand between the ridges to ridged bedrock with boulders or a mixture of cobbles, gravel and sand. Kelp is very common to about 18m. Below this it becomes rare and the community is characterised by coralline crusts and red foliose algae.

Other coastal habitats that occur within the site include the following:

Stony beaches and bedrock shores - these shores support a typical zonation of seaweeds (Fucus spp., Ascophyllum nodosum and kelps).

Shingle beaches - the more stable areas of shingle support characteristic species such as Sea Beet, Sea Mayweed (Matricaria maritima), Sea Campion and Curled Dock (Rumex crispus).

Sandbanks which are slightly covered by sea water at all times – there is a known occurrence of sand/gravel beds in the area from Kerry Head to Beal Head.

Sand dunes - a small area of sand dunes occurs at Beal Point. The dominant species is Marram Grass (Ammophila arenaria).

Flowing into the estuaries are a number of tidal rivers. Freshwater rivers have been included in the site, most notably the Feale and Mulkear catchments, the Shannon from Killaloe to Limerick (along with some of its tributaries, including a short stretch of the Kilmastulla River), the Fergus up as far as Ennis, and the Cloon River. These systems are very different in character: the Shannon being broad, generally slow-flowing and naturally eutrophic; the Fergus being smaller and alkaline; while the narrow, fast-flowing Cloon is acid in nature. The Feale and Mulkear catchments exhibit all the aspects of a river from source to mouth. Seminatural habitats, such as wet grassland, wet woodland and marsh occur by the rivers, however, improved grassland is most common. One grassland type of particular conservation significance, Molinia meadows, occurs in several parts of the site and the examples at Worldsend on the River Shannon are especially noteworthy. Here are found areas of wet meadow dominated by rushes and sedges and supporting a diverse and species-rich vegetation, including such uncommon species as Blue-eyed Grass (Sisyrinchium bermudiana) and Pale Sedge (Carex pallescens). Floating river vegetation characterised by species of Water-crowfoot (Ranunculus spp.), Pondweeds (Potamogeton spp.) and the moss Fontinalius antipyretica are present throughout the major river systems within the site. The rivers contain an interesting bryoflora with Schistidium alpicola var. alpicola recorded from in-stream boulders on the Bilboa, new to county Limerick. Alluvial woodland occurs on the banks of the Shannon and on islands in the vicinity of the University of Limerick. The woodland is up to 50m wide on the banks and somewhat wider on the largest island. The most prominent woodland type is gallery woodland where White Willow (Salix alba) dominates the tree layer with occasional Alder (Alnus glutinosa). The shrub layer consists of various willow species with sally (Salix cinerea ssp. oleifolia) and what appear to be hybrids of S. alba x S. viminalis. The herbaceous layer consists of tall perennial herbs. A fringe of Bulrush (Typha sp.) occurs on the riverside of the woodland. On slightly higher ground above the wet woodland and on the raised embankment remnants of mixed oak-ash-alder woodland occur. These are poorly developed and contain numerous exotic species but locally there are signs that it is invading open grassland. Alder is the principal tree species with occasional Oak (Quercus robur), Elm (Ulmus glabra, U. procera), Hazel (Corylus avellana), Hawthorn (Crataegus monogyna) and the shrubs Guelder-rose (Viburnum opulus) and willows. The ground flora is species-rich. Woodland is infrequent within the site, however Cahiracon Wood contains a strip of old Oak woodland. Sessile Oak (Quercus petraea) forms the canopy, with an understorey of Hazel and Holly (Ilex aquifolium). Great Wood-rush (Luzula sylvatica) dominates the ground flora. Less common species present include Great Horsetail (Equisetum telmeteia) and Pendulous Sedge (Carex pendula). In the low hills to the south of the Slievefelim mountains, the Cahernahallia River cuts a valley through the Upper Silurian rocks. For approximately 2 km south of Cappagh Bridge at Knockanavar, the valley sides are wooded. The woodland consists of Birch (Betula spp.), Hazel, Oak, Rowan (Sorbus aucuparia), some Ash (Fraxinus excelsior) and Willow (Salix spp.). Most of the valley is not grazed by stock, and as a result the trees are regenerating well. The ground flora feature prominent Greater wood-rush and Bilberry (Vaccinium myrtillus) with a typical range of woodland herbs. Where there is more light available, Bracken (Pteridium aquilinum) features. The valley sides of the Bilboa and Gortnageragh Rivers, on higher ground north east of Cappamore, support patches of semi-natural broadleaf woodland dominated by Ash, Hazel, Oak and Birch. There is a good scrub layer with Hawthorn, Willow, Holly and Blackthorn (Prunus spinosa) common. The herb layer in these woodlands is often open with a typically rich mixture of woodland herbs and ferns. Moss species diversity is high. The woodlands are ungrazed. The hazel is actively coppiced in places.

There is a small area of actively regenerating cut away raised bog at Ballyrorheen. It is situated approx. 5 km north west of Cappamore Co. Limerick. The bog contains some wet areas with good moss (Sphagnum) cover. Species of particular interest include the Cranberry (Vaccinium oxycoccos) and the White Sedge (Carex curta) along with two other regionally rare mosses including S. fimbriatum. The site is being invaded by Birch (Betula pubescens) scrub woodland. Both commercial forestry and the spread of rhododendron has greatly reduced the overall value of the site. A number of plant species that are Irish Red Data Book species occur within the site - several are protected under the Flora (Protection) Order, 1999:
Triangular Club-rush (Scirpus triquetrus) - in Ireland this protected species is only found in the Shannon Estuary, where it borders creeks in the inner estuary.
Opposite-leaved Pondweed (Groenlandia densa) - this protected pondweed is found in the Shannon where it passes through Limerick City.
Meadow Barley (Hordeum secalinum) - this protected species is abundant in saltmarshes at Ringmoylan and Mantlehill.
Hairy Violet (Viola hirta) - this protected violet occurs in the Askeaton/Foynes area.
Golden Dock (Rumex maritimus) - noted as occurring in the River Fergus Estuary.
Bearded Stonewort (Chara canescens) - a brackish water specialist found in Shannon Airport lagoon.
Convergent Stonewort (Chara connivens) - presence in Shannon Airport Lagoon to be confirmed.
Overall, the Shannon and Fergus Estuaries support the largest numbers of wintering waterfowl in Ireland. The highest count in 1995-96 was 51,423 while in 1994-95 it was 62,701. Species listed on Annex I of the E.U. Birds Directive which contributed to these totals include: Great Northern Diver (3; 1994/95), Whooper Swan (201; 1995/96), Pale-bellied Brent Goose (246; 1995/96), Golden Plover (11,067; 1994/95) and Bar-tailed Godwit (476; 1995/96). In the past, three separate flocks of Greenland White-fronted Goose were regularly found but none were seen in 1993/94. Other wintering waders and wildfowl present include Greylag Goose (216; 1995/96), Shelduck (1,060; 1995/96), Wigeon (5,976; 1995/96); Teal (2,319; 1995-96); Mallard (528; 1995/96), Pintail (45; 1995/96), Shoveler (84; 1995/96), Tufted Duck (272; 1995/96), Scaup (121; 1995/96), Ringed Plover (240; 1995/96), Grey Plover (750; 1995/96), Lapwing (24,581; 1995/96), Knot (800; 1995/96), Dunlin (20,100; 1995/96), Snipe (719, 1995/96), Black-tailed Godwit (1062; 1995/96), Curlew (1504; 1995/96), Redshank (3228; 1995/96), Greenshank (36; 1995/96) and Turnstone (107; 1995/96). A number of wintering gulls are also present, including Black-headed Gull (2,216; 1995/96), Common Gull (366; 1995/96) and Lesser Black-backed Gull (100; 1994/95). This is the most important coastal site in Ireland for a number of the waders including Lapwing, Dunlin, Snipe and Redshank. It also provides an important staging ground for species such as Black-tailed Godwit and Greenshank. A number of species listed on Annex I of the E.U. Birds Directive breed within the cSAC site. These include Peregine Falcon (2-3 pairs),

Sandwich Tern (34 pairs on Rat Island, 1995), Common Tern (15 pairs: 2 on Sturamus Island and 13 on Rat Island, 1995), Chough (14-41 pairs, 1992) and Kingfisher. Other breeding birds of note include Kittiwake (690 pairs at Loop Head, 1987) and Guillemot (4010 individuals at Loop Head, 1987).

There is a resident population of Bottle-nosed Dolphin in the Shannon Estuary consisting of at least 56-68 animals (1996). This is the only known resident population of this E.U. Habitats Directive Annex II species in Ireland. Otter, a species also listed on Annex II of this directive, is commonly found on the site. Five species of fish listed on Annex II of the E.U. Habitats Directive are found within the site. These are Sea Lamprey (Petromyzon marinus), Brook Lamprey (Lampetra planeri), River Lamprey (Lampetra fluviatilis), Twaite Shad (Allosa fallax fallax) and Salmon (Salmo salar). The three lampreys and Salmon have all been observed spawning in the lower Shannon or its tributaries. The Fergus is important in its lower reaches for spring salmon while the Mulkear catchment excels as a grilse fishery though spring fish are caught on the actual Mulkear River. The Feale is important for both types. Twaite Shad is not thought to spawn within the site. There are few other river systems in Ireland which contain all three species of Lamprey. Two additional fish of note, listed in the Irish Red Data Book, also occur, namely Smelt (Osmerus eperlanus) and Pollan (Coregonus autumnalis pollan). Only the former has been observed spawning in the Shannon. Freshwater Pearl-mussel (Margaritifera margaritifera), a species listed on Annex II of the E.U. Habitats Directive, occurs abundantly in parts of the Cloon River. There is a wide range of landuses within the site. The most common use of the terrestrial parts is grazing by cattle and some areas have been damaged through overgrazing and poaching. Much of the land adjacent to the rivers and estuaries has been improved or reclaimed and is protected by embankments (especially along the Fergus Estuary). Further, reclamation continues to pose a threat as do flood relief works (e.g. dredging of rivers). Gravel extraction poses a major threat on the Feale. In the past, Cord-grass (Spartina sp.) was planted to assist in land reclamation. This has spread widely, and may oust less vigorous colonisers of mud and may also reduce the area of mudflat available to feeding birds.

Domestic and industrial wastes are discharged into the Shannon, but water quality is generally satisfactory - except in the upper estuary, reflecting the sewage load from Limerick City. Analyses for trace metals suggest a relatively clean estuary with no influences by industrial discharges apparent. Further industrial development along the Shannon and water polluting operations are potential threats.

Fishing is a main tourist attraction on the Shannon and there are a large number of Angler Associations, some with a number of beats. Fishing stands and styles have been erected in places. The River Feale is a designated Salmonid Water under the E.U. Freshwater Fish Directive. Other uses of the site include commercial angling, oyster farming, boating (including dolphin-watching trips) and shooting. Some of these may pose threats to the birds and dolphins through disturbance. Specific threats to the dolphins include underwater acoustic disturbance, entanglement in fishing gear and collisions with fast moving craft.

This site is of great ecological interest as it contains a high number of habitats and species listed on Annexes I and II of the E.U. Habitats Directive, including the priority habitat lagoon, the only known resident population of Bottle-nosed Dolphin in Ireland and all three Irish lamprey species. A good number of Red Data Book species are also present, perhaps most notably the thriving populations of Triangular Club-rush. A number of species listed on Annex I of the E.U. Birds Directive are also present, either wintering or breeding. Indeed, the Shannon and Fergus Estuaries form the largest estuarine complex in Ireland and support more wintering wildfowl and waders than any other site in the country. Most of the estuarine part of the site has been designated a Special Protection Area (SPA), under the E.U. Birds Directive, primarily to protect the large numbers of migratory birds present in winter.

17.05.2005

3.3.2 Lower River Suir SAC (Site Code: 002137) site synopsis (NPWS)

This site consists of the freshwater stretches of the River Suir immediately south of Thurles, the tidal stretches as far as the confluence with the Barrow/Nore immediately east of Cheekpoint in Co. Waterford and many tributaries including the Clodiagh in Co. Waterford, the Lingaun, Anner, Nier, Tar, Aherlow, Multeen and Clodiagh in Co. Tipperary. The Suir and its tributaries flows through the counties of Tipperary, Kilkenny and Waterford. Upstream of Waterford city, the swinging meanders of the Suir crisscross the Devonian sandstone rim of hard rocks no less than three times as they leave the limestone-floored downfold below Carrick In the vicinity of Carrick-on-Suir the river follows the limestone floor of the Carrick Syncline. Upstream of Clonmel the river and its tributaries traverse Upper Palaeozoic Rocks, mainly the Lower Carboniferous Visean and Tournaisian. The freshwater stretches of the Clodiagh River in Co. Waterford traverse Silurian rocks, through narrow bands of Old Red Sandstone and Lower Avonian Shales before reaching the carboniferous limestone close to its confluence with the Suir. The Aherlow River flows through a Carboniferous limestone valley, with outcrops of Old Red Sandstone forming the Galtee Mountains to the south and the Slievenamuck range to the north. Glacial deposits of sands and gravels are common along the valley bottom, flanking the present-day river course.

The site is a candidate SAC selected for the presence of the priority habitats on Annex I of the E.U. Habitats Directive - alluvial wet woodlands and Yew Wood. The site is also selected as a candidate SAC for floating river vegetation, Atlantic salt meadows, Mediterranean salt meadows, old oak woodlands and eutrophic tall herbs, all habitats listed on Annex I of the E.U. Habitats Directive. The site is also selected for the following species listed on Annex II of the same directive - Sea Lamprey, River Lamprey, Brook Lamprey, Freshwater Pearl Mussel, Crayfish, Twaite Shad, Atlantic Salmon and Otter.

Alluvial wet woodland is declining habitat in Europe as a result of drainage and reclamation. The best examples of this type of woodland in the site are found on the islands just below

Carrick-on-Suir and at Fiddown Island. Species occurring here include Almond Willow (Salix triandra), White Willow (S. alba), Grey Willow (S. cinerea), Osier (S. viminalis), with Iris (Iris pseudacorus), Hemlock Water-dropwort (Oenanthe crocata), Angelica (Angelica sylvestris), Pendulus Sedge (Carex pendula), Meadowsweet (Filipendula ulmaria) and Valerian (Valeriana officinalis). The terrain is littered with dead trunks and branches and intersected with small channels which carry small streams to the river. The bryophyte and lichen floras appear to be rich and require further investigation. A small plot is currently being coppiced and managed by National Parks and Wildlife. In the drier areas the wet woodland species merge with other tree and shrub species including Ash (Fraxinus excelsior), Hazel (Corylus avellana), Hawthorn (Crataegus monogyna) and Blackthorn (Prunus spinosa). This adds further to the ecological interest of this site.

Eutrophic tall herb vegetation occurs in association with the various areas of alluvial forest and elsewhere where the flood-plain of the river is intact. Characteristic species of the habitat include Meadowsweet (Filipendula ulmaria), Purple Loosestrife (Lythrum salicaria), Marsh Ragwort (Senecio aquaticus), Ground Ivy (Glechoma hederacea) and Hedge Bindweed (Calystegia sepium).

Old oak woodlands are also of importance at the site. The best examples are seen in Portlaw Wood which lies on both sides of the Clodiagh River. On the south-facing side the stand is more open and the Oaks (mainly Quercus robur) are well grown and spreading. Ivy (Hedera helix) and Bramble (Rubus fruticosus) are common on the ground, indicating relatively high light conditions. Oak regeneration is dense, varying in age from 0-40 years and Holly (Ilex aquifolium) is fairly common but mostly quite young. Across the valley, by contrast, the trees are much more closely spaced and though taller are poorly grown on average. There are no clearings; large Oaks extend to the boundary wall. In the darker conditions, Ivy is much rarer and Holly much more frequent, forming a closed canopy in places. Oak regeneration is uncommon since there are as yet few natural clearings. The shallowness of the soil on the northfacing slope probably contributes to the poor tree growth there. The acid nature of the substrate has induced a “mountain” type Oakwood community to develop. There is an extensive species list present throughout including an abundance of mosses, liverworts and lichens. The rare lichen Lobaria pulmonaria, an indicator of ancient woodlands, is found.

Inchinsquillib Wood consists of three small separate sloping blocks of woodland in a valley cut by the young Multeen River and its tributaries through acidic Old Red Sandstone, and Silurian rocks. Two blocks, both with an eastern aspect, located to the north of the road, are predominantly of Sessile oak (Quercus petraea) and Hazel, with Downy Birch (Betula pubescens), Ash and Holly. The ground flora is quite mixed with for example Wood sedge (Carex sylvatica), Bluebell (Hyacinthoides non-scriptus), Primrose (Primula vulgaris), Wood-sorrel (Oxalis acetosella), Pignut (Conopodium majus) and Hard fern (Blechnum spicant). The base poor nature of the underlying rock is, to some extent masked by the overlying drift. The third block, to the south of the road, and with a northern aspect, is a similar although less mature mixture of Sessile Oak, Birch and Holly, the influence of the drift is more marked, with the occurrence of Wood anemone (Anemone nemorosa) amongst the ground flora.

Floating river vegetation is evident in the freshwater stretches of the River Suir and along many of its tributaries. Typical species found include Canadian Pondweed (Elodea canadensis), Milfoil (Myriophyllum spp.), Fennel Pondweed (Potamogeton pectinatus), Curled Pondweed (P. crispus), Perfoliate Pondweed (P. perfoliatus), Pond Water-crowfoot (Ranunculus peltatus), other Crowfoots (Ranunculus spp.) and the moss Fontinalis antipyretica. At a couple of locations along the river, Oppositeleaved Pondweed (Groenlandia densa) occurs. This species is protected under the Flora (Protection) Order, 1999.

The Aherlow River is fast-flowing and mostly follows a natural unmodified river channel. Submerged vegetation includes the aquatic moss Fontinalis antipyretica and Stream Water-crowfoot (Ranunculus pencillatus), while shallow areas support species such as Reed Canary-grass (Phalaris arundinacea), Brooklime (Veronica beccabunga) and Water Mint (Mentha aquatica). The river bank is fringed in places with Alder (Alnus glutinosa) and Willows (Salix spp.).

The Multeen River is fast flowing, mostly gravel-bottomed and appears to follow a natural unmodified river channel. Water Crowfoots occur in abundance and the aquatic moss Fontinalis antipyretica is also common. In sheltered shallows, species such as Water-cress (Rorippa nasturtium-aquaticum) and Water-starworts (Callitriche spp.) occur. The river channel is fringed for most of its length with Alder, Willow and a narrow strip of marshy vegetation.

Salt meadows occur below Waterford City in old meadows where the embankment is absent, or has been breached, and along the tidal stretches of some of the in-flowing rivers below Little Island. There are very narrow, non-continuous bands of this habitat along both banks. More extensive areas are also seen along the south bank at Ballynakill, the east side of Little Island, and in three large salt meadows between Ballynakill and Cheekpoint. The Atlantic and Mediterranean sub types are generally intermixed. The species list is extensive and includes Red Fescue (Festuca rubra), Oraches (Atriplex spp.), Sea Aster (Aster tripolium), Sea Couch Grass (Elymus pycnanthus), frequent Sea Milkwort (Glaux maritima), occasional Wild Celery (Apium graveolens), Parsley Water-dropwort (Oenanthe lachenalii), English Scurvygrass (Cochlearia anglica) and Sea Arrowgrass (Triglochin maritima). These species are more representative of the Atlantic sub-type of the habitat. Common Cord-grass (Spartina anglica), is rather frequent along the main channel edge and up the internal channels. The legally protected (Flora (Protection) Order, 1999) Meadow Barley (Hordeum secalinum) grows at the landward transition of the saltmarsh. Sea Rush (Juncus maritimus), an indicator of the Mediterranean salt meadows, also occurs.

Other habitats at the site include wet and dry grassland, marsh, reed swamp, improved grassland, coniferous plantations, deciduous woodland, scrub, tidal river, stony shore and mudflats. The most dominant habitat adjoining the river is improved grassland, although there are wet fields with species such as Yellow Flag (Iris pseudacorus), Meadow Sweet (Filipendula ulmaria), Rushes (Juncus spp.), Meadow Buttercup (Ranunculus acris) and Cuckoo Flower (Cardamine pratensis).

Cabragh marshes, just below Thurles, lie in a low-lying tributary valley into which the main river floods in winter. Here there is an extensive area of Common Reed (Phragmites australis) with associated marshland and peaty fen. The transition between vegetation types is often well displayed. A number of wetland plants of interest occur, in particular the Narrow-leaved Bulrush (Typha angustifolia), Bottle Sedge (Carex rostrata) and Blunt-flowered Rush (Juncus subnodulosus). The marsh is naturally eutrophic but it has also the nutritional legacy of the former sugar factory which discharged into it through a number of holding lagoons, now removed. Production is high which is seen in the size of such species as Celery-leaved Buttercup (Ranunculus sceleratus) as well as in the reeds themselves.

Throughout the Lower River Suir site are small areas of woodland other than those described above. These tend to be a mixture of native and non-native species, although there are some areas of semi-natural wet woodland with species such as Ash and Willow. Cahir Park Woodlands is a narrow tract of mixed deciduous woodland lying on the flatlying floodplain of the River Suir. This estate woodland was planted over one hundred years ago and it contains a large component of exotic tree species. However, due to original planting and natural regeneration there is now a good mix of native and exotic species. About 5km north west of Cashel, Ardmayle pond is a long, possibly artificial water body running parallel to the River Suir. It is partly shaded by planted Lime (Tilia hybrids), Sycamore (Acer pseudoplatanus) and the native Alder. Growing beneath the trees are shade tolerant species such as Remote sedge (Carex remota).

The site is of particular conservation interest for the presence of a number of Annex II animal species, including Freshwater Pearl Mussel (Margaritifera margaritifera and M. m. durrovensis), Freshwater Crayfish (Austropotamobius pallipes), Salmon (Salmo salar), Twaite Shad (Alosa fallax fallax), three species of Lampreys - Sea Lamprey (Petromyzon marinus), Brook Lamprey (Lampetra planeri) and River Lamprey (Lampetra fluviatilis) and Otter (Lutra lutra). This is one of only three known spawning grounds in the country for Twaite Shad.

The site also supports populations of several other animal species. Those which are listed in the Irish Red Data Book include Daubenton's Bat (Myotis daubentoni), Natterer's Bat (M. nattereri), Pipistrelle (Pipistrellus pipistrellus), Pine Marten (Martes martes), Badger (Meles meles), the Irish Hare (Lepus timidus hibernicus), Smelt (Osmerus eperlanus) and the Frog (Rana temporaria). Breeding stocks of Carp are found in Kilsheelan Lake. This is one of only two lakes in the country which is known to have supported breeding Carp. Carp require unusually high summer water temperatures to breed in Ireland and the site may therefore support interesting invertebrate populations.

Parts of the cSAC site have also been identified as of ornithological importance for a number of Annex I (EU Birds Directive) bird species, including Greenland White-fronted Goose (10), Golden Plover (1490), Whooper Swan (7) and Kingfisher. Figures given in brackets are the average maximum counts from 4 count areas within the site for the three winters between 1994 and 1997. Wintering populations of migratory birds use the site. Flocks are seen in Coolfinn Marsh and also along the reedbeds and saltmarsh areas of the Suir. Coolfinn supports nationally important numbers of Greylag Geese on a regular basis. Numbers between 600 and 700 are recorded. Other species occurring include Mallard (21), Teal (159), Wigeon (26), Tufted Duck (60), Pintail (4), Pochard (2), Little Grebe (2), Black-tailed Godwit (20), Oystercatcher (16), Lapwing (993), Dunlin (101), Curlew (195), Redshank (28), Greenshank (4) and Green Sandpiper (1). Nationally important numbers of Lapwing (2750) were recorded at Faithlegg in the winter of 1996/97. In Cabragh marshes there is abundant food for surface feeding wildfowl which total at 1,000 or so in winter. Widgeon, Teal and Mallard are numerous and the latter has a large breeding population - with up to 400 in summer. In addition, less frequent species like Shoveler and Pintail occur and there are records for both Whooper and Bewick's swans. Kingfisher, a species that is listed on Annex I of the EU Birds Directive, occurs along some of the many tributaries throughout the site.

Landuse at the site consists mainly of agricultural activities including grazing, silage production, fertilising and land reclamation. The grassland is intensively managed and the rivers are therefore vulnerable to pollution from run-off of fertilisers and slurry. Arable crops are also grown. Fishing is a main tourist attraction on stretches of the Suir and some of its tributaries and there are a number of Angler Associations, some with a number of beats. Fishing stands and styles have been erected in places. Both commercial and leisure fishing takes place on the rivers. The Aherlow River is a designated Salmonid Water under the EU Freshwater Fish Directive. Other recreational activities such as boating, golfing and walking are also popular. Several industrial developments, which discharge into the river, border the site including three dairy related operations and a tannery.

The Lower River Suir contains excellent examples of a number of Annex I habitats, including the priority habitat Alluvial Forest. The site also supports populations of several Annex II animal species and a number of Red Data Book animal species. The presence of two legally protected plants (Flora (Protection) Order, 1999) and the ornithological importance of the river adds further to the ecological interest of this site.

6.10.2006

3.3.3 Slievefelim to Silvermines Mountains SPA (004165)

The Slievefelim to Silvermines Mountains SPA is an extensive upland site located in Counties Tipperary and Limerick. Much of the site is over 200 m in altitude and rises to 694 m at Keeper Hill. Other peaks included in the site are Slieve Felim, Knockstanna, Knockappul, Mother Mountain, Knockteige, Cooneen Hill and Silvermine Mountain. The site is underlain mainly by sandstones of Silurian age. Several important rivers rise within the site, including the Mulkear, Bilboa and Clare. 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 clear-fell are also present at any one time. The principal tree species present are Sitka Spruce (Picea sitchensis) and Lodgepole Pine (Pinus contorta). Roughly one-quarter of the site is unplanted blanket bog and heath, with both wet and dry heath present. The bog and heath vegetation includes such typical species as Ling Heather (Calluna vulgaris), Bilberry (Vaccinium myrtillus), Bell Heather (Erica cinerea), Common Cottongrass (Eriophorum angustifolium), Hare's-tail Cottongrass (Eriophorum vaginatum), Deergrass (Scirpus cespitosus) and Purple Moorgrass (Molinia caerulea). The remainder of the site is mostly rough grassland that is used for hill farming. This varies in composition and includes some wet areas with rushes (Juncus spp.) and some areas subject to scrub encroachment. Some stands of deciduous woodland also occur, especially within the river valleys.

The site is a Special Protection Area (SPA) under the E.U. Birds Directive, of special conservation interest for Hen Harrier. This SPA is one of the strongholds for Hen Harrier in the country. A survey in 2005 resulted in four confirmed and one possible breeding pairs, whereas nine pairs had been recorded in the 1998-2000 period. These numbers represent 3% of the national total. The mix of forestry and open areas provides optimum habitat conditions for this rare bird, which is listed on Annex I of the Birds Directive. The early stages of new and second-rotation conifer plantations are the most frequently used nesting sites, though some pairs may still nest in tall heather of unplanted bogs and heath. Hen Harriers will forage up to c. 5 km from the nest site, utilising open bog and moorland, young conifer plantations and hill farmland that is not too rank. Birds will often forage in openings and gaps within forests. In Ireland, small birds and small mammals appear to be the most frequently taken prey. The site is also a traditional breeding site for a pair of Peregrine. Merlin has been recorded within the site but further survey is required to determine its status. Both of these species are also listed on Annex I of the E.U. Birds Directive. Red Grouse is found on some of the unplanted areas of bog and heath – this is a species that has declined in Ireland and is now Red-listed.

The main threat to the long-term survival of Hen Harriers within the site is further afforestation, which would reduce and fragment the area of foraging habitat, resulting in possible reductions in breeding density and productivity. Overall, the site provides excellent nesting and foraging habitat for breeding Hen Harrier and is among the top five sites in the country for the species

16.7.2007

3.3.4 Features of Interest of the Lower River Shannon cSAC

Table 11 below lists the Annex I habitats and Annex II species for which the Lower River Shannon cSAC has been selected.

Table 11: List of qualifying Features of Interest of the Lower River Shannon cSAC.

Qualifying Interests of the Lower River Shannon cSAC (Site Code: 002165)
Habitats
Sandbanks which are slightly covered by sea water all the time [1110]
Estuaries [1130]
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 colonizing mud and sand [1310]
Spartina swards (Spartinion maritimae) [1320]
Atlantic salt meadows (Glauco-Puccinellietalia maritimae) [1330]
Mediterranean salt meadows (*Juncetalia maritimi*) [1410]
Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation [3260]
Molinia meadows on calcareous, peaty or clavey-silt-laden soils (*Molinion caeruleae*) [6410]
Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae) [91E0]
Species
Freshwater pearl mussel (*Margaritifera margaritifera*) [1029]
Sea lamprey (*Petromyzon marinus*) [1095]
Brook lamprey (*Lampetra planeri*) [1096]
River lamprey (*Lampetra fluviatilis*) [1099]
Salmon (*Salmo salar*) [1106]
Bottle-nosed dolphin (*Tursiops truncatus*) [1349]
Otter (*Lutra lutra*) [1355]

3.3.5 Features of Interest of the Lower River Suir SAC.

Table 12, below, lists the Annex I habitats and Annex II species for which the Lower River Suir cSAC has been selected.

Table 12: List of qualifying Features of Interest for the Lower River Suir cSAC.

Qualifying Interests of the Lower River Suir cSAC (Site Code: 002165) Habitats
Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) [1330]
Mediterranean salt meadows (*Juncetalia maritimi*) [1410]
Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation [3260]
Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels [6430]
Old sessile oak woods with *Ilex* and Blechnum in British Isles [91A0]
Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae) [91E0]
Taxus baccata woods of the British Isles [91J0]
Species
Freshwater pearl mussel (*Margaritifera margaritifera*) [1029]
White-clawed crayfish (*Austropotamobius pallipes*) [1092]
Sea lamprey (*Petromyzon* marinus) [1095]
Brook lamprey (*Lampetra planeri*) [1096]
River lamprey (*Lampetra fluviatilis*) [1099]
Allis shad (*Alosa alosa*) [1102]
Twaite shad (*Alosa fallax fallax*) [1103]
Salmon (*Salmo salar*) [1106]
Otter (*Lutra lutra*) [1355]

3.3.6 Feature of Interest of the Slievefelim to Silvermines Mountains SPA (004165).

Table 13, below, lists the bird species for which the Slievefelim to Silvermines Mountains SPA (004165) has been selected.

Table 13: List of qualifying Features of Interest of the Slievefelim to Silvermines Mountains SPA.

Qualifying Interests of the Slievefelim to Silvermines Mountains SPA Site Code:(004165)
Hen Harrier (*C. cyaneus*) [A082]

3.4 Conservation Status

According to the Habitat's Directive, the conservation status of a natural habitat will be taken as 'favourable' when:

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

According to the Habitat's Directive, the conservation status of a species means the sum of the influences acting on the species concerned that may affect the long-term distribution and abundance of its populations. The conservation status will be taken as 'favourable' when:

- population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats,
- 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.

3.4.1 Conservation Objectives and Management Plans

There are no management plans completed to date for the Lower River Shannon cSAC, Lower River Suir cSAC or the Silvermines Mountains SPA. The conservation objectives for the Natura 2000 Sites are as follows:

3.4.1.1 *Lower River Shannon cSAC (site code: 002165):*

Objective: To maintain or restore the favourable conservation condition of the Annex I habitat(s) and/or the Annex II species for which the SAC has been selected:

[1029] Margaritifera margaritifera
[1095] Petromyzon marinus
[1096] Lampetra planeri
[1099] Lampetra fluviatilis
[1106] *Salmo salar* (only in fresh water)
[1110] Sandbanks which are slightly covered by sea water all the time
[1130] Estuaries
[1140] Mudflats and sandflats not covered by seawater at low tide
[1150] Coastal lagoons
[1160] Large shallow inlets and bays
[1170] Reefs
[1220] Perennial vegetation of stony banks
[1230] Vegetated sea cliffs of the Atlantic and Baltic coasts
[1310] *Salicornia* and other annuals colonizing mud and sand
[1330] Atlantic salt meadows (*Glauco-Puccinellietalia* maritimae)
[1349] Tursiops truncatus
[1355] Lutra lutra
[1410] Mediterranean salt meadows (*Juncetalia* maritimi)
[3260]Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation [3260]
[6410] *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*)

[91E0] Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae)

3.4.1.2 *Lower River Suir cSAC (site code: 002137)*

Objective: To maintain or restore the favourable conservation condition of the Annex I habitat(s) and/or the Annex II species for which the SAC has been selected:
[1029] Margaritifera margaritifera
[1092] Austropotamobius pallipes
[1095] Petromyzon marinus
[1096] Lampetra planeri
[1099] Lampetra fluviatilis
[1103] Alosa fallax
[1106] *Salmo salar* (only in fresh water)
[1330] Atlantic salt meadows (*Glauco-Puccinellietalia* maritimae)
[1355] Lutra lutra
[1410] Mediterranean salt meadows (*Juncetalia maritimi*)
[3260]Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation
[6430] Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels
[91A0] Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles
[91E0] Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae)
[91J0] *Taxus baccata* woods of the British Isles

3.4.1.3 *Slievefelim to Silvermines Mountains SPA (site code: 004165):*

Objective: To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA:
Circus cyaneus [breeding]

3.4.2 Conclusion

Any impact which is likely to cause or contribute to any of the qualifying species and habitats not reaching or maintaining favourable conservation status within these Natura 2000 Sites would be regarded as being in conflict with the management of the sites. In addition, any impact which would hinder the maintenance of the extent, species richness and biodiversity of the sites would also be in conflict with the conservation objectives.

3.5 Ecological Features Selected for Natura Impact Assessment

Tables 11, 12 and 13 above, list the habitats and species for which the Natura 2000 sites, considered in this section of the document, have been designated. It is considered that some of these features will not be impacted by the proposed development and these are listed below in Table 14 with the Natura 2000 sites designated for their protection, in section 3.5.1 below. The significance of the impacts affecting the remaining habitats and species, listed in section 3.5.2, below, will then be assessed in terms of magnitude/extent, probability and duration in sections following.

3.5.1 Ecological features not selected for Natura Impact Assessment

The species and habitats of qualifying interest that will not be impacted by the proposed development are listed in Table 14. These habitats,which are either coastal in their distribution or are grassland and forest habitats not connected to the proposal site either directly within the footprint of the development or via waterways draining the site. Dolphin is a marine species and therefore not present within the zone of impact influence of the proposed windfarm site.

Table 14: List of Ecological features not selected for Natura Impact Assessment with Natura 2000 site designated for their protection

Feature	Designated Site
Coastal and Halophytic Habitats	
Sandbanks which are slightly covered by sea water all the time [1110]	Lower River Shannon cSAC
Estuaries [1130]	Lower River Shannon cSAC
Mudflats and sandflats not covered by seawater at low tide [1140]	Lower River Shannon cSAC
Coastal lagoons [1150]	Lower River Shannon cSAC
Large shallow inlets and bays [1160]	Lower River Shannon cSAC
Reefs [1170]	Lower River Shannon cSAC
Perennial vegetation of stony banks [1220]	Lower River Shannon cSAC
Vegetated sea cliffs of the Atlantic and Baltic coasts [1230]	Lower River Shannon cSAC
Salicornia and other annuals colonizing mud and sand [1310]	Lower River Shannon cSAC
Spartina swards (Spartinion maritimae) [1320]	Lower River Shannon cSAC
Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) [1330]	Lower River Shannon cSAC, Lower River Suir cSAC
Mediterranean salt meadows (*Juncetalia maritimi*) [1410]	Lower River Shannon cSAC, Lower River Suir cSAC
Natural and Semi-natural grassland Habitats	

Molinia meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*) [6410]	Lower River Shannon cSAC
Forest Habitats	
Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae) [91E0]	Lower River Shannon cSAC, Lower River Suir cSAC
Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels [6430]	Lower River Suir cSAC
Old sessile oak woods with Ilex and Blechnum in British Isles [91A0]	Lower River Suir cSAC
Taxus baccata woods of the British Isles [91J0]	Lower River Suir cSAC
Species (Marine)	
Bottlenose dolphin (*T. truncatus*) [1349]	Lower River Shannon cSAC

3.5.2 Ecological features selected for Appropriate Assessment

All of the features of qualifying interest that were deemed relevant to the proposed development were selected for further analysis in respect to likely impacts. These features are listed in Table 15, below. Characteristics of the ecological features selected for Appropriate Assessment are then discussed in the sections following.

Table 15: Ecological features selected for Natura Impact Assessment within Natura 2000 Sites designated for their protection

Feature	Designated Site
Freshwater Habitats (Aquatic)	
Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation [3260]	Lower River Shannon cSAC, Lower River Suir cSAC
Birds	
Hen Harrier (*C. cyaneus*) [A082]	Slievefelim to Silvermines Mountains SPA
Invertebrates	
Freshwater pearl mussel (*M. margaritifera*) [1029]	Lower River Shannon cSAC, Lower River Suir cSAC
White-clawed crayfish (*A. pallipes*) [1092]	Lower River Suir cSAC
Fishes	
Salmon (*S. salar*) [1106]	Lower River Shannon cSAC, Lower River Suir cSAC

Sea lamprey (*P. marinus*) [1095]	Lower River Shannon cSAC, Lower River Suir cSAC
Brook lamprey (*L. planeri*) [1096]	Lower River Shannon cSAC, Lower River Suir cSAC
River lamprey (*L. fluviatilis*) [1099]	Lower River Shannon cSAC, Lower River Suir cSAC
Allis shad (*A. alosa*) [1102]	Lower River Suir cSAC
Twaite shad (*A. fallax fallax*) [1103]	Lower River Suir cSAC
Mammals	
Otter (*L. lutra*) [1355]	Lower River Shannon cSAC, Lower River Suir cSAC

3.5.2.1 *Habitat*

Both the Lower River Shannon cSAC and the Lower River Suir cSAC are designated for the protection of the habitat type 'Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation [3260]'. This is a freshwater habitat found in sections of water courses with natural or semi-natural dynamics (minor, average and major beds) where the water quality shows no significant deterioration (EDG, 2007). This habitat is described as being present 'in the major river systems within' the Lower River Shannon cSAC (see Section 3.3.1, Site synopsis 002165), and is 'present in the freshwater stretches of the River Suir and along many of its tributaries' (See Section 3.3.2, site synopsis 002137) Because floating river vegetation communities are found along some the freshwater stretches within both Natura 2000 sites there is the potential that this habitat is within the zone of impact influence of the proposal. The primary pressures on this habitat are considered to be eutrophication, overgrazing, excessive fertilisation, afforestation and the introduction of invasive alien species;the current conservation status of this habitat type is bad (NPWS, 2008). Any impact on this habitat would occur as a result of unmitigated adverse water quality impacts caused by the proposal described in this report. These impacts are discussed in section 3.6.3 below.

3.5.2.2 *Birds*

Hen Harrier (*C. cyaneus*) [A082]
The hen harrier is listed as an Annex I species under the Birds Directive and classified as an 'Amber Listed' species of medium conservation concern (see Lynas *et al*. 2007). Breeding birds are confined to moorland and young forestry plantations, where they nest on the ground. Hen harriers are found mainly in Counties Laois, Tipperary, Cork, Clare, Limerick and Kerry. In summer hen harrier are found on mountains and moorlands, nesting on the ground.

It also nests in young conifer plantations. In winter birds can roost communally and are found in most parts of Ireland including coastal areas.

There is a clear association between habitat composition and hen harrier activity (Wilson *et al.* 2006) and both the quality and quantity of foraging habitats are known to influence hen harrier distribution (Watson, 1977, Pain et al., 1997, Redpath & Thirgood, 1999, Redpath et al., 2002, Madders 2003 cited in Ruddock *et al*. 2012). In their analysis of the distribution of hen harriers in Ireland Wilson *et al.* (2006) determined that areas with less than 30% cover of bog, rough pasture or young forest were avoided by hen harriers. Therefore, the habitat composition of the area is a determining factor influencing the potential level of hen harrier activity. An additional, and primary, governing factor is the proximity of hen harrier nests, as this has a major influence on habitat use (Madders, 2000), both by breeding birds and fledging juveniles, within the areas adjacent to any location.

Therefore, an extensive area of habitats, which are of high ecological value to hen harrier, is available in the extended geographical area surrounding the proposed Upperchurch Windfarm site. It is considered that hen harriers species will preferentially select these areas of high ecological value above the, lower value, post thicket canopy conifer and agricultural grassland habitats or the remnant upland blanket bog/wet heath mosaic areas that are available within the windfarm site.

Post thicket conifer plantation is of only limited value to hen harrier (O'Flynn 1983, Sim et al. 2001 cited in Wilson *et al*., 2009) and is not strongly associated with either foraging or breeding (Madders 2003, Barton *et al*. 2006 cited in Wilson *et al.* 2009) possibly because of the lack of structural diversity within the uniform conifer blocks (O'Donoghue et al. 2011).

It is noted that hen harriers in Ireland strongly avoid this habitat type for nesting due to the lack of cover and the levels of human activity (Wilson *et al*., 2009).

There is a strong association in Ireland between, pre thicket, second rotation conifer plantation and hen harrier nest site selection (Norriss *et al*. 2002, O'Donoghue 2004 cited in Wilson *et al*. 2009; Irwin *et al*. 2012) albeit that other factors, such as the remaining area of heath/bog and rough grassland that is available for foraging (Norris *et al*. 2007, cited in Lewis *et al*. 2009) also influence site selection.. Young second rotation conifer are of value to nesting and foraging hen harrier after 4 years and were replanting to take place in 2035 then the habitat could be conceivable of value for 1-6 years during the later years of windfarm operation.

3.5.2.3 *Aquatic species*

Freshwater pearl mussel (*M. margaritifera*) [1029]

The freshwater pearl mussel is listed under Annex II of the EU Habitats Directive and is one of the species for which the Lower River Shannon cSAC and the Lower River Suir cSAC have been designated. Ireland is said to support up to 46% of the known populations of the freshwater pearl mussel (*M. margaritifera*) within the European Union (Anon, 2010). The freshwater pearl mussel is listed under Annex II of the EU Habitats Directive and is one of the species for which both the Lower River Shannon cSAC, Lower River Suir cSAC have been designated. Freshwater pearl mussels have a complex life cycle. They mature between seven and 15 years of age and can have a prolonged fertile period lasting into old age. The larvae (glochidia) initially attach to the gills of salmonid fish hosts which provide nourishment, before they become large enough for independent development in the river bed. After excysting from host fish juvenile mussels survive in the interstices of the substrate, comprised of a stable combination of sand, gravels and cobbles, where good oxygen exchange occurs. A covering of fine silt may prevent this and cause heavy mortalities. In summary, the freshwater pearl mussel requires very high quality rivers with clean river beds and waters with very low levels of nutrients without artificially elevated levels of siltation. The survival of the freshwater pearl mussel is under threat and many of the populations are not reproducing and will ultimately disappear if rehabilitative action is not taken.

Of the remaining populations in Ireland it is estimated that at least 90% will "probably never breed successfully again" (Moorkens, 2006, cited in Byrne et al., 2009).

The principal threat to this species is poor substrate quality due to increased growth of algal and macrophyte vegetation as a result of severe nutrient enrichment, as well as physical siltation. Freshwater pearl mussel is listed as critically endangered in the Republic of Ireland in the most recent review of local IUCN threat status of Irish molluscs. Its overall conservation status in Ireland is 'Unfavourable' (NPWS, 2008)

The published current distribution for this species[4] does not include either of the 10km squares which incorporate the location of the proposal considered in this document namely R95 and R96.

White-clawed crayfish (*A. pallipes*) [1092]

The Lower River Suir cSAC is designated for the protection of this species. In Ireland, the white-clawed crayfish most commonly occurs in small and medium-sized lakes, large rivers, streams and drains, wherever there is sufficient lime (Reynolds, 2007). The species prefers relatively cool temperatures and adequate dissolved oxygen and lime, although it is capable of tolerating significant fluctuations. Juveniles live among submerged tree-roots, gravel or aquatic plants, while larger crayfish need stones to hide under, or earthen banks in which to burrow. Crayfish show little activity during the winter period (December to March), spending most of their time torpid in refuges. They become more active when the water temperature increases. Females carry their eggs over winter attached in a dense cluster under their tails (Peay, 2003) and they require undisturbed shelter over a prolonged winter-spring period.

White-clawed crayfish eat a wide range of food including fallen leaves, aquatic vegetation, dead fish, aquatic invertebrates such as snails and caddis-fly larvae, and other dead or live crayfish. They have a wide range of predators; juveniles are eaten by fish, birds and

[4] Species distribution mapping referred to in this section of the document is published in NPWS, 2008

invertebrate predators, adults are taken by large predators; heron, otter and mink. The crayfish try to avoid predation by hiding in refuges by day and coming out at night, when most birds and fish are resting.

The overall conservation status of the white-clawed crayfish in Ireland is poor, due to the reduction in its range and the continuing pressures that it faces (NPWS, 2008). The most recently published Current Range and Current Distribution mapping for this species includes both 10km grid squares which incorporate the proposal considered in this document.

Salmon (*S. salar*) [1106]

Atlantic salmon is a species of qualifying interest for both the Lower River Shannon cSAC, Lower River Suir cSAC .It is an anadromous species, living in freshwater for at least the first 2 or 3 years of life before migrating to sea. Relatively large cool rivers with extensive gravelly bottom headwaters are essential during their early life. Smolts migrate to sea where they may live for 1 or 2 years before returning to freshwater. A decline in Salmon stocks is well recognised in Ireland and throughout the range of the North Atlantic Salmon and is attributed to several factors including the salmon disease Ulcerative Dermal Necrosis (UDN), poor marine survival and some overfishing. The NPWS suggest that agricultural enrichment, forestry related pressures and poor water quality resulting from inadequate sewage treatment are the major pressures affecting Irish salmon rivers (NPWS 2007).

The most recently published Current Range and Current Distribution mapping for this species includes the 10km grid squares that encompass the location of the proposal considered in this document, and indicates that the species has a wide distribution within the River Suir system ranging from the headwaters to the lower reaches of the system and and also within the extended Mulkear River system, which is a tributary of the Shannon, to which first order streams adjacent to the site drain.

Sea lamprey (*P. marinus*) [1095]

Both the Lower River Shannon cSAC and the Lower River Suir cSAC are designated for the protection of this species. Sea lampreys spend their adult life in marine and estuarine waters, living as external parasites on other fish species. They migrate up rivers to spawn in areas of clean gravels and after they have spawned, they die. After hatching, the young larvae settle in areas of fine sediment in still water, where they burrow. They live as filter feeders and may remain in fine sediments for several years before transforming into adult fish. Sea lampreys, which can grow up to 1m in length, are widely distributed around the coast. However they tend to occur in low densities. Overall, the conservation status of the sea lamprey in Ireland is considered to be poor (NPWS, 2008). The Current Range and Current Distribution mapping does not include the 10km squares which encompass the proposal considered in this document

Brook lamprey (*L. planeri*) [1096] River lamprey (*L. fluviatilis*) [1099]

The river lamprey grows to 30cm and has a similar life history to the sea lamprey. The brook lamprey is the smallest of the three lampreys native to Ireland at 15 to 20cm. It is also the only one of the three which is non-parasitic and spends all its life in freshwater. Despite the difference in ecology, brook and river lamprey are very similar genetically and extremely difficult to distinguish from each other. Juvenile river and brook lampreys cannot be discriminated and metamorphosed individuals can only be distinguished on the basis of dentition (King *et al.*, 2004). As a result, for the purposes of this assessment, the brook and river lampreys have been treated together. Both are species of qualifying interest for both the Lower River Shannon cSAC and the Lower River Suir cSAC. The current conservation status of these species in Ireland is considered to be good (NPWS, 2008).

Allis shad (*A. alosa*) [1102]

Allis shad spend their adult life at sea or in the lower reaches of estuaries, ascending to freshwater to spawn in early summer. The spawning females shed their eggs into the water where they either drop into the gravel bed or begin to drift downstream. Those eggs that fall into gravels hatch after several days and then drift downstream. The young fish may remain in estuarine waters during their second year before finally going to sea where they mature. While European populations have a recorded capacity for significant migration upstream, this capacity seems more constrained in Irish populations (King *et al.*, 2004). Weirs and dams are known to be obstacles to the migration of Allis shad upstream. The current conservation status of the species is 'Unknown' (NPWS, 2008).

Twaite shad (*A. fallax* fallax) [1103]

The twaite shad is a member of the herring family and is found in coastal areas from Norway and Iceland to the north-eastern Mediterranean. Shad normally live in estuarine and coastal waters but come into the lower reaches of rivers to spawn. Very little is known about the distribution, abundance and biology of the twaite shad although it has been studied in the River Barrow in County Waterford, and in the Solway rivers (Scotland)[5]. Twaite shad normally spawn, in May and June, near the tidal limits (NPWS, 2008). Weirs and dams are known to be obstacles to the migration of Twaite shad upstream. The current conservation status of the species is bad (NPWS, 2008).). Irish Red Data Book classified as vulnerable.

3.5.2.4 *Mammals*

Otter (*L. lutra*) [1355]

The otter is a species of qualifying interest for both the Lower River Shannon cSAC and Lower River Suir cSAC. The otter is widespread throughout the country, in freshwater and coastal habitats, and Ireland has long been considered to hold one of the most important otter populations in Western Europe (Whilde, 1993). Due to a decline in the population in Europe, including Ireland, the otter has been listed in Annex II of the EU Habitats Directive and Appendix II of the Berne Convention. It is also protected under the Wildlife Acts 1976 and 2000. It is listed in the Red Data Book (Whilde, 1993) as vulnerable.

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[5] http://www.habitas.org.uk/priority/species.asp?item=42767

Otters can, potentially, exploit all stretches of a river system where they are present. The two major threats facing otters in Europe are habitat destruction and water pollution (from NPWS, 2008) and the current conservation status for the species is considered ‘Unfavourable-Inadequate’ (NPWS, 2008). In an Irish context the main four threats have been assessed to be direct and indirect habitat destruction, pollution (particularly organic pollution resulting in fish kills), disturbance from increasing recreational activities and accidental death and persecution (Foster-Turley, *et al.*, 1990).

3.6 Assessment of Potential Impacts

3.6.1 Habitat loss or alteration

3.6.1.1 *Habitats*

The proposal considered in this document does not require any land take from any Natura 2000 or Ramsar site. It is considered that no significant habitat loss or alteration impacts, within any of the designated sites considered in this section of the document, are reasonably foreseeable as a result of the proposal considered in this document.

3.6.1.2 *Aquatic habitats*

The potential for the alteration of aquatic habitats due to an impairment of water quality is assessed section 3.6.3 below.

3.6.2 Disturbance and/or displacement of species

3.6.2.1 *Birds*

In relation to the Natura 2000 sites and their conservation objectives, the main bird species of concern is the hen harrier as this is the species for which the Slievefelim to Silvermines Mountains SPA is designated. The bird surveys of the Upperchurch area show that the proposed development site is not greatly or regularly utilised by hen harriers. Hen harriers which use the wider district for foraging could be affected by:
construction activities;
disturbance/displacement by the actual presence of the turbines; and
risk of collision.
It is possible that the construction activities (construction vehicles, erection of turbines, construction of access roads, turbine foundations and hardstandings *etc*.) could cause disturbance to foraging and/or potential nesting hen harriers in the area. However, the bird surveys show that no breeding took place within the study area in 2011. Hence, the construction activities at the proposed development site are unlikely to impact breeding hen harriers.
Disturbance/displacement by the presence of the turbines
Recent research shows that operational turbines cause low levels of displacement of foraging hen harriers. A monitoring study on hen harriers at an existing windfarm in Derrybrien, Co. Galway indicates that the displacement of hen harriers due to wind turbines is also relatively low, with foraging hen harriers regularly observed within 50m of turbines (Madden and Porter, 2007).
Displacement in terms of nesting/breeding appears to be greater. Whitfield and Madders (2006) refer to Natural Research unpublished data from Argyll in Scotland and Northern

Ireland, which indicate that nesting attempts may occur in the order of 200-300m around turbines. More recent research indicates that there is a lower density of breeding hen harriers within 500m of turbines (Pearce-Higgins *et al.*, 2009).

Hen harrier was observed on two occasions at Upperchurch during the course of the winter and summer raptor vantage point surveys. The randomness and low number of hen harrier observations during the vantage point surveys in 2010 and 2011 suggests that the proposed windfarm site 2km west of Upperchurch is used infrequently by hen harriers. The very low number of observations would suggest that the significance of the risk of Disturbance/displacement as a result of the construction of the wind farm is considered *very low*.

Collision risk

Collision risk for hen harriers is considered to be low (see Madden and Porter, 2007; Whitfield and Madders, 2006). They are known to be manoeuvrable in flight and have been observed to fly to within 10m of turbine bases (Madden and Porter, 2007) and to fly through the gaps in an electricity pylon. The minimum distance between the proposed turbine hubs within the proposed development site is 280m. The randomness and low number of hen harrier observations during the vantage point surveys in 2010 and 2011 suggests that the proposed windfarm site 2km west of Upperchurch is used infrequently by hen harriers and the resultant risk of collision is *very low*.

3.6.2.2 *Aquatic species*

Freshwater pearl mussel (Margaritifera margaritifera)

Distribution in the Lower River Shannon cSAC

As was noted previously the current published distribution for this species within the Shannon river system does not include any 10km square which incorporates any stretch of river downstream of the location of the proposal considered in this document. Mapping of the distribution in this cSAC indicates that the species is restricted to the Feale system a separate tributary which drains to the Shannon Estuary via the Cashen River in North County Kerry. No records for the river system downstream of the proposal site are retained at the NBDC on line data resource. On the basis of the evidence outlined in this paragraph it is concluded that no impacts on this species, within the Lower River Shannon cSAC downstream of the proposal site, are reasonably foreseeable as a result of the proposal considered in this document.

Distribution in the Lower River Suir cSAC

The published current distribution for this species includes 10km grid squares R94 and S05 which incorporate the Clodiagh River into which first order stream adjacent to the proposal site drain. The distribution mapping also includes 10km grid squares S04, S02 and S01 which contain a significant stretch of the main channel of the Suir further downstream of the proposal site. In addition records from 2006, retained at the National Biodiversity Data

Centre on line data resource, indicate that the species was then recorded in several locations on the Multeen River. An unnamed stream adjacent to the proposal site drains to the Turaheen River which in turn drains to the Multeen. The nearest record retained is for 1km grid square R9844 situated approximately 21km downstream[6] of the proposal site. It is presumed in light of the aforementioned direct evidence and on the basis of the precautionary principle, that this species is potentially present within the zone of impact influence of the proposal.

There is a risk that the water quality of the local watercourses, that drain the site, could be impaired during the construction stage of the proposed windfarm. It is possible that this could impact negatively on the Freshwater pearl mussel within the Lower River Suir cSAC downstream of the proposal site.

There is also a risk of negative impact to this species because of its complex life cycle which includes a larval stage when they are dependent on salmonid fish hosts. It is possible that these salmonids could be in the impact zone of the development when they migrate further upstream. The main potential risk to the mussel posed by the proposed development is the threat of sedimentation and pollution of waterways during the construction phase of the proposal. Therefore, it cannot be objectively concluded that significant indirect impacts on the freshwater pearl mussel will not ensue from an unmitigated construction phase.

White-clawed crayfish (Austropotamobius pallipes)

As was noted previously the most recently published Current Range and Current Distribution mapping for this species includes both 10km grid squares which incorporate the proposal considered in this document. In addition, records retained at the NBDC include one location within the Turraheen system and several locations on the Owenbeg system all of which are downstream of the proposal site considered in this document. The record on the Turraheen is located approximately 8km[7] downstream of the site. The nearest location on the Owenbeg is approximately 4km downstream of the site. O Connor (2007) noted that crayfish were abundant at Munroe Bridge which is situated on the Cromoge River which drains to Clodiagh at a point upstream of the point of confluence of the Clodiagh and Owenbeg. Taken together these various records indicate the strong likelihood of the presence of a significant population(s) within the upper Clodiagh/Owenbeg system. It is presumed in light of the aforementioned direct evidence and on the basis of the precautionary principle, that this species is potentially present within the zone of impact influence of the proposal.

There is a risk that the water quality of the local watercourses, that drain the site, could be impaired during the construction stage of the proposed windfarm. It is possible that this could impact negatively on the white-clawed crayfish.

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[6] Distance measured on 'Draw and Measure' tool on the IFI Water Framework Directive Fish Survey Map Viewer (Available at http://www.ifigis.ie/WFDFishMap/ [accessed 14/08/2012])

[7] Distances measured on 'Analysis' tool on the NBDC Biodiversity Maps Map Viewer. (Available at http://maps.biodiversityireland.ie/#/Map [accessed 15/08/2012])

Therefore, it cannot be objectively concluded that significant indirect impacts on the white-clawed crayfish will not ensue from an unmitigated construction phase.

Salmon (S. salar) [1106]

As was mentioned previously, current available evidence indicates that this species has a wide distribution within both cSAC river systems. It is presumed in light of the aforementioned evidence and on the basis of the precautionary principle, that this species is potentially present within the zone of impact influence of the proposal.

There is a risk that the water quality of the local watercourses, that drain the site, could be impaired during the construction stage of the proposed windfarm. It is possible that this could impact negatively on the Atlantic salmon. The main potential risk posed by the proposed development is the threat of sedimentation and pollution of waterways and consequent potential loss of spawning habitat during the construction phase. Therefore, it cannot be objectively concluded that significant indirect impacts on the salmon will not ensue from an unmitigated construction phase.

Potential nursery habitat was recorded along the stream to the south of turbines T9 and T10. No suitable salmon nursery habitat was recorded within the other streams within the site boundary.

Sea lamprey (Petromyzon marinus)

Distribution in the Lower River Shannon cSAC

The Current Range and Current Distribution mapping indicates that this species is not present within the tributary system which connects the proposal considered in this document, via the Mulkear River, to the main channel of the River Shannon. The mapping indicates that the nearest record is for 10km Grid square R55 at a location downstream of the point of confluence of the Mulkear and Shannon rivers, near Castletroy in Limerick city. This location is a linear distance in excess of 29km west of the proposal site and separated from it by a watercourse of significantly greater length. It is noted that the weir at Annacotty is a migration barrier that prevents lamprey from accessing the Mulkear of the river[8]. On the basis of the evidence outlined in this paragraph it is concluded that within the Lower River Shannon cSAC downstream of the proposal site, no significant impacts on this species are reasonably foreseeable as a result of the proposal considered in this document.

Distribution in the Lower River Suir cSAC

The Current Range and Current Distribution mapping indicates that that the distribution of the species extends to a location which is in excess of 12km downstream of the point of confluence of the Turaheen/ Multeen system and the Owenbeg/ Suir system (near Golden, County Tipperary). This location, which is in excess of a linear distance of 34km south east of the proposal, is adjacent to Cahir in County Tipperary. O Connor, (2007 p.4) states that sea lamprey were recorded downstream of Cahir, County Tipperary a finding confirmed by the

[8] http://www.mulkearlife.com/sea-lamprey.php

Current range and Distribution mapping which indicates that the species has a wide distribution within the River Suir system spanning the Suir from downstream of Cahir to the lower reaches of the system (NPWS, 2008). It is presumed in light of the aforementioned direct evidence and on the basis of the precautionary principle, that this species is potentially present within the zone of impact influence of the proposal.

There is a risk that the water quality of the local watercourses, that drain the site, could be impaired during the construction stage of the proposed windfarm. It is possible that this could impact negatively on the sea lamprey within the Lower River Suir cSAC downstream of the proposal site.

The main potential risk posed by the proposed development is the threat of sedimentation and pollution of waterways during the construction phase of the proposal. Therefore, it cannot be objectively concluded that significant indirect impacts on the sea lamprey will not ensue from an unmitigated construction phase.

Brook lamprey (Lampetra planeri) [1096] and River lamprey (Lampetra fluviatilis]

Currently no records are retained online at the National Biodiversity Data Centre for these species within the extended river systems of either cSAC. The current known distribution for these species includes the 10km squares within which the proposal considered in this document occurs and the grid squares which incorporate the extended river systems which drain to both cSACs. O Connor (2007) confirmed the presence of these species within the Multeen, upstream of its point of confluence with the Aughnaglanny River, at a site approximately 18km downstream of the proposal site. The same survey recorded these species on the Owenbeg and Clodiagh rivers at sites located up stream of their point of confluence which is situated approximately 9km downstream on the Owenbeg and 19km downstream on the Clodiagh.

It is presumed in light of the aforementioned evidence and on the basis of the precautionary principle, that these species are potentially present within the zone of impact influence of the proposal. within both cSACs.

There is a risk that the water quality of the local watercourses, that drain the site, could be impaired during the construction stage of the proposed windfarm. It is possible that this could impact negatively on the lamprey within the Lower River Suir cSAC downstream of the proposal site.

There is a potential risk of a negative impact on these species from the construction. The main potential risk posed by the proposed development is the threat of sedimentation and pollution of waterways during the construction phase of the proposal. Therefore, it cannot be objectively concluded that significant indirect impacts on lamprey will not ensue from an unmitigated construction phase.

Allis shad (*A. alosa*) [1102]

The Lower River Suir cSAC is designated for the protection of this species because Current Range mapping for this species is only available in 50km grid cells the resolution is less fine than that which is available for other species. However, mapping of the Current Distribution of this species, which is available at 10km grid resolution, indicates that the species is confined to the lower reaches of the Suir system (NPWS, 2008) which is a linear distance of in excess of 60km south east of the proposal site and separated from it by a watercourse of considerably greater length[9]. Therefore, on the basis of the distribution mapping, and bearing in mind the constrained capacity for upstream migration referred to previously, it is considered unlikely that this species occurs within 15km of the proposed development. On the basis of the evidence outlined in this paragraph it is concluded that on this species, within the cSAC, no significant impacts are reasonably foreseeable as a result of the proposal considered in this document.

Twaite shad (*A. fallax* fallax) [1103]

The Lower River Suir cSAC is designated for the protection of this species Because Favourable Reference Range Mapping for this species is only available in 50km grid cells the resolution is less fine than that which is available for other species. However, mapping of the Current Distribution of this species, which is available at 10km grid resolution, indicates that the species s is confined to the lower reaches of the Suir system at a linear distance of in excess of 60km[10] south east of the proposal site and separated from it by a watercourse of considerably greater length. Therefore on the basis of the distribution mapping, and the evidence sited in the site synopsis, it is considered unlikely that this species occurs within 15km of the proposed development. On the basis of the evidence outlined in this paragraph it is concluded that on this species, within either cSAC, no significant impacts are reasonably foreseeable as a result of the proposal considered in this document.

[9] Distance measured using 'Measure Distance' Analysis Tool available at http://maps.biodiversityireland.ie/#/Map [accessed 14/08/2012]

[10] Distance measured using 'Measure Distance' Analysis Tool available at http://maps.biodiversityireland.ie/#/Map [accessed 14/08/2012]

3.6.2.3 *Mammals*

Otter (L. lutra)

A search of the NBDC online resource indicates that the most recent, adjacent, records retained for this species are 1980 records included in the 1982 Otter Survey of Ireland[11]. At that time otter were recorded in 100m grid square R947628 approximately 1.3km north east of T21 on the Clodiagh river and in 100m grid square R974594 on the Owenbeg, approximately 1.2km south east of T2.These records, albeit historic, indicate that otters are potentially present within the vicinity of the proposal.

It is presumed in light of the aforementioned evidence and on the basis of the precautionary principle, that these species are potentially present within the zone of impact influence of the proposal.

There is a risk that disturbance due to noise and human presence could cause disturbance or displacement impacts on this species during the construction phase of the proposed windfarm. There is also a risk that the water quality of the local watercourses, that drain the site, could be impaired during the construction stage of the proposed windfarm. It is possible that this could impact negatively on the otter within both the Lower River Shannon cSAC and the Lower River Suir cSAC downstream of the proposal site.

It is considered that the proposal considered in this document could potentially pose a risk of habitat degradation through sedimentation and/or pollution. This could impact the otter directly or indirectly through the reduced availability of prey. Therefore, it cannot be objectively concluded that significant indirect impacts on the otter will not ensue from an unmitigated construction phase.

3.6.3 Water Quality

The potential significant impacts of the proposed development on aquatic ecology (without mitigation) are summarised as follows:

Pollution of watercourses with suspended solids due to runoff of soil from construction areas.

In the absence of adequate mitigation measures, contamination of water courses with suspended solids may have the potential to impact on potential salmonid spawning and nursery areas and this is one of the most significant potential impacts of the proposed development. The impact would be classified as a significant negative impact on all affected streams (namely the Clydagh and Breanagh Rivers and their tributaries). Pollution of the local watercourses would result in a direct impact on the SPA and particularly the cSAC.

Pollution of watercourses with nutrients due to ground disturbance during construction and during clear felling of forestry.

The main potential sources of nutrient inputs to freshwater due to ground disturbance are:

Nutrients adsorbed or chemically bound to eroded suspended solids

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[11] Available at: http://maps.biodiversityireland.ie/#/Map [accessed 7/06/2012]

Leaching of fertilisers used during the forestry operation
Pollution of watercourses with nutrients due to decomposition of brash after forestry clear felling.
Pollution of watercourses, during construction phase, with other substances such as fuels, lubricants, waste concrete, waste water from wash facilities, etc.

Pollution of watercourses with surface drainage water from paved areas and road surfaces.
There is a risk of pollution of surface waters with hydrocarbons from paved areas after the construction is complete.
Permanent loss of habitat due to stream crossings.
Construction of stream crossings at site entrance and installation of box culvert at may result in potential for in-stream deterioration of water quality.
In the absence of adequate mitigation measures, pollution of water courses from any of the above possible sources has the potential to impact on qualifying interests, aquatic species, otter and freshwater habitat within the *Lower River Shannon and Lower River Suir c SACs*. This is the most significant potential impact of the proposed development. The impact, if it resulted in a severe pollution event, would be classified as a significant negative impact on the adjacent stream and on both cSACs. A number of species of qualifying interest could be affected, particularly if spawning success of these species was negatively impacted. Additional impacts would occur, particularly to otter, should availability of prey be reduced.

Table 16 Summary of unmitigated impacts

Ecological Feature	Potential impacts	**Potential significance of the unmitigated impact Lower River Shannon cSAC**	**Potential significance of the unmitigated impact Lower River Suir cSAC**
Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation [3260]	Possible decrease in water quality as a result of run-off of pollution.	**Significant**	**Significant**
Freshwater pearl mussel (*Margaritifera margaritifera*) [1029]	Possible decrease in habitat quality from sedimentation or pollution. Possible death of glochidia larvae. Possible decrease in abundance of parasitic salmonid hosts due to sedimentation or pollution of habitat.	*None expected*	**Significant**
White-clawed crayfish (*Austropotamobius pallipes*)[1092]	Possible decrease in habitat quality from sedimentation or pollution.	<u>Species not a Qualifying Feature of Interest</u>	**Significant**
Atlantic salmon (*Salmo salar*) [1106]	Possible decrease in habitat quality from sedimentation or pollution and reduction in spawning area.	**Significant**	**Significant**
Sea lamprey (*Petromyzon marinus*)[1095]	Possible decrease in habitat quality from sedimentation or pollution.	*None expected*	**Significant**

Ecological Feature	Potential impacts	**Potential significance of the unmitigated impact Lower River Shannon cSAC**	**Potential significance of the unmitigated impact Lower River Suir cSAC**
Brook lamprey (*L. Planeri*) [1096] and River lamprey (*Lampetra fluviatilis*) [1099]	Possible decrease in habitat quality from sedimentation or pollution and reduction in spawning area.	**Significant**	**Significant**
Allis shad (*A. alosa*) [1102]		Species not a Qualifying Feature of Interest	*None expected*
Twaite shad (*A. fallax fallax*) [1103]		Species not a Qualifying Feature of Interest	*None expected*
Otter (*L. lutra*) [1355]	Possible disturbance or displacement impacts from noise and human presence during construction phase. Possible decrease in habitat quality and/or prey availability from sedimentation or pollution.	**Significant**	**Significant**
Ecological Feature	Potential impacts	**Potential significance of the unmitigated impact Slieve Felim to Silvermines SPA**	
Hen harrier (*C.cyaneus*) [A082]	Disturbance/displacement from habitat Potential risk of collision	**Not Significant**	

3.7 Mitigation

Construction of the windfarm has the potential to cause negative short-term and/or permanent impacts to terrestrial habitats within the proposed windfarm site and to aquatic habitats and species in the rivers and streams associated with the site. A number of planned mitigation measures detailed below will reduce these impacts significantly. Many of the mitigation measures below have been based on CIRIA (Construction Industry Research and Information Association, UK) technical guidance on water pollution control and on current accepted best practice.

3.7.1.1 *Storage, Stockpiling and Waste Generation Management*

All excavated earth materials must be either re-used in an environmentally appropriate and safe manner, e.g. used for landscaping, or removed from the development site at the end of the construction phase.

In addition, a construction phase Environmental Management Plan will be incorporated to include regular checking of equipment, materials storage and transfer areas, drainage structures and their attenuation ability during the construction phase of the project. The purpose of this management control is to ensure that the measures that are put in place continue to operate effectively, to prevent accidental leakages, and to identify potential breaches in the protective retention and attenuation network during earthworks operations

3.7.1.2 *Soil, Subsoil and Bedrock Removal*

The removal of topsoil, mineral subsoil and bedrock is an unavoidable impact of the development but every effort will be made to ensure that the amount of earth materials excavated is kept to a minimum in order to limit the impact on the geological and hydrological aspects of the site.

A number of mitigation measures have been incorporated into the project design in order to reduce the likely significance of the impacts on the Natura 2000 sites as outlined above. The main concern is the potential impacts on the water quality of watercourses within the Lower River Suir and the Lower River Shannon cSACs during the construction phase, and the subsequent impacts on the aquatic species of qualifying The main risk to the water quality of the streams draining the site, which drain into the nearby Lower River Suir cSAC and the Lower River Shannon cSAC, results from the potential sedimentation of streams, run-off of pollutants from construction discharging into watercourses and accidental fuel spillages. These risks arise from both felling and construction activities. Management measures will be put in place to avoid any pollution risks to the Lower River Suir cSAC and the Lower River Shannon cSAC.

3.7.2 Water Quality Measures during the Construction Phase

It is noted that no in-stream works are proposed. A number of mitigation measures will be implemented in order to reduce the significance of the potential adverse impacts associated with the construction phase.

3.7.2.1 *Runoff and sediment control*

Erosion control where runoff is prevented from flowing across exposed ground and sediment control where runoff is slowed to allow suspended sediment to settle are important elements in runoff and sediment control. An erosion and sediment control management plan has been designed to prevent sediment and pollutant runoff into the river during the construction phase and is included as Appendix 15-2 Volume 3. This plan will be implemented during construction to control increased runoff and associated suspended solid loads in discharging waters from the development areas. The main elements of this plan include:

Implement erosion control to prevent runoff flowing across exposed ground and becoming polluted by sediments;

Intercept and divert clean water runoff away from construction site runoff to avoid cross-contamination of clean water with soiled water;

Implement sediment control to slow down runoff allowing suspended sediments to settle in situ particularly on roads;

When working at each stage and section (e.g. access road, substation compound, turbine bases, etc) of the development the associated erosion and sediment controls at each section will be put in place prior to construction of each section. Access roads will need to be constructed to access the proposed site for turbine locations. The associated erosion and sediment controls, drains, sediment traps and settling ponds, will be constructed along side these roads and in a conscious manner to ensure that the potential risk to water quality is minimised;

Minimise area of exposed ground by maintaining existing vegetation that would otherwise be subject to erosion in the vicinity of the windfarm infrastructure and keeping excavated areas to a minimum;

The clearing of soil and peat associated with the proposed development will take place immediately before construction begins;

Avoid working near watercourses during or after prolonged rainfall or an intense rainfall event and cease work entirely near drains when it is evident that pollution is occurring;

Install a series of silt fences or other appropriate silt retention measure where there is a risk of erosion runoff to watercourses from construction related activity particularly if working during prolonged wet weather period or if working during intense rainfall event;

Implement sediment control measures that includes for the prevention of runoff from adjacent intact ground that is for the separation of clean and 'dirty' water;

Install appropriate silt control measures such as silt-traps, check dams and sedimentation ponds;

Provide recommendations for public road cleaning where needed particularly in the vicinity of drains; and

Controls need to be regularly inspected and maintained otherwise a failure may result, such as a build up of silt or tear in a fence, which will lead to water pollution so controls must work well until the vegetation has re-established; inspection and maintenance is critical after prolonged or intense rainfall.

Run-off from wind turbine foundation concrete pours shall not be permitted to enter the drainage system and shall be contained within the foundation excavations and designated areas that are suitably sited and designed;

No work will take place within 50m buffer zones of live watercourses except for the stream crossings.

All construction method statements will be prepared in consultation with Inland Fisheries Ireland;

All associated tree felling will be undertaken using good working practices as outlined by the Forest Service in their 'Forestry Harvesting and Environment Guidelines' (Forest Service, 2000a) and the 'Forestry and Water Quality Guidelines '(Forest Service, 2000b). The latter guidelines deal with sensitive areas, erosion, buffer zone guidelines for aquatic zones, ground preparation and drainage, chemicals, fuel and machine oils;

Drainage ditches or other suitable measures will be adopted alongside access roads, turbines and other disturbed areas to prevent silt or contamination from construction water runoff entering watercourses;

Check dams will be placed at regular intervals based on slope gradient along all drains to slow down runoff to encourage settlement and to reduce scour and ditch erosion;

Drains, carrying construction site runoff, will be diverted into silt traps;

Wheel washes will be provided for exiting heavy vehicles to ensure roads outside of the site boundary are clean;

Pumped or tremied concrete will be monitored carefully to ensure no accidental discharge into the watercourse;

A programme of inspection and maintenance of drainage and sediment control measures during construction will be designed and dedicated construction personnel assigned to manage this programme;

Water quality monitoring will be carried out for two years post-construction to determine whether water quality is impacted.

3.7.2.2 *Protection of Watercourses (General Measures)*

It is recommended that the following measures should be incorporated into the development so as to ensure no significant negative impact on water course and the features of conservation interest:

Raw or uncured waste concrete / cementitious material will be disposed of by removal from the site.
The amount of *in-situ* concreting required will be minimised and ready-mix suppliers will be used in preference to on-site batching.
Fuelling and lubrication of equipment will be carried out in bunded areas.
Any spillage of fuels, lubricants or hydraulic oils will be immediately contained and the contaminated soil removed from the site and properly disposed of.
Oil booms and oil soakage pads will be kept on site to deal with any accidental spillage.
Waste oils and hydraulic fluids will be collected in leak-proof containers and removed from the site for disposal or re-cycling.
Prior to any work it will be ensured that all construction equipment is mechanically sound to avoid leaks of oil, fuel, hydraulic fluids and grease.
Overnight parking of vehicles away from watercourses

3.7.2.3 *Run-off and Sediment Control Plan and Measures*

A Sediment and Erosion Control Plan will be designed to safeguard the water environment and incorporated into the Construction Environmental Management Plan (CEMP) and other surface water management measures employed during the construction phase of the proposed windfarm (see Chapter 6 Volume 2). The main aspects of the plan are outlined hereunder:
Reduce changes in run-off regimes
Control surface water run-off within and its effects outside the site
Protect aquatic environments
Separate clean water from construction activity effected water
Appropriately design and specify the provision of sediment series ponds and silt traps
Prevent all sediment associated pollution entering watercourses and groundwater
Erosion control where run-off is prevented from flowing across exposed ground and sediment control where run-off is slowed to allow suspended sediment to settle are important elements in run-off and sediment control. This plan will be implemented during construction to control increased run-off and associated suspended solid loads in discharging waters from the construction area. All site compound drainage will be passed through a settlement facility with the capacity to retain any accidental spillage or leakage of polluting substances. The main elements of this plan include:
Prior to excavation, drains will be established to effectively drain grounds prior to earthworks. Such drains will be positioned at an oblique angle to slope contours to ensure ground stability.
All site excavations and construction will be supervised by a suitably qualified engineer. The contractor's methodology statement will be reviewed and approved by a suitably qualified engineer prior to site operations.

Run-off from foundation concrete / cementitious material pours shall not be permitted to enter the watercourse and shall be contained within the foundation excavations and designated areas that are suitably sited and designed.
The area of exposed ground will be kept to a minimum by maintaining, where possible, existing vegetation.
Temporary deposition areas will be designated and designed to hold temporary stockpiles of spoil. These will be located away from the stream and stockpiles that are at risk of erosion will be protection by silt trapping apparatus such as a geotextile silt fence to prevent contaminated run-off.
Silt fences or other appropriate silt retention measure will be installed where there is a risk of erosion run-off to the stream from construction related activity, particularly during prolonged wet weather periods or an intense rainfall event.
Check dams will be placed at regular intervals based on slope gradient along all drains to slow down run-off to encourage settlement and to reduce scour and ditch erosion.
Drains carrying construction site run-off will be diverted into silt traps.
It is recommended that wheel washes will be provided in a bunded area at a remove from the stream.
Pumped or tremied concrete / cementitious material will be monitored carefully to ensure no accidental discharge into the stream.
A programme of inspection and maintenance of drainage and sediment control measures during construction will be designed and dedicated construction personnel assigned to manage this programme.
Silt traps will be regularly inspected, any blockages cleared and they will be maintained and cleaned during dry weather.

A continuous silt fence will be installed down slope from the works area where construction shall take place within 100m of a stream. This will act as a physical impediment to any material or run-off reaching the stream and will be installed prior to the commencement of site excavations for each section. Effective and adequate temporary silt fences will be erected on the river side to trap sediment particles when work is taking place during a prolonged wet weather period or intense rainfall event. The silt fences will be inspected regularly to ensure that the integrity of the structure remains intact and fit for purpose throughout the construction phase of the proposal.

3.7.2.4 *Fuel and Oil Management Plan*

Fuel management measures will be implemented which will incorporate the following elements:
Machinery will be confirmed as being mechanically sound and without fuel or oil leaks and fit for purpose prior to project start;
Use of biodegradable products where possible, e.g. hydraulic fluid;

Mobile bowsers, tanks and drums will be stored in secure, impermeable storage area, a minimum of 50m from drains and open water;
Fuel containers must be stored within a secondary containment system e.g. bund for static tanks or a drip tray for mobile stores;
Ancillary equipment such as hoses, pipes must be contained within the bund;
Taps, nozzles or valves must be fitted with a lock system;
Fuel and oil stores including tanks and drums will be regularly inspected for leaks and signs of damage;
Only designated trained operators will be authorised to refuel plant on site and emergency spill kits will be present at equipment for all refuelling events;
Procedures and contingency plans will be set up to deal with an emergency accidents or spills; and
An emergency spill kit with oil boom, absorbers etc. will be kept on site in the event of an accidental spill.

3.7.2.5 *Replanting and Reinstatement of Site*

Exposed areas of the site that are slow to re-vegetate may need to be replanted with suitable vegetation. This will be decided by the developer in consultation with the project ecologist near the end of the construction phase.
As a result of permanent felling, works areas surrounding T3, T9, T12, T14 and T22 will be bare and it is proposed to incorporate these areas into an Ecological Management Plan for the site.

3.7.2.6 *Truck Wash and Concrete / Cementitious Material Residue*

It is important to prevent concrete and other cementitious material from entering the streams situated in close proximity to the site.
It is recommended that a designated bunded and impermeable truck wash area be provided. Resultant waste water is to be diverted to siltation pond for settling out of solids, prior to release. It is important that a pumping / dewatering system is well planned. Pumped water will need to be treated in the adequate settlement pond and silt trap before it can enter the stream. Among other things, concrete and other cementitious material will be used for the construction and the following measures will be implemented:
Designate a concrete / cementitious material washout area away from drains and watercourses at a designated, contained impermeable area or washout trucks off-site.
A designated trained operator experienced in working with concrete and other cementitious material will be employed during the pouring phase.
Large volumes of concrete and other cementitious material water to be pumped into a skip to settle out.

3.7.2.7 *Waste Control*

The main contractor should engage a waste company to deal with all its wastes during construction, so all waste streams should be identified at the outset and a selection of skips and bins are delivered to the contractor's compound at the outset and the waste is then managed throughout the construction phase. The contractor should prepare a Waste Management Plan.

Any introduced semi-natural (road building materials) or artificial (PVC piping, cement materials, electrical wiring etc.) must be taken off site at the end of the construction phase. Any accidental spillage of solid state introduced materials must be removed from the site.

3.7.2.8 *Storage*

The storage of materials, containers, stockpiles and waste, however temporary, should follow best practice at all times and be stored at designated areas. Storage will be located as follows:

Away from drains and any watercourses or drains

Fuel oils etc. will be stored in a sheltered area well removed from aquatic zones

Under cover to prevent damage from the elements

In secure areas

Well away from moving plant, machinery and vehicles

All containers will be stored upright and clearly labelled.

3.7.3 Summary of Residual Mitigated Impacts

Table 16 below includes an assessment of the likely residual impacts of the proposed Upperchurch Windfarm provided that all management mitigation measures outlined above are adequately implemented.

Table 17: Potential Significance of the mitigated impact

Ecological Feature(s) / Impact	**Potential significance of the unmitigated impact**	**Summary of Mitigation Measures**	**Potential significance of the mitigated**
Freshwater pearl mussel (*Margaritifera margaritifera*) / Impairment of water quality	Significant	• Protection of water quality (general) • Run-off and Sediment Control Plan and Measures • Fuel and Oil Management Plan • Truck Wash and Concrete / Cementitious Material Residue • Waste Control • Storage	Not significant
White-clawed crayfish (*Austropotamobius pallipes*) / Impairment of water quality	Significant		Not significant
Sea lamprey (*Petromyzon marinus*) / Impairment of water quality	Significant		Not significant
River lamprey (*Lampetra fluviatilis*) and brook lamprey (*L. Planeri*) / Impairment of water quality	Significant		Not significant
Atlantic salmon (*Salmo salar)* Impairment of water quality	Significant		Not significant
Otter (*Lutra lutra*) / Impairment of water quality	Significant		Not significant
Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation / Impairment of water quality	Significant		Not significant

4 Cumulative Impact Assessment

The Natura Impact Assessment has been revised and updated following the a request by NTCC as part of a RFI (13/51/0003) for a cumulative impact assessment and ecological management plan.

4.1 Cumulative Impact upon SPA

The Upperchurch Wind Farm including a buffer zone of 250m radius around the turbines does not overlap with the SPA; the nearest turbine is 490m to the boundary of the *Slieve Felim to Silvermines Mountains SPA* (see Map 3, Appendix 1). Four of the turbines are located within 1km of the SPA, three turbines lies between 1km and 2km while the remaining turbines are located a distance of over 2km from the SPA.

The study area for the assessment includes the *Slieve Felim to Silvermines Mountains SPA* as well as a distance of 250m outside of the SPA.

Again, it is important to emphasise that the proposed Upperchurch Wind Farm will not affect the number of turbines within the SPA or within the 250m buffer zone surrounding the SPA boundary.

Table 18 below details the wind farm projects within the *Slievefelim to Silvermines Mountains SPA* and within the 250m buffer zone from its boundary. Of the 45 turbines within the SPA, 16 are proposed, 16 are permitted and 13 are operational. The Upperchurch Wind Farm is outside the SPA with the nearest turbine being 490m and the majority of turbines are located between 1-2km from the edge of the SPA (see Map 3, Appendix 1).

Table 18. Details of the wind farm projects within the SPA

Wind Farm	Owner	Status	No. turbines	No. turbines within SPA & 250m buffer zone	No. turbines outside SPA
Garracummer	Bord Gais	Operating	17	7*	10
Knockstanna	Airtricity	Operating	5	5	0
Bunkimalta	ESB/Coillte	Proposed	16	16	0
Knockmeale	Templederry Windfarm Ltd	Operating	2	1	1
Castlewaller	Castlewaller Woodland Partnership	Permitted	16	16	0
			56	**45**	**11**

* Two of the seven turbines lie outside the SPA but within the 250m buffer zone

Conifer plantation is considered to provide suitable foraging habitat during the open canopy stage, between years 2-10 of planting. Therefore, conifer plantation is only suitable for 20% or 8 years of its estimated 40 year rotational cycle and is thus considered to provide suitable habitat on a short-term basis. The provision of suitable conifer plantation habitat thus only coincides with a portion, and not all, of the lifetime of a windfarm. Marginal or semi-natural habitats, which are permanently open (i.e. not subject to the rotational cycles of conifer plantations), are considered suitable hen harrier foraging habitats over the lifetime of the windfarm.

Table 19. Details of the Upperchurch Wind Farm

Wind Farm	No. turbines within SPA & 250m buffer zone	Habitat types within 250m displacement zones of use to hen harrier	Short-term suitable foraging areas, conifer plantation (ha)	Area of suitable conifer plantation over project lifetime (ha)	Permanently suitable foraging areas, semi-open & marginal habitats (ha)
Upperchurch	0	Conifer plantation, acid grassland, wet grassland, upland blanket bog, wet heath	108ha	11ha	84ha

Table 2 above details the habitat types and areas within Upperchurch Wind Farm that are suitable on a short-term and permanent basis. At Upperchurch there is a mix of permanently open habitats (acid grassland, wet grassland, bog, heath) and conifer plantation (suitable on a short-term basis).Table 20 below details the habitat types and areas of the wind farms within the *Slievefelim to Silvermines Mountains* SPA and the 250m buffer zone that are suitable on short-term and permanent basis (see Map 1, Appendix 1). At Garracummer, Bunkimalta and Castlewaller the displacement zones are dominated by conifer plantation. The 5 turbines at Knockastanna support bog and wet grassland that can be considered as suitable foraging habitat through the lifetime of the wind farm (i.e. permanently suitable). Knockmeale supports less than 1ha of suitable foraging habitat.

Table 20. Details of the wind farm projects within the SPA and buffer zone (information sourced from relevant wind farm planning application documentation, note Planning Ref. (PR) quoted)

Wind Farm	**No. turbines within SPA & 250m buffer zone**	**Habitat types within 250m displacement zones of use to hen harrier**	**Conifer plantation (ha)**	**Area of suitable conifer plantation available over project lifetime (ha)**	**Permanently suitable foraging areas, semi-open & marginal habitats (ha)**
Garracummer	7	Conifer plantation	106	44	20
Knockstanna	5	Upland blanket bog, wet grassland	6		46
Bunkimalta (P.R. 13510035)	16	Conifer plantation, upland blanket bog, wet grassland	274	163	27
Knockmeale	1	Agricultural grassland, wet grassland	0	0	1
Castlewaller (P.R. 11510251)	16	Conifer plantation	288	48	0
	45		**674**	**255**	**84**

It is estimated that of the 674ha within the displacement zones of the turbines within the SPA and 250m SPA buffer zone, 255ha of this is likely to be suitable as hen harrier foraging habitat over the lifetime of the wind farms. When combined with the 84ha of permanently open habitat this increases to a total area of 339ha of suitable hen harrier foraging habitat within the displacement zones. Should hen harrier avoid the 250m displacement zones around turbines and foraging habitat is lost as a result, there is potential for cumulative impacts to arise within the SPA. Upperchurch Wind Farm will not contribute to any habitat loss within the SPA or associated 250m buffer zone, however, hen harrier are known to use the site though infrequently and the loss of approximately 95ha of potentially suitable hen harrier habitat may result in a cumulative effect. The potential losses of foraging habitat for the hen harrier associated with the Upperchurch Wind Farm will be fully mitigated by the creation of areas of suitable foraging habitat (see EcMP for further detail). Therefore, it is considered that impact of Upperchurch Wind Farm will be neutral and it will not contribute to a significant cumulative impact upon the *Slieve Felim to Silvermines Mountains SPA.*

The two largest wind farms within the SPA, the proposed Bunkimalta (Planning Ref. 13510035) and the permitted Castlewaller (Planning Ref. 11510251), which make up 74% of wind farms within the SPA, have acknowledged the potential for potential cumulative effects for foraging hen harrier. To remedy this, both have provided for the creation of equivalent areas of suitable foraging habitat. Mitigation habitat that is the creation of equivalent areas of suitable foraging habitat has been proposed by the applicants for the Bunkimalta and Castlewaller Wind Farm projects. The Bunkimalta project proposes to create an equivalent area of open canopy forest over the lifetime of the wind farm. Bunkimalta and Castlewaller are the largest of the wind farm projects within the SPA and they have the greatest coverage of forestry. Therefore, as a full mitigation programme involving the provision of equivalent areas of suitable foraging habitat is proposed for the Bunkimalta and Castlewaller projects it can be concluded that the net impact of these projects on the SPA is neutral and therefore the SPA should not be adversely affected.

In summary, the provision of mitigatory habitat for most of the turbines within the SPA and at Upperchurch Wind Farm coupled with the fact that Upperchurch wind farm lies outside the SPA and the associated 250m buffer zone, a cumulative impact effect with the SPA is not expected to arise.

4.1.1 Cumulative Impact of Other Wind Farms

The cumulative impact assessment area for the assessment of in-combination effects with other wind farms is made up of an area of 15km from the outer turbines of the Upperchurch Windfarm as well as the *SlieveFelims to Silvermines Mountains SPA* in addition to a buffer of 3km on the western edge of the SPA. The total area of this assessment area is 106,915ha. This differs from the SPA assessment area which was confined to the SPA and the surrounding 250m buffer zone.

There are a number of permitted and existing wind farms in the assessment area, as detailed in Table 21 below and Map 2 (Appendix 1). Of the 45 turbines within the SPA, 16 are proposed, 16 are permitted and 13 are existing and operating. The Upperchurch Wind Farm is outside the SPA with the nearest turbine being a distance of 490mm; most turbines are located at distances greater than 1km and 2km from the edge of the SPA (see Map 3, Appendix 1). The remaining 101 turbines within the study area are outside the SPA and within 15km of the Upperchurch Wind Farm. Most of these are located to the southeast of Upperchurch Wind Farm.

Table 21. Wind Farms within 15km of the proposed wind farm (wind farms with turbines with the SPA have been bolded for clarity)

	Wind Farm	Owner	Status	No. turbines	Distance from nearest UWF turbine - KM	No. turbines within SPA	No. turbines outside SPA	Distance of nearest turbine from SPA - KM
1	Upperchurch	Ecopower Developments	Proposed	22	0	0	22	0.5
2	**Garracummer**	**Bord Gais**	**Operating**	**17**	**2.8**	**5**	**12**	**0**
3	**Knockstanna**	**Airtricity**	**Operating**	**5**	**8**	**5**	**0**	**0**
4	Cappawhite	ESB	Permitted	18	8.5	0	18	3.7
5	Glencarbry	Ecopower Developments	Permitted	11	4.5	0	11	3.4
6	Glenough	ABO Wind	Operating	14	3.2	0	14	2.7
7	Hollyford	Viridian	Under construction	3	3.7	0	3	3.1
8	Turraheen	Ecopower Developments	Proposed	3	5.6	0	3	5.5
9	Milestone	ABO Wind	Proposed	5	0.4	0	5	1.3
10	**Bunkimalta**	**ESB/Coillte**	**Proposed**	**16**	**9.5**	**16**	**0**	**0**
11	**Knockmeale**	**Templederry Windfarm Ltd**	**Operating**	**2**	**7.8**	**1**	**1**	**0.03**
12	**Castlewaller**	**Castlewaller Woodland Partnership**	**Permitted**	**16**	**14**	**16**	**0**	**0**
13	Ballinlough	Jaroma Windfarm Ltd	Operating	3	12.7	0	3	9.2
14	Curraghgraigue	Aeolus Energy Ltd	Operating	6	9.4	0	6	2.4
15	Ballinveny	North Tipperary Windpower Ltd	Operating	3	12.8	0	3	11.9
				144		**43**	**101**	

A GIS and autocad software have been used to map and estimate abundances for potentially useful hen harrier foraging habitat such as conifer plantation (suitable on a short-term basis during its open canopy stage) and marginal and semi-natural habitats, which are useful over the 25 year lifetime of the wind farm. The results of this analysis are presented in the following tables and have been used to undertake the assessment (see Map 2, Appendix 1).

Table 22. Temporarily and permanently suitable foraging habitat within the assessment area

	Wind Farm	No. turbines within SPA & 250m buffer zone	Habitat types within 250m displacement zones of use to hen harrier	Area of conifer plantation within 250m displacement zones (ha)	Area available conifer plantation within 250m displacement zones (ha) over lifetime of windfarm	Permanently suitable foraging areas, semi-open & marginal habitats (ha)
1	Upperchurch	0	Conifer plantation, acid grassland, wet grassland, upland blanket bog, wet heath	11	11	84
2	Garracummer	7	Conifer plantation	106	44	77
3	Knockstanna	5	Upland blanket bog, wet grassland	6	4	46
4	Cappawhite	0	Conifer plantation, wet grassland, bog/heath	234	92	93
5	Glencarbry	0	Conifer plantation, wet grassland, acid grassland, wet heath mosaic	135	44	17
6	Glenough	0	Conifer plantation, wet grassland, wet heath, acid grassland	90	18	29
7	Hollyford	0	Conifer plantation, wet grassland, wet heath, acid grassland, heath/bog cutover	5	0	19
8	Turraheen	0	Conifer plantation, wet grassland, bog/grassland mosaic, bog, wet heath	16	14	12
9	Milestone	0	Conifer plantation, wet grassland, wet heath	15	15	10

10	Bunkimalta	16	Conifer plantation, upland blanket bog, wet grassland	163	163	27
11	Knockmeale	1	Agricultural grassland, wet grassland	0	-	1
12	Castlewaller	16	Conifer plantation	48	48	0
13	Ballinlough	0	-	-	-	-
14	Curraghgraigue	0	Conifer plantation	1	0	0
15	Ballinveny	0	Conifer plantation	7	7	0
		45		**788**	**451**	**415**

Table 5 above presents all of the wind farms within the assessment areas. The total area of conifer plantation within the 205m displacement zones is 788ha, however, this does not reflect the fact that the plantation canopy will be closed for 80% of 4/5 of its rotational cycle. Therefore, this figure is a considerable overestimation. Following an analysis of the amount of area of available conifer plantation for foraging hen harrier over the lifetime of the Upperchurch Wind Farm this has been reduced to 451ha within the 250m displacement zones.

Table 6 below presents the corine landcover analysis, which was used in the assessment. Based on an analysis of the definitions of the landcover classifications habitats that are considered to provide potentially suitable forging habitat include transitional woodland-scrub, coniferous forestry, peat bog, moor and heath and natural grassland. It has been estimated that a total of approximately 22,000ha of potentially suitable hen harrier habitat occurs within the assessment area.

Table 23. Corine landcover estimates within the assessment area

Landcover type	Area (ha)	Potentially suitable hen harrier foraging area (ha)	Class as a % of the Zone
Pasture	73,169	-	68%
Transitional Woodland-Scrub	**9,092**	**9,092**	**9%**
Coniferous Forestry	**7,536**	**7,536**	**7%**
Agricultural	7,271	-	7%
Peat Bog	**4,562**	**4,562**	4%
Un-Irrigated Land	2,427	-	2%
Complex Cultivation	984	-	1%
Natural Grassland	**521**	**521**	0%
Broadleaf Forestry	409	-	0%
Discontinuous Urban	398	-	0%
Moor and Heath	**304**	**304**	0%
Inland Marsh	240	-	0%
		22,015	100.0%

When taken into context of the total area of potentially suitable available landcover of ~ 22,000ha for foraging hen harrier, the Upperchurch project will potentially affect 95ha (see Table 19), which is less than 0.5%. The other wind farm projects within the assessment area will potentially affect 451ha of useful conifer plantation and 415ha of open habitat giving a total of 866ha (see Table 22). When taken in context of the 22,015ha of available land this constitutes less than 4% of the total suitable landcover. The presence of the other windfarms may result in a cumulative effect; however, it is unlikely to be significant.

Mitigatory habitat has been proposed for Upperchurch Wind Farm through the provision of areas of suitable foraging habitat (nearest turbine is 490m from edge of SPA, therefore outside 250m buffer zone around SPA) the net impact is considered neutral. It is not anticipated that Upperchurch Wind Farm will contribute in a significant way to a cumulative effect.

Furthermore, mitigatory habitat has been proposed to offset loss of potential foraging habitat for the two largest wind farms, Bunkimalta and Castlewaller. Mitigatory habitat has also been proposed for Milestone Wind Farm (P.R. 12510385), which lies within the vicinity of Upperchurch Wind Farm but like Upperchurch is located outside of the SPA.

4.1.2 Cumulative Impact of Forestry

The *Slievefelim to Silvermines Mountains SPA* is an extensive upland site and approximately half of the site is afforested, including both first and second rotation plantations and clear fell areas. Roughly one-quarter of the site is unplanted blanket bog and heath, with both wet and dry heath present. The remainder of the site is largely rough grassland that is used for hill farming while some stands of deciduous woodland also occur, especially in the river valleys.

A considerable portion of the forestry within the SPA was planted pre-2000 and much of the current crop is in its second 40 year rotation. Of the total area of land within the assessment area (that is the 15km around the windfarm + SPA + 3km area surrounding SPA) 14,862ha or 13.9% of the forestry within the greater assessment area was planted prior to the year 2000. The significance of this is that that area may be of value to hen harrier for a portion of the lifetime of Upperchurch Wind Farm, which is planned for construction in 2017. It is only pre-thicket or open canopy conifer plantation during the years 2-10, or often years 3-9, that are considered to be of use to the hen harrier. Most of the forestry planted post-2000 will already be past the pre-thicket stage and the canopy will have closed.

From examination of a number of evidence sources in particular aerial photography and analysis presented in the planning documentation submitted in support of other wind farms in the region, it is expected that the area of available suitable forestry for hen harrier foraging will decrease over the lifetime of the Upperchurch Wind Farm. The expected reduction is mainly due to the impending closure of open canopy young second rotation forestry, which occurs 10 years after planting. This will likely result in a reduction in potential foraging habitat for the hen harrier within the SPA and influence future population trends.

According to the National Hen Harrier Survey (Ruddock, 2012) a significant decrease in population has been recorded since the previous national survey in 2005. It is considered that forest maturation is considered partly responsible for this due to a shift in the age structure to more mature closed canopy. It is worth noting that one of the principal threats to nesting hen harrier is predators such as crows and foxes (pers. comm. Barry O'Donoghue).

With the creation of an area of hen harrier foraging habitat as part of the Upperchurch project, it is expected that the hen harrier will use this area while forestry lands within the SPA come under pressure. With the EcMP in place the potential impact of the Upperchurch Wind Farm will be neutral, and may even be considered positive. It is not anticipated that the project when considered with forestry will result in a significant cumulative impact.

4.2 Other Cumulative Effects

4.2.1 Cumulative disturbance effects

Cumulative disturbance effects can occur during the construction phase in particular, due to noise, visual intrusion or disturbance effectively amounting to habitat loss arising from the effect of displacement from more than one wind farm development. Disturbance is short term and may occur during construction. Disturbance effects may be non-linear where birds may tolerate a certain level of disturbance up to a threshold (SNH, 2012).

Observations of a female hen harrier during a breeding season survey at Glencarbry Windfarm Extension in summer 2011, while the western-most turbine turbine at Glenough wind farm was undergoing construction, indicated no disturbance effect. The bird was first observed over mature conifer plantation and circled north over improved agricultural grassland, to within 300m of the construction area (pers. obs.). Glencarbry wind farm and Glenough wind farm are 4.5km and 3.2 km to the south of the proposed Upperchurch wind farm, respectively (pers. obs. 2011).

It is not expected that cumulative disturbance effects, which are temporary in nature, will be significant.

4.2.2 Cumulative Collision Effects

Cumulative collision effects can arise as a result of a number of wind farm developments in an area as well as changes in behaviour of bird species in response, making them more / less likely to collide (King et al., 2009). In practice, most birds take avoidance action to avoid a wind farm or wind turbine structure and alter their flight lines (SNH, 2012). Information on collision is limited, because as mentioned it can rarely be assumed that all collisions are detected, due to scavenging, as well as surveyor bias.

The evidence to date indicates that the effects are extremely species and site specific. Not all species are equally sensitive to collision. Large birds such as raptors and wildfowl are considered to be at greater risk of collision due to their flight behaviour and mobility (Percival, 2003). Percival notes that in Ireland, wind farms are most likely to have a serious negative impact on birds in areas of high concentrations of seabirds, wintering wildfowl or breeding raptors. There is no evidence of breeding raptors at Upperchurch Wind Farm with the nearest known nest recorded roughly 4km to the southeast of the Upperchurch site bordering the Glenough windfarm to the southeast of the site.

There is no known hen harrier flight paths between foraging and roosting areas associated with the Upperchurch project.

Observations at the Glenough wind farm in 2012 and 2013 indicated that potential hen harriers collision was unlikely as the majority of flying adults and juveniles were recorded below 35m i.e. below turbine blade height (Cork Ecology 2012, 2013).
All observations of hen harrier during breeding and winter surveys at Upperchurch in 2011 and 2013 were recorded below 35m.

The main collision risk to hen harrier occurs where nests are located within 500m of a turbine. A risk to fledglings that are not as aerially skilled as adults may result in a collision risk.

At Glenough wind farm, there is an historic hen harrier nest site, c. 300m from the nearest turbine and another c. 2.5km from the nearest turbine. In 2012, during a post-construction survey, two fledged young were observed at the nest site, 2.4km from the nearest turbine. In 2013, two fledged young were observed at the nest site, 300m from the nearest turbine (Cork Ecology 2012, 2013). As already stated, Glenough wind farm is 3.2km from the nearest turbine at the proposed Upperchurch wind farm.

Post-construction monitoring at a wind farm site in Co. Galway indicated that most observations were of hen harrier foraging at less than 10m above ground, although birds were also recorded at rotor height. Between 10 and 11 pairs of hen harriers bred within 5km of the win farm site boundary, during each year of monitoring (Madden and Porter 2007).
It is not expected that collision of hen harrier with turbines at Upperchurch will occur due to the low flying height of foraging hen harriers together with the absence of recorded nests within the vicinity of the project.

4.2.3 Cumulative Barrier Effects

Cumulative barrier effects occurs where birds alter their migration flyways or local flight paths, to avoid wind farm developments, resulting in increased energy expenditure as birds have to fly longer distances and could result in disruption. Barrier effects depend on species, type of bird movement, flight height, turbine layout, wind force and direction (King at al., 2009).

There is a strong relationship between cumulative barrier effects and cumulative displacement effects, particularly after construction has taken place. It will depend on the number of wind farms and the number of turbines in these wind farms, within the vicinity of the proposed wind farm at Upperchurch. It will also depend on the quality of hen harrier habitats available within these wind farms and in the surrounding area.

At a 71 turbine wind farm site in Co. Galway, within the Slieve Aughty SPA, there were numerous sightings of hen harrier. Monitoring commenced in 2004, prior to the erection of turbines and continued in 2006 and 2007, when the wind farm was in full operation. Most observations were of hen harrier foraging at less than 10m over the bog. Birds regularly passed within 50m of turbines, with one bird foraging within 10m of a turbine base. The behavioural observations indicated that birds passed between turbines or along lines of turbines, and no sudden movements were seen that suggested alarm or hesitation (Madden and Porter 2007).

At the 14 turbine wind farm at Glenough, the levels of hunting recorded during the post-construction monitoring, indicated that there was suitable hunting habitat both within the wind farm and in the immediate surrounding area, and that the presence of turbines did not act as a barrier to foraging hen harrier (Cork Ecology 2013).

The turbines at Upperchurch are well spread and the site is not considered a bird migration route. Other wind farms in the region are well spread and spaced from one another and most turbines are at a minimum of 300-400m apart.

In summary it is not expected that the Upperchuch Wind Farm proposal will contribute a significant cumulative barrier effect with other windfarms.

4.2.4 Cumulative Impact of Agriculture

The area within and surrounding the proposed wind farm at Upperchurch is currently intensively farmed and is primarily improved agricultural grassland. This habitat is deemed unsuitable for foraging hen harrier. It is one of the main habitats associated with the 250m buffer displacement zone around the turbines. If the wind farm was granted permission, it is likely that farming would continue within these buffer zones.

It is expected that the quota for milk will be removed in 2015 and under Harvest 2020[12] milk production is expected to increase by 50% by 2020. Existing marginal land such as that surrounding the SPA and within 15km of the wind farm may be subject to improvement in an effort to increase the amount of available high quality agricultural grassland and meet the 2020 target for milk production. If this occurs on a significant level it is likely to result in the reduction of future hen harrier foraging habitat and may have a knock-on effect on future population trends.

The proposed Ecological Management Plan prepared as part of the RFI proposes the management of approximately 120ha of land outside the SPA. This will have the effect of securing this land for hen harrier foraging habitat over the lifetime of the wind farm whose construction is likely to coincide with the early years of the removal of the milk quota. With

[12] http://www.agriculture.gov.ie/agri-foodindustry/foodharvest2020/

the Ecological Management Plan in place the potential impact of the Upperchurch Wind Farm will be neutral, and may even be considered positive. A significant cumulative effect with agriculture is not antipated.

4.3 Hen Harrier Habituation to Wind Farm Development

Certain bird species are known to habituate to the presence of wind farms (Spaans et al., 1998 a & b). In Pierce-Higgins et al., (2012) following temporary disturbance during construction, upland bird populations became habituated to operational wind farms. This conclusion was based on a 3 year period of wind farm operation. The main finding of this study for breeding bird populations suggests that the main effects of wind farms may be through disturbance displacement during construction. The turbines at Upperchurch are carefully sited and well spread; it is likely that hen harriers will habituate to the wind farm to a degree over its lifetime.

At Garracummer wind farm, there were no observations of hen harrier nesting behaviour during the construction phase in 2011/2012, although there was hen harrier breeding activity observed in the 5km hinterland, during the construction phase. However, there was a significant increase in raptor activity during post-construction monitoring at the site in 2013 (pers. comm. BGE, 29/11/2013). Garracummer wind farm is 2.8km from the nearest turbine at Upperchurch wind farm and is within 5km of the wind farm at Glenough.

As already mentioned with regard to the 14 turbine wind farm at Glenough, the levels of hunting recorded during the post-construction monitoring, indicated that there was suitable hunting habitat both within the wind farm and in the immediate surrounding area, and that the presence of turbines did not act as a barrier to foraging hen harrier (Cork Ecology 2013).

5 Conclusion

The proposed windfarm lies within 15 km of Lower River Shannon cSAC (site code 002165), Bolingbrook Hill cSAC (site code 002124), Lower River Suir cSAC (site code 002137), Anglesey Road cSAC (site code 002125), Slievefelim to Silvermines Mountains SPA (site code 004165), Silvermines mountains West SAC (site code 002258), Keeper Hill SAC (site code 001197), Kilduff, Devilsbit Mountain SAC (site code 000934) and Philipston Marsh SAC (site code 001847). An Appropriate Assessment has been undertaken to determine the significance of the impact on Natura 2000 sites. No adverse impact is expected to arise to Natura 2000 Sites as a result of the proposed development.

The main potential negative impacts identified relate to habitat loss, disturbance to fauna during construction phase of the development, risk of collision for the hen harrier and the pollution of waterways downstream of the drains/streams within the proposed site.

A comprehensive erosion and sediment plan has been developed and this will reduce the likelihood of any potential pollution event occurring which could impact on protected sites downstream of the development. Other mitigation measures include the implementation of a fuel management plan, control of wheel wash, dewatering and concrete, and the recommendation for the composition of an ecological management plan prior to construction.

Pre-construction monitoring will be undertaken for birds and post construction monitoring will be undertaken for the first two year of operation.

No significant ecological residual impacts are expected as a result of the construction and operational phase of the proposed Upperchurch Windfarm.

Following the completion of a cumulative impact assessment it is anticipated that the project will not contribute to significant cumulative impacts.

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6.1

REFERENCE DOCUMENTS

Appendix 1

Figures

FIGURE 13-II-1: SPECIAL AREAS OF CONSERVATION (SAC) WITHIN 15KM OF THE STUDY AREA

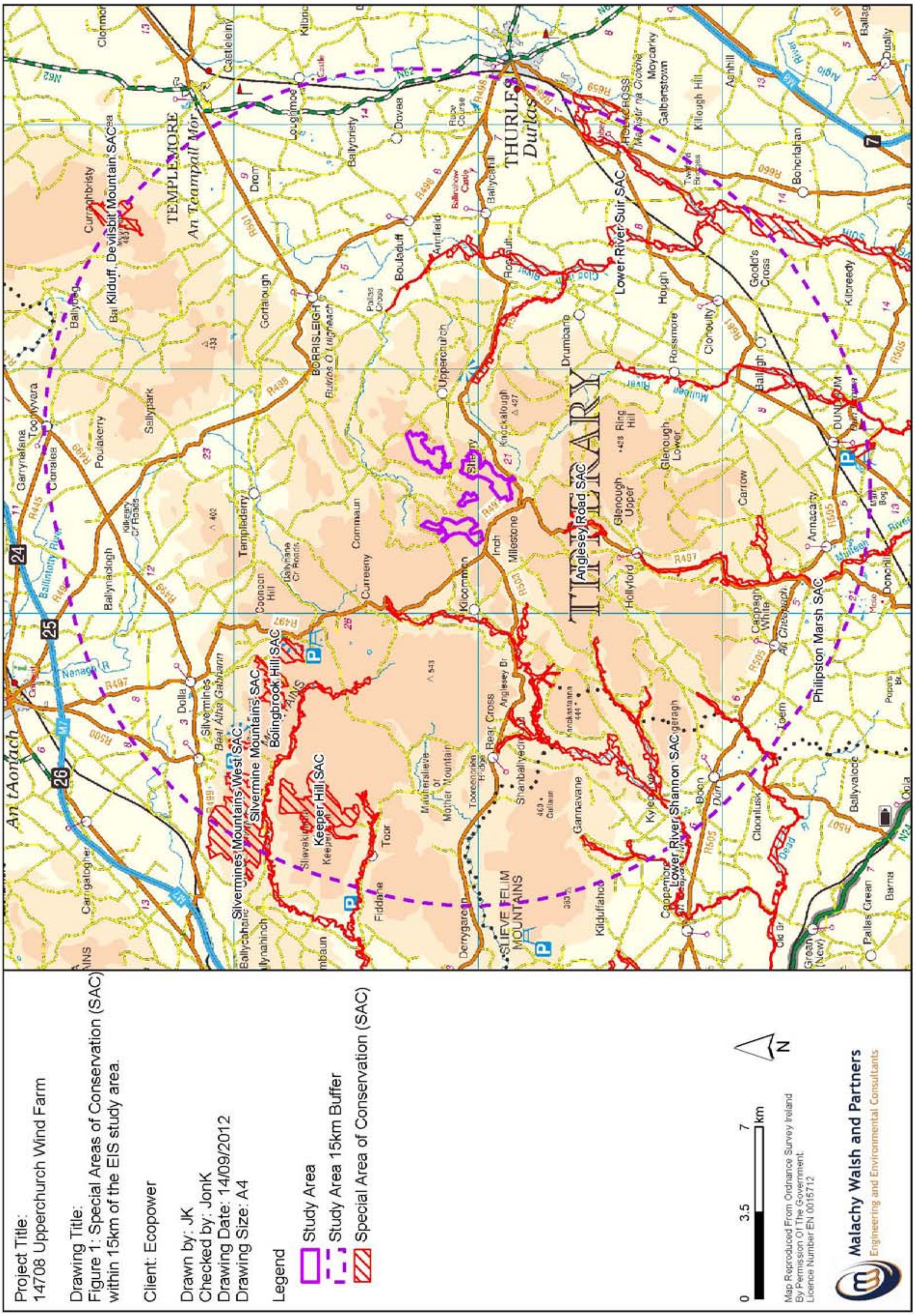
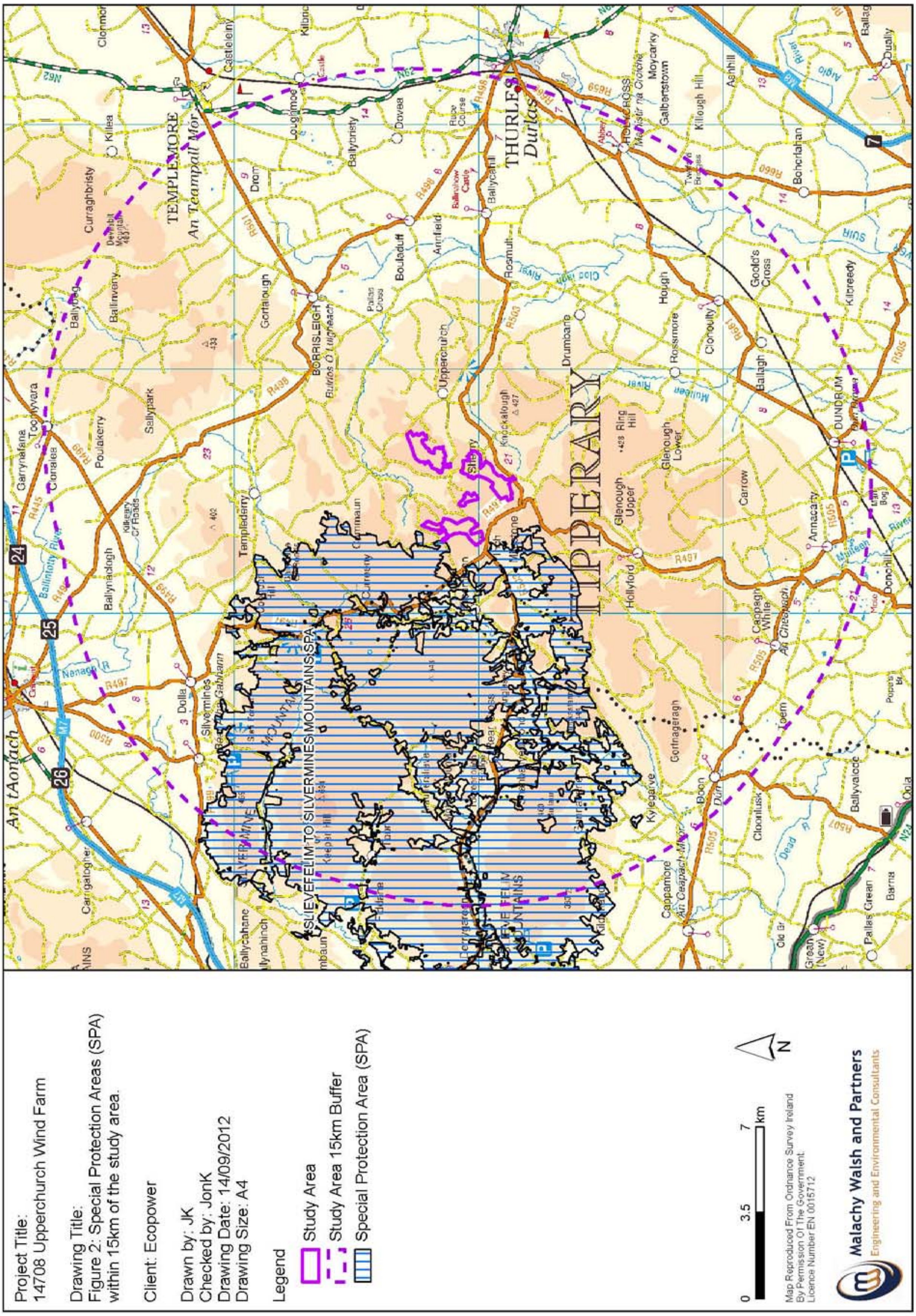


FIGURE 13-II-2: SPECIAL PROTECTION AREAS (SPA) WITHIN 15KM OF THE STUDY AREA



Upperchurch Windfarm Environmental Impact Statement

Appendix 2
Conservation Objectives

Conservation Objectives for Anglesey Road SAC [002125]

The overall aim of the Habitats Directive is to maintain or restore the favourable conservation status of habitats and species of community interest. These habitats and species are listed in the Habitats and Birds Directives and Special Areas of Conservation and Special Protection Areas are designated to afford protection to the most vulnerable of them. These two designations are collectively known as the Natura 2000 network.

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.

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.

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 condition of the Annex I habitat(s) and/or the Annex II species for which the SAC has been selected:

- [6230] * Species-rich *Nardus* grasslands, on siliceous substrates in mountain areas (and submountain areas, in Continental Europe)

Citation:

NPWS (2011) Conservation objectives for Anglesey Road SAC [002125]. Generic Version 3.0. Department of Arts, Heritage & the Gaeltacht.

For more information please go to: www.npws.ie/protectedsites/conservationmanagementplanning

Conservation Objectives for Kilduff, Devilsbit Mountain SAC [000934]

The overall aim of the Habitats Directive is to maintain or restore the favourable conservation status of habitats and species of community interest. These habitats and species are listed in the Habitats and Birds Directives and Special Areas of Conservation and Special Protection Areas are designated to afford protection to the most vulnerable of them. These two designations are collectively known as the Natura 2000 network.

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.

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.

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 condition of the Annex I habitat(s) and/or the Annex II species for which the SAC has been selected:

- [4030] European dry heaths
- [6230] * Species-rich *Nardus* grasslands, on siliceous substrates in mountain areas (and submountain areas, in Continental Europe)

Citation:

NPWS (2011) Conservation objectives for Kilduff, Devilsbit Mountain SAC [000934]. Generic Version 3.0. Department of Arts, Heritage & the Gaeltacht.

For more information please go to: www.npws.ie/protectedsites/conservationmanagementplanning

Conservation Objectives for Keeper Hill SAC [001197]

The overall aim of the Habitats Directive is to maintain or restore the favourable conservation status of habitats and species of community interest. These habitats and species are listed in the Habitats and Birds Directives and Special Areas of Conservation and Special Protection Areas are designated to afford protection to the most vulnerable of them. These two designations are collectively known as the Natura 2000 network.

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.

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.

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 condition of the Annex I habitat(s) and/or the Annex II species for which the SAC has been selected:

- [4010] Northern Atlantic wet heaths with *Erica tetralix*
- [6230] * Species-rich *Nardus* grasslands, on siliceous substrates in mountain areas (and submountain areas, in Continental Europe)
- [7130] Blanket bogs (* if active only)

Citation:

NPWS (2011) Conservation objectives for Keeper Hill SAC [001197]. Generic Version 3.0. Department of Arts, Heritage & the Gaeltacht.

For more information please go to: www.npws.ie/protectedsites/conservationmanagementplanning

Conservation Objectives for Philipston Marsh SAC [001847]

The overall aim of the Habitats Directive is to maintain or restore the favourable conservation status of habitats and species of community interest. These habitats and species are listed in the Habitats and Birds Directives and Special Areas of Conservation and Special Protection Areas are designated to afford protection to the most vulnerable of them. These two designations are collectively known as the Natura 2000 network.

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.

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.

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 condition of the Annex I habitat(s) and/or the Annex II species for which the SAC has been selected:

- [7140] Transition mires and quaking bogs

Citation:

NPWS (2011) Conservation objectives for Philipston Marsh SAC [001847]. Generic Version 3.0. Department of Arts, Heritage & the Gaeltacht.

For more information please go to: www.npws.ie/protectedsites/conservationmanagementplanning

Conservation Objectives for Bolingbrook Hill SAC [002124]

The overall aim of the Habitats Directive is to maintain or restore the favourable conservation status of habitats and species of community interest. These habitats and species are listed in the Habitats and Birds Directives and Special Areas of Conservation and Special Protection Areas are designated to afford protection to the most vulnerable of them. These two designations are collectively known as the Natura 2000 network.

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.

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
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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 condition of the Annex I habitat(s) and/or the Annex II species for which the SAC has been selected:

- [4010] Northern Atlantic wet heaths with *Erica tetralix*
- [4030] European dry heaths
- [6230] * Species-rich *Nardus* grasslands, on siliceous substrates in mountain areas (and submountain areas, in Continental Europe)

Citation:

NPWS (2011) Conservation objectives for Bolingbrook Hill SAC [002124]. Generic Version 3.0. Department of Arts, Heritage & the Gaeltacht.

For more information please go to: www.npws.ie/protectedsites/conservationmanagementplanning

Conservation Objectives for Lower River Suir SAC [002137]

The overall aim of the Habitats Directive is to maintain or restore the favourable conservation status of habitats and species of community interest. These habitats and species are listed in the Habitats and Birds Directives and Special Areas of Conservation and Special Protection Areas are designated to afford protection to the most vulnerable of them. These two designations are collectively known as the Natura 2000 network.

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.

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.

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 condition of the Annex I habitat(s) and/or the Annex II species for which the SAC has been selected:

- [1029] *Margaritifera margaritifera*
- [1092] *Austropotamobius pallipes*
- [1095] *Petromyzon marinus*
- [1096] *Lampetra planeri*
- [1099] *Lampetra fluviatilis*
- [1103] *Alosa fallax*
- [1106] *Salmo salar* (only in fresh water)
- [1330] Atlantic salt meadows (*Glauco-Puccinellietalia* maritimae)
- [1355] *Lutra lutra*
- [1410] Mediterranean salt meadows (*Juncetalia maritimi*)
- [3260] Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation
- [6430] Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels
- [91A0] Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles

Citation:

NPWS (2011) Conservation objectives for Lower River Suir SAC [002137]. Generic Version 3.0. Department of Arts, Heritage & the Gaeltacht.

For more information please go to: www.npws.ie/protectedsites/conservationmanagementplanning

- [91E0] * Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*)
- [91J0] * *Taxus baccata* woods of the British Isles

Citation:

NPWS (2011) Conservation objectives for Lower River Suir SAC [002137]. Generic Version 3.0. Department of Arts, Heritage & the Gaeltacht.

For more information please go to: www.npws.ie/protectedsites/conservationmanagementplanning

Conservation Objectives for Lower River Shannon SAC [002165]

The overall aim of the Habitats Directive is to maintain or restore the favourable conservation status of habitats and species of community interest. These habitats and species are listed in the Habitats and Birds Directives and Special Areas of Conservation and Special Protection Areas are designated to afford protection to the most vulnerable of them. These two designations are collectively known as the Natura 2000 network.

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.

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.

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 condition of the Annex I habitat(s) and/or the Annex II species for which the SAC has been selected:

- [1029] *Margaritifera margaritifera*
- [1095] *Petromyzon marinus*
- [1096] *Lampetra planeri*
- [1099] *Lampetra fluviatilis*
- [1106] *Salmo salar* (only in fresh water)
- [1110] Sandbanks which are slightly covered by sea water all the time
- [1130] Estuaries
- [1140] Mudflats and sandflats not covered by seawater at low tide
- [1150] * Coastal lagoons
- [1160] Large shallow inlets and bays
- [1170] Reefs
- [1220] Perennial vegetation of stony banks
- [1230] Vegetated sea cliffs of the Atlantic and Baltic coasts
- [1310] *Salicornia* and other annuals colonizing mud and sand
- [1330] Atlantic salt meadows (*Glauco-Puccinellietalia* maritimae)

Citation:

NPWS (2011) Conservation objectives for Lower River Shannon SAC [002165]. Generic Version 3.0. Department of Arts, Heritage & the Gaeltacht.

For more information please go to: www.npws.ie/protectedsites/conservationmanagementplanning

- [1349] *Tursiops truncatus*
- [1355] *Lutra lutra*
- [1410] Mediterranean salt meadows (*Juncetalia maritimi*)
- [3260] Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation
- [6410] *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*)
- [91E0] * Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*)

Citation:

NPWS (2011) Conservation objectives for Lower River Shannon SAC [002165]. Generic Version 3.0. Department of Arts, Heritage & the Gaeltacht.

For more information please go to: www.npws.ie/protectedsites/conservationmanagementplanning

Conservation Objectives for Silvermines Mountains West SAC [002258]

The overall aim of the Habitats Directive is to maintain or restore the favourable conservation status of habitats and species of community interest. These habitats and species are listed in the Habitats and Birds Directives and Special Areas of Conservation and Special Protection Areas are designated to afford protection to the most vulnerable of them. These two designations are collectively known as the Natura 2000 network.

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.

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.

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 condition of the Annex I habitat(s) and/or the Annex II species for which the SAC has been selected:

- [4010] Northern Atlantic wet heaths with *Erica tetralix*
- [4030] European dry heaths

Citation:

NPWS (2011) Conservation objectives for Silvermines Mountains West SAC [002258]. Generic Version 3.0. Department of Arts, Heritage & the Gaeltacht.

For more information please go to: www.npws.ie/protectedsites/conservationmanagementplanning

Conservation Objectives for Slievefelim to Silvermines Mountains SPA [004165]

The overall aim of the Habitats Directive is to maintain or restore the favourable conservation status of habitats and species of community interest. These habitats and species are listed in the Habitats and Birds Directives and Special Areas of Conservation and Special Protection Areas are designated to afford protection to the most vulnerable of them. These two designations are collectively known as the Natura 2000 network.

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.

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.

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 condition of the bird species listed as Special Conservation Interests for this SPA:

- *Circus cyaneus* [breeding]

Citation:

NPWS (2011) Conservation objectives for Slievefelim to Silvermines Mountains SPA [004165]. Generic Version 4.0. Department of Arts, Heritage & the Gaeltacht.

For more information please go to: www.npws.ie/protectedsites/conservationmanagementplanning

13 /51/0003 – response to RFI dated 28th February, 2013

Q2.*The Bat survey work and report is incomplete. The Eurobats "Guidelines for consideration of bats in windfarm projects" shall be followed, especially with regard to survey and mitigation and the necessary additional information submitted.*

The answer to Q.2follows(over);

UPPERCHURCH WINDFARM BAT SURVEY

13 /51/0003 – response to RFI dated 28th February, 2013

Further Information 13/51/0003 (22 No. wind Turbines at Upperchurch)

REFERENCE DOCUMENTS

Malachy Walsh and Partners

Engineering and Environmental Consultants

Upperchurch Wind Farm Bat Survey

15388

November 2013

Job number	Revision	Prepared by	Checked by	Status	Date
15388-6003	A	JK	MK	Final	21st November 2013

MWP ENVIRONMENT AND PLANNING

Table of Contents

Appendices

Appendix A: Figures

Appendix B: Bat Sonograms

1 Introduction

Malachy Walsh and Partners were commissioned to conduct bat surveys as a response to a Request for further Information sent by North Tipperary County Council (13/51/0003). The following report gives a detailed account of the bat surveys conducted, between July and August 2013 at Upperchurch, Co. Tipperary.

2 Site Description

The proposed Upperchurch Wind Farm site is located in north Co. Tipperary, approximately 1.9 km west of the village of Upperchurch and a further 18 km west of Thurles town. The study area is made up of four sections with an overall area of 12 km^2.

The surrounding local landscape is dominated by 'Pasture' with 'Forestry, 'Bog', 'Other Agricultural Land' and 'Other' land located to the south of the proposed wind farm site (NPWS, online mapping 2012). The area is underlain by Silurian Metasediments and Volcanics with subsoils consisting of "Sandstone and shales till Devonian/Carboniferous"

The four sections of the site are located on a series of small hills or drumlins that reach elevations between 363mOD and 411mOD where the peaks are generally at heights of 100m above the intervening lower terrain. The highest peak is that of Knockmaroe at an elevation of 411mOD.

The area originally would have had a shallow peat land cover but most of it has been reclaimed by deep ploughing and converted to pasture. The remaining peat areas are used mainly for commercial forestry. Some rock outcropping occurs, most notably at the northeast part of the site.

3 Legal and conservation status

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

All bats are listed in Annex IV of the Habitats Directive and the lesser horseshoe bat is further listed under Annex II.

4 Survey Methodology

Bats in Ireland feed exclusively on insects and in the summer they generally emerge from their roosts at dusk to feed. The distances covered while foraging varies considerably between species. They are known to use a number of different foraging sites in the same night and move between them to locate areas of high insect density. They are also known to exhibit a level of site loyalty and will frequently return to the same foraging sites night after night (Joint Nature Conservancy Committee JNCC, 2001).

Survey methodology was designed with reference to *Eurobats - Guidelines for consideration of bats in wind farm projects*. Stationary automated bat detectors were utilised throughout the site to supplement data already retrieved during Anabat activity surveys in 2012 (which consisted of walked transects, car-based transects and point counts). As per Eurobats guidelines an initial desktop study was carried out to collated data of the study area. The following resources were utilised during the desktop study.

- Bat Conservation Ireland (BCI);
- National Parks and Wildlife Service (NPWS);
- National Biodiversity Data Centre (NBDC); and
- OSI Aerial photography and 1:50000 mapping.

Building on existing guidance, an assessment was made of the quality of the habitat at the site and in the wider landscape, and the potential for these areas to support bats, taking into account:

- the extent and quality of foraging and commuting habitat within and surrounding the site e.g. woodland, well-connected and structured hedgerows, waterways and water bodies,
- the proximity of the proposed site to areas designated for bats (Natural Heritage Areas or Special Areas of Conservation), and
- the presence of buildings or other features or structures that may support or are known to support bat roosts.

Consultation was also undertaken with Bat Conservation Ireland on the 20th June 2012. National Parks and Wildlife Services were contacted between March and April 2013 (Stefan Jones District Conservation Officer of Limerick/North Tipperary region and Áine Lynch Local Conservation Ranger for Tipperary – North) to arrange a meeting to discuss the Request for Further Information but a meeting failed to materialise.

In line with Eurobats guidelines bat surveys were carried out at five predefined sampling stations over an extended period of time from the 3rd July 2013 to the 1st August, 2013. This survey supplemented a previous Anabat activity survey conducted in June 2012. Locations of stationary bat detectors were selected based on its potential value to bats species including a cluster of old farm buildings, the edges of conifer plantation, hedgerows and a stream. An upland area along the edge of conifer plantation was also selected to assess the potential value of this area for bat species (BSS5). A remote recording device, a SM2+, was left at these locations programmed to record from sunset to sunrise. Two ultrasonic microphones placed on the end of extension cables allowed for unidirectional recording of high frequency sounds. The SM2+ unit records real-time calls which can be converted to sonograms. It is these sonograms (2-d sound pictures) that are digitally stored on the CF card and downloaded for analysis. Each time a bat is detected, an individual time-stamped (date and time to the second) file is recorded. This detector system records bat ultrasonic calls on a continuous basis and stores the information onto an internal flash card for later analysis.

Evidence of bats was searched for and information on all potential roosts was recorded according to roost identification guidelines 'Bat Survey Guidelines: Traditional Farm Buildings Scheme', Aughney, T., Kelleher, C. & Mullen, D. (2008).

Eurobats guidelines have been developed to standardise bat survey methodology and impact assessment for wind farms on a European wide level. There are strong provisions within these guidelines for the assessment of migratory species and bat species know to commute across large open sections of habitat rather than more linear features utilised by many of Irelands bat species. Although it is known that Nathusius' pipistrelle *Pipistrellus nathusii* migrates seasonally from Scandinavia to Scotland and to the north of Ireland and back again (Russ *et al*. 2001), there is currently no evidence at present of bat migration elsewhere in Ireland.

5 Results of bat survey

Table 1: Results of survey at location 1

Bat Sampling Station 1 (BSS 1)		
Habitats and features of interest		
Microphones located on a peat bank at the entrance to a firebreak and along the edge of a conifer plantation. The surrounding habitat was heath, grassland and enclosed conifer plantation.		
Date	**Species present**	**Number of calls recorded**
03/07/2013	Common pipistrelle	29
	Leisler's bat	3
	Whiskered bat	1
	Daubenton's bat	4
04/07/2013	Common pipistrelle	10

Table 2: Results of survey at location 2

Bat Sampling Station 2 (BSS 2)		
Habitats and features of interest		
Bat located along the edge of a young conifer plantation along a farm track with a nearby stream.		
Date	**Species present**	**Number of calls recorded**
05/07/2013	Common pipistrelle	10
	Leisler's bat	13
	Myotis	1
	Soprano pipistrelle	7
	Daubenton's bat	2
06/07/2013	Leisler's bat	6
07/07/2013	No bats	-
08/07/2013	No bats	-
09/07/2013	No bats	-
10/07/2013	No bats	-

Table 3: Results of survey at location 3

Bat Sampling Station 3 (BSS 3)		
Habitats and features of interest		
Bat box located on a field boundary between a blanket bog to the east and a grassland field to the west. There were scattered low lying gorse and willow trees along the hedgerow.		
Date	**Species present**	**Number of calls recorded**
11/07/2013	Common pipistrelle	15
	Leisler's bat	12
	Whiskered bat	1
	Soprano pipistrelle	1
	Nathusius' pipistrelle	4
12/07/2013	Common pipistrelle	39
	Leisler's bat	11
	Whiskered bat	3

Bat Sampling Station 3 (BSS 3)		
13/07/2013	Common pipistrelle	39
	Soprano pipistrelle	20
	Leisler's bat	16
	Myotis	3
	Whiskered bat	3
14/07/2013	Common pipistrelle	3
15/07/2013	Common pipistrelle	2
	Leisler's bat	11
	Myotis	1
16/07/2013	Common pipistrelle	30
	Soprano pipistrelle	2
	Leisler's bat	10
	Myotis (probable Whiskered bat)	7
17/07/2013	Common pipistrelle	7
	Soprano pipistrelle	5
	Leisler's bat	3

Table 4: Results of survey at location 4

Bat Sampling Station 4 (BSS 4)		
Habitats and features of interest		
Located near a series of old farm buildings of varying degree of use with conifer plantation to the west and surrounding grassland fields. The stationary detector was moved locally to two locations in order to collate data of site utilisation.		
Date	**Species present**	**Number of calls recorded**
23/07/2013	No bats	-
24/07/2013	No bats	-
25/07/2013	No bats	-
26/07/2013	Common pipistrelle	67
	Soprano pipistrelle	69

Bat Sampling Station 4 (BSS 4)		
	Leisler's bat	11
	Whiskered bat	5
27/07/2013	Common pipistrelle	125
	Soprano pipistrelle	10
	Leisler's bat	13
	Whiskered bat	3
28/07/2013	Common pipistrelle	29
	Soprano pipistrelle	2
	Leisler's bat	11
29/07/2013	Common pipistrelle	26
	Soprano pipistrelle	164
	Leisler's bat	22
	Whiskered bat	8

Table 5: Results of survey at location 5

Bat Sampling Station 5 (BSS 5)		
Habitats and features of interest		
Located on top of the hill (Circa 350m O.D.) on a boundary ditch along the edge of a conifer plantation and an improved grassland field.		
Date	**Species present**	**Number of calls recorded**
30/07/2013	Common pipistrelle	9
	Leisler's bat	2
	Daubenton's bat	1
31/07/2013	Leisler's bat	1

Table 6: Summary of results of the transect survey

Species	**Total number of calls recorded**	**Number of sampling stations at which the species was recorded**
Common pipistrelle (*Pipistrellus pipistrellus*)	440	5
Leisler's bat (*Nyctalus leisleri*)	145	5
Soprano pipistrelle (*Pipistrellus pygmaeus*)	280	3
Whiskered bat (*Myotis mystacinus*)	34	3
Daubenton's bat (*Myotis daubentonii*)	7	3
Myotis sp.*	5	2
Nathusius' pipistrelle (*Pipistrellus nathusii*)	4	1

* Likely to be Whiskered or Daubenton's bats but not clear from sonogram

6 Results of 2012 bat survey

Four species of bat were recorded in all during the bat survey conducted on the 21st of June 2012 namely common pipistrelle, soprano pipistrelle, brown long eared bat (*Plecotus auritus*) and either a whiskered or Brandt's bat (*Myotis brandtii*). The *Myotis* species, the whiskered/Brandt's bat was recorded along a hedgerow and a mix of broadleaf and conifer treeline located to the north-east of the western section. Two calls were heard during the entire transects routes, with the second pass recorded just to the south of the western section of the site.

Overall 6 passes of brown long eared bat were recorded, commuting and hunting along the foliage of hedgerows and forest edge. Common pipistrelle, were the most recorded species with 73 passes throughout the whole survey. This is one Ireland's most common species and was recorded along all transects, except for transect BT 1.Two passes of soprano pipistrelle was recorded during the survey. Both species were observed hunting midges and moths along hedgerows and treelines, flying rapidly and twisting in flight.

The majority of the activity was recorded along BT 5, recording all species that were encountered during the whole survey. This route runs parallel with the western section of the site and is adjacent to most habitats that occur within the site. The weather conditions at the time of the survey were favourable for bats. Following the survey it can be concluded that the habitats at the Upperchurch site support a healthy population of common pipistrelle and to a lesser extent brown long eared bat, Soprano pipistrelle and whiskered/Brandts bat. Table 7 below shows the species recorded during the bat survey at the Upperchurch site in 2012.

Table 7: Bat Species recorded during survey

Common name	Scientific name
Common pipistrelle	*Pipistrellus pipistrellus*
Soprano pipistrelle	*Pipistrellus pygmaeus*
Brown long eared bat	*Plecotus auritus*
Whiskered/Brandts bat	*Myotis sp.*

7 Discussion of Bat Surveys

Throughout the site common pipistrelles and soprano pipistrelles were recorded on the edge of woodland, along access tracks, hedgerows, treelines, over areas of scrub, semi-natural grassland and improved agricultural grassland. Common pipistrelle was the most common species recorded during surveys in 2012 and 2013. Soprano pipistrelle were the second most common species recorded however the species was recorded in only three of the five sampling locations. The relatively recent discovery that the species formerly known as the pipistrelle (*Pipistrellus pipistrellus*) was in fact two separate but cryptic species, the common pipistrelle and the soprano pipistrelle, has been well documented (Barratt *et al*., 1997). O'Sullivan (1994) found 584 pipistrelle bat roosts during the National Bat Survey, the highest number for any species, and described it as the most abundant in Ireland and widely distributed. It is worth noting however that both species were considered to be the same at that time. It has been established following their separation that the common and soprano pipistrelles were the most common and second most common species encountered respectively (Roche *et al*., 2007).

Ireland's two smallest bat species, are the bats most likely to be seen flying around soon after dusk in both urban and rural areas. Both have a rapid, twisting flight as they pursue tiny prey of midges, mosquitoes and small moths. A single pipistrelle (weighing approximately 5-6g) may consume as many as 3,500 of these insects in one night (BCI, 2013). Summer roosts of soprano and common pipistrelles are normally in buildings (NPWS, 2009). Pipistrelles are frequently found roosting in houses, although they also roost in other locations such as tree holes. In houses they prefer to occupy confined spaces such as behind hanging tiles and soffit boards or between roofing felt and roof tiles, rather than the main attic space (BCI, 2013, McGuire, 1998 and Allen *et al*., 2000).

Four calls of what is considered to be Nathusius' pipistrelle were recorded on the night of the 11th of July 2013 at sampling station 3. The sonograms were not typical of the species but the frequency slope and range exhibited elements consistence with the species. The closest know records of this species are a roosting site north of Clonmel and near Birr in co. Offaly. Maternity roosts for the species have only been recorded in Northern Ireland but currently, the only known Nathusius' roosts in the Republic are of single males.

Leisler's bat were recorded at all five sampling locations and were the third most common species recorded during the 2013 survey. The species was not recorded within the study area during the survey in 2012. Results from the Car-Based Bat Monitoring Scheme for Ireland (Roche *et al*., 2009) recorded that Leisler's bats had been the third most frequently encountered species during the monitoring scheme in all survey years, except 2006 when the species was the second-most common. This species was encountered in all of the survey squares (Roche *et al*., 2009).

Whiskered bat was recorded at 3 sampling stations with 33 calls heard over the month of surveys. The unidentifiable Myotis sp. calls recorded at sampling stations 2 and 3 are also considered likely to have been calls from whiskered bat. During surveys in 2012 the species was recorded flying along a hedgerow and a mix of broadleaf and conifer treeline located to the north-east of the western section of the site. Although the whiskered bat is widely distributed throughout Ireland, there are relatively few records (NPWS, 2009). O'Sullivan (1994) recorded that whiskered bats are found in houses during the summer, roosting in small numbers in the roof space, often between the rafters and felt or in narrow slits where timbers meet, where they are difficult to observe.

Daubenton's bat were recorded sporadically over the survey period. Seven calls in total were recorded at 3 sampling station. This species also known as the 'water bat' is strongly associated within watercourses. The two streams within the site boundary although not significant in size offer potential habitat for this species as a corridor of foraging habitat from the larger watercourses downstream of the site.

Brown long eared bat were not recorded during surveys in 2013 but had been recorded during surveys within the study area in 2012. The species is considered likely to be using habitat within the greater area and potentially features within the proposed site boundary.

No bat roosts were recorded within the site boundary. The farm buildings west of turbine T22 were investigated for potential bat roost during surveys in July with no evidence of bats recorded. Large numbers of soprano pipistrelle (29/07/2012) calls and common pipistrelle calls (27/07/2013) were recorded one night each when the SM2 bat box was stationed beside the farm buildings. There is the potential that bat maybe roosting occasionally within these buildings however the buildings are located outside the site boundary and over 350m from the nearest turbine T22. Large mature treelines in the greater area offer potential roosting sites for bats particularly along the roads in Shevry and Gleninchnaveigh. The large stands of conifer plantation with the site offer very poor roosting habitat for bat lacking the hole, crevices and cracks preferable to bats features common in mature deciduous trees.

Collision Risk

Natural England has produced guidance on the impacts of wind farms to bats (Natural England, 2012). Collision risk is an issue in relation to bats, particularly in relation to *Myotis* spp. which exhibit swarming behaviour (JNCC, 2001). Natural England has produced guidance on the impacts of wind farms to bats (Natural England, 2012). In this guidance, they have assessed the risk of collision to different species and placed them into low, medium or high risk categories, based on a number of factors, such as flight patterns and foraging strategies. This risk assessment is summarised below in Table 8, where the information on species that occur in Ireland has been extracted. In contrast to JNCC (2001), Natural England has classified *Myotis* species as being at low risk of collision.

Table 8: Assessment of the likely level of risk to bat species occurring in the UK, from collision with wind turbines (information on species that occur in Ireland extracted). Source: Natural England (2012).

Risk of turbine impact			
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	Intermediate – more plastic in their echolocation	Long range Low frequency High intensity Detection distance

Risk of turbine impact			
Factor	**Low Risk**	**Medium Risk**	**High Risk**
	~15m		~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
Conclusion	***Myotis* species** **Long eared-bats** **Horseshoe bats**	**Common pipistrelle** **Soprano pipistrelle**	**Leisler's bat** **Nathusius' pipistrelle**

Given a relative population size for each species and the likely risk posed by turbines, it may be possible to determine the level of threat posed to populations of bats. Most effort should be expended on populations likely to be at high risk of collisions and that may be most threatened. Table 9 below lists the likely level of risk, considering the population size in the UK i.e. the resultant risk to the overall population of a more common species would be less than a rarer species. Species present in Ireland have been extracted from Natural England's list. It should be noted however, that Leisler's bat are more common in Ireland due to the lack of competition from the Noctule bat which is absent from Ireland.

Table 9: Assessment of the likely level of risk to the populations of bat species occurring in the UK, from collision with wind turbines (information on species that occur in Ireland extracted). Source: Natural England (2012).

Low Risk	Medium Risk	High Risk
Myotis species		Leisler's bat
Long-eared bats		Nathusius' pipistrelle
Horseshoe bats		
Common pipistrelle		
Soprano pipistrelle		

Common pipistrelle and soprano pipistrelle were the two most common bat species recorded during the survey described in this report. These two species are considered to be of 'Low Risk' from collision with wind turbines (Natural England, 2012). Brown long eared bat, whiskered bat and Daubenton's bat all fall within this category. Leisler's bat and nathusius' pipistrelle are classified as high risk species.

Turbine blades for the proposed wind farm could reach a maximum of 45 metres in length, with a hub height ranging between 78 - 85 metres. The tip of the turbine blades at the proposed wind farm would be 50m away from hedgerows and trees. Most bat species in the Ireland are unlikely to come into contact with the blades during their normal movements, because bats rarely fly at height levels that intersect with turbine blades. Pipistrelle bats generally fly between 5-25m above ground level (Stebbings *et al,* 2007). Myotis species (Brandt's bat/whiskered bat) are generally low flying species ranging from 2-20m above ground level. Leisler's bat and nathusius' pipistrelle are known to fly high when commuting and low when hunting (Harris and Yalden, 2008). Due to the fact that some bat species fly at higher heights and therefore are at risk.

There is also the possibility that bats may investigate turbine towers either to feed on insects attracted by the heat generated by nacelles, or because they are simply attracted by moving blades. Such behaviours could also put bats at risk of collision. However the use of red lights will reduce the risk of insects being attached to turbines and in turn bats. Natural England (2012) has advised that predicted harm to bats could be minimised by altering locations of turbines within a site. The design of the wind farm has taken into the account the Natural England recommended guidelines. Further mitigation measures for bats outlined in the Ecological Management Plan include planting of new hedgerows to mitigation the loss of hedgerow during the construction phase. The location of these hedgerows will be sited to ensure the connectivity of existing corridors will be maintained and will be designed by the project ecologist during the construction phase of the wind farm. There is also the provision for the improvement of existing hedgerows (filling gaps) both within the site and the alternative habitats put forward for hen harrier outside the site. This measure shall improve existing corridors within the site. The reverting of these alternative habitats back to more semi natural habitat will increase diversity of plant species within these areas which in turn will lead to an increase of prey items to bats (insects).

8 Conclusion

Malachy Walsh and Partners were commissioned to conduct bat surveys for the proposed Upperchurch Wind Farm as a response to a request for further information from North Tipperary County Council.

The results of bats surveys indicate that up to seven species of bat are utilising habitats within the study area or are commuting through the site to more suitable habitat in the greater area. A potential Nathusius pipistrelle was recorded on one night over the month of surveys indicating that the species is commuting through the site boundary. Only single males have been recorded within the Republic of Ireland with no maternity roosts confined to a few sites in Northern Ireland. The level of activity during surveys indicates that the site does not contain a roost. Nathusius pipistrelle along with Leisler's bat would be deemed at high risk from collision from a poorly designed and sited wind farm, however the mitigation measures proposed both within the design and as part of the overall management of the site would reduce the potential risk to these species.

8.1 Further recommendations

It is recommended that pre and post construction monitoring of the bats be carried out as part of the management of the site and this has been included in the ecological management plan.

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Appendix A

Figures

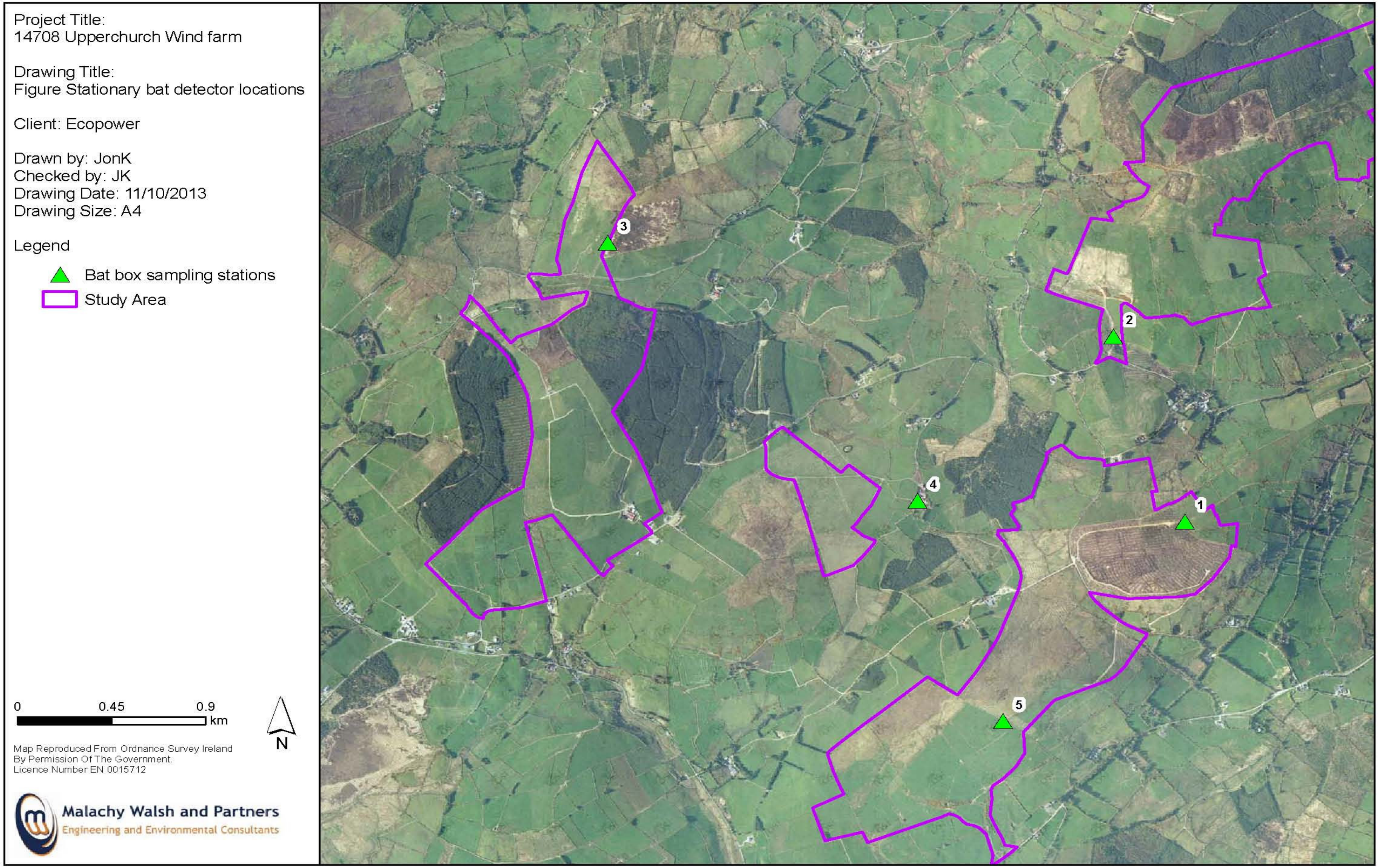

Figure 1: SM2 (stationary bat detector) locations

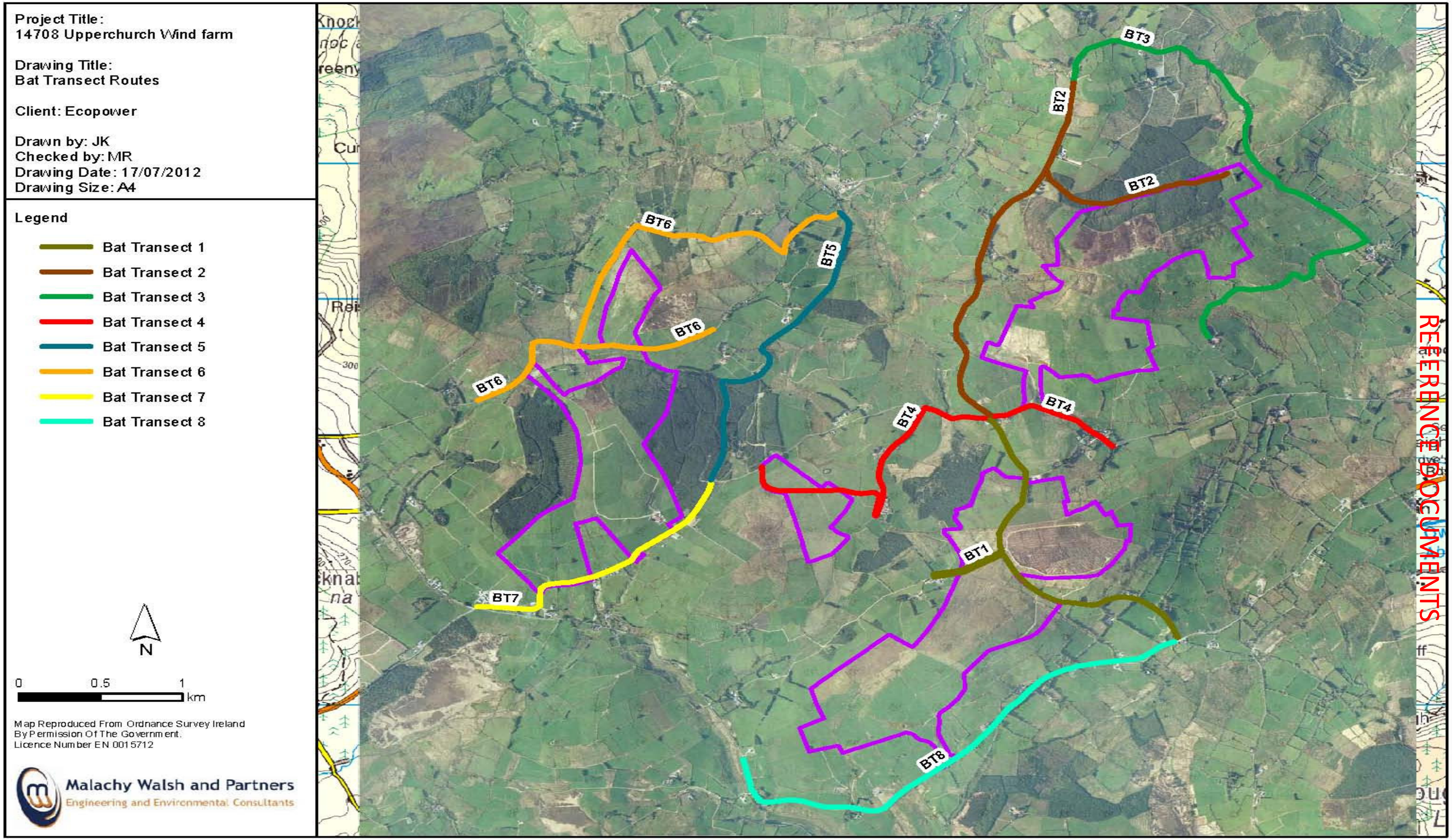

Figure 2: Bat transects June 2012

Appendix B

Bat Sonograms

REFERENCE DOCUMENTS

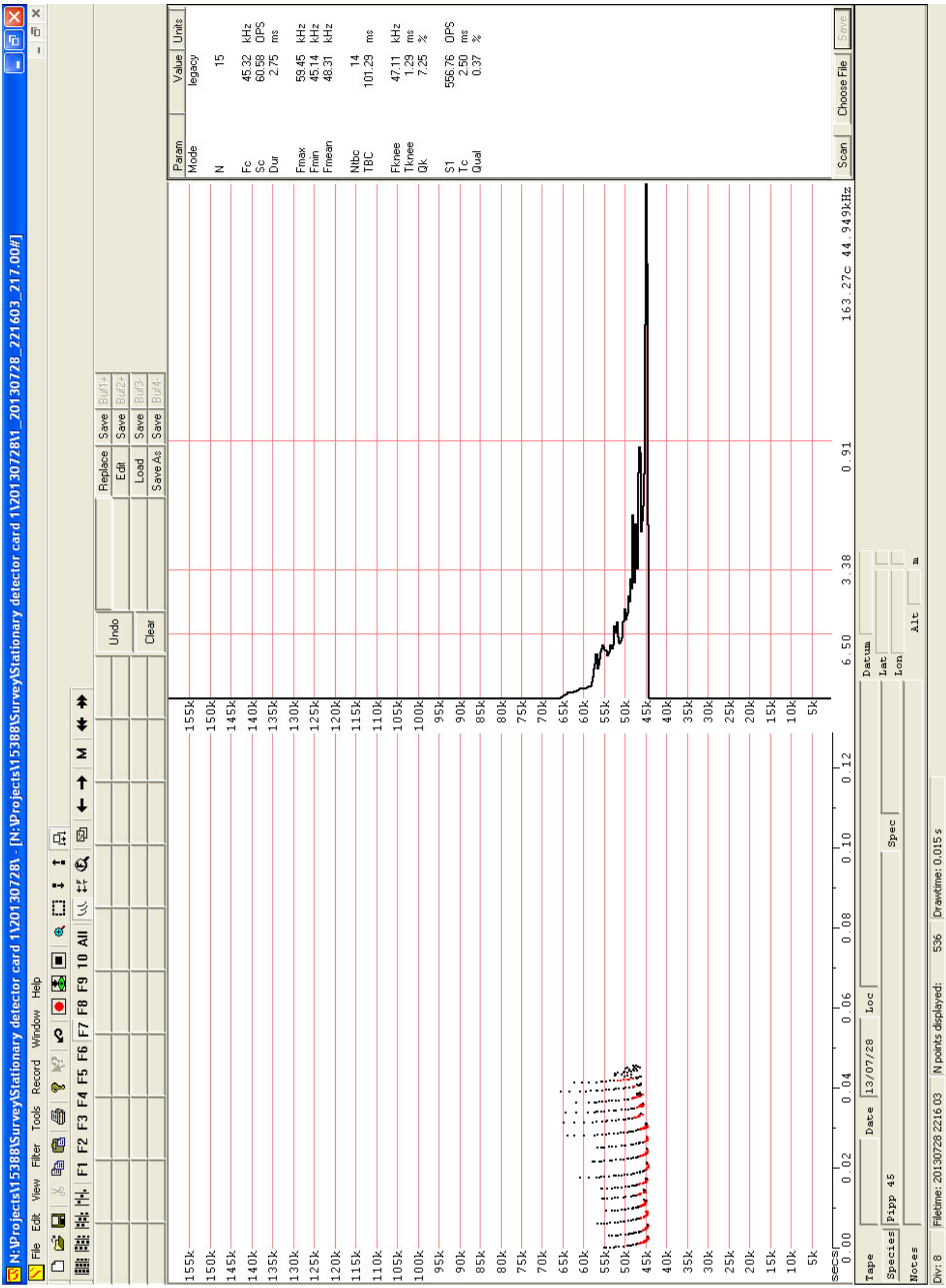

Figure 1B: Common Pipistrelle recorded during surveying.

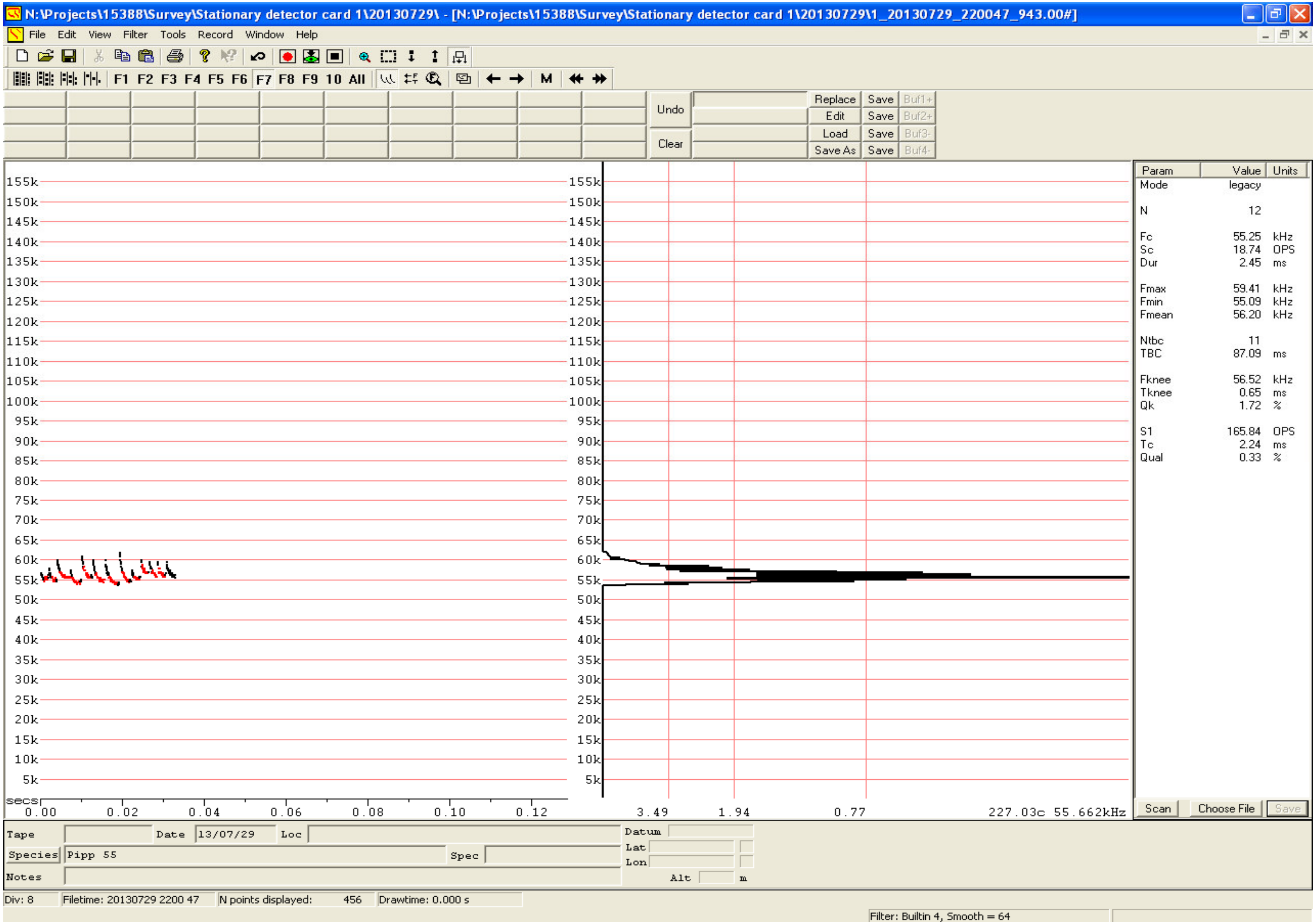

Figure 2B: Soprano Pipistrelle recorded during surveying.

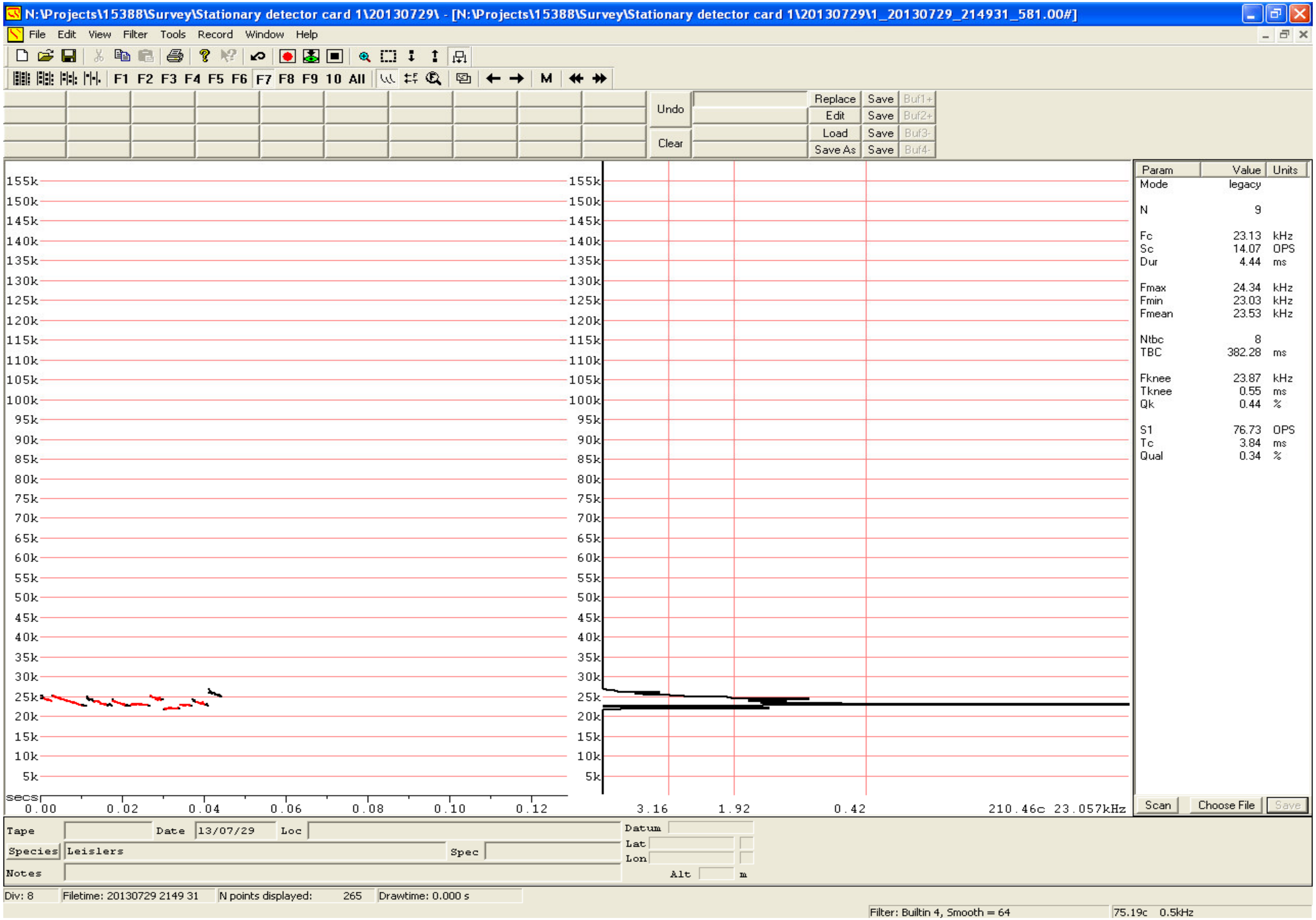

Figure 3B: Leisler's bat recorded during surveying.

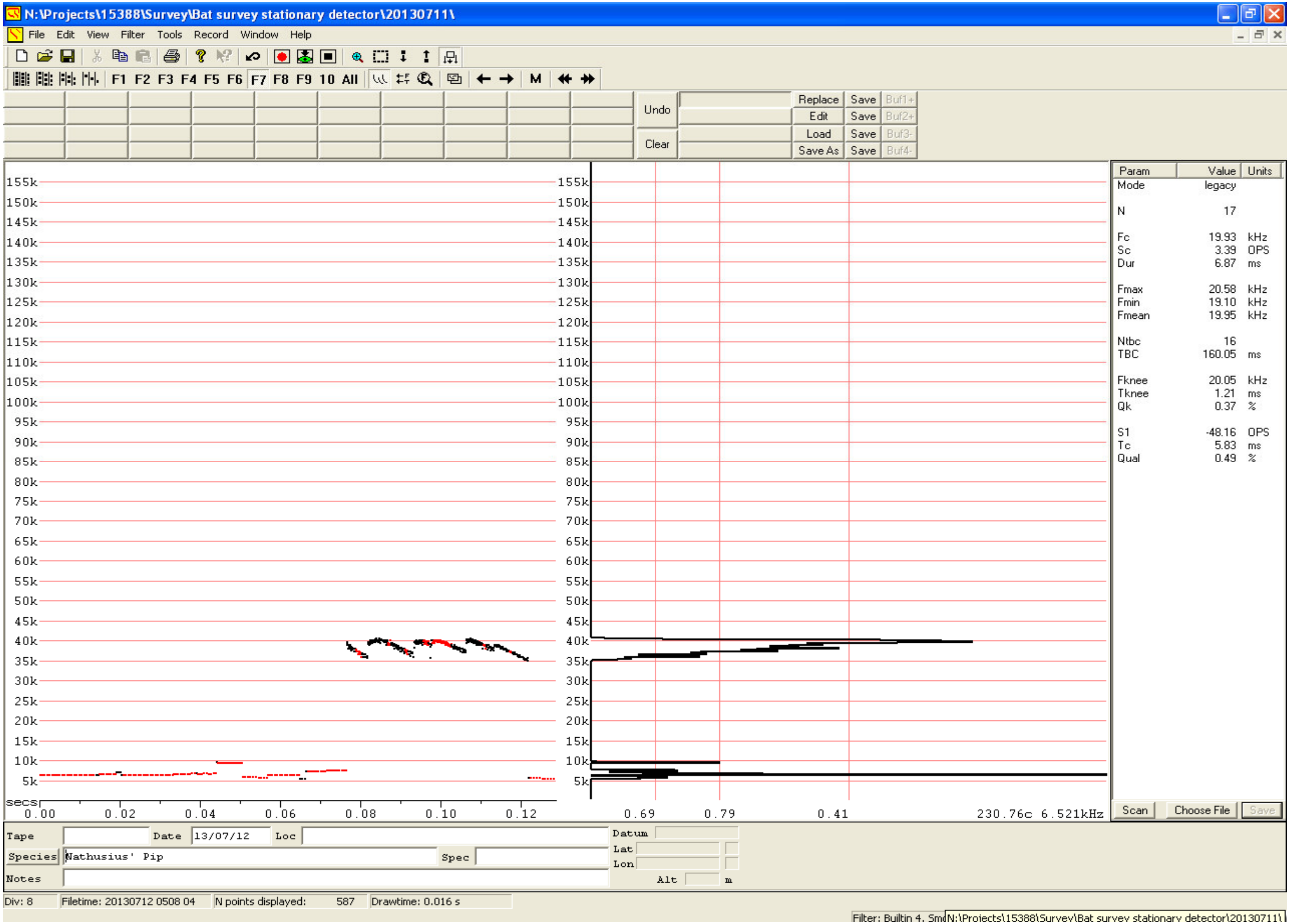

Figure 4B: Nathusius' pipistrelle recorded during surveying.

REFERENCE DOCUMENTS

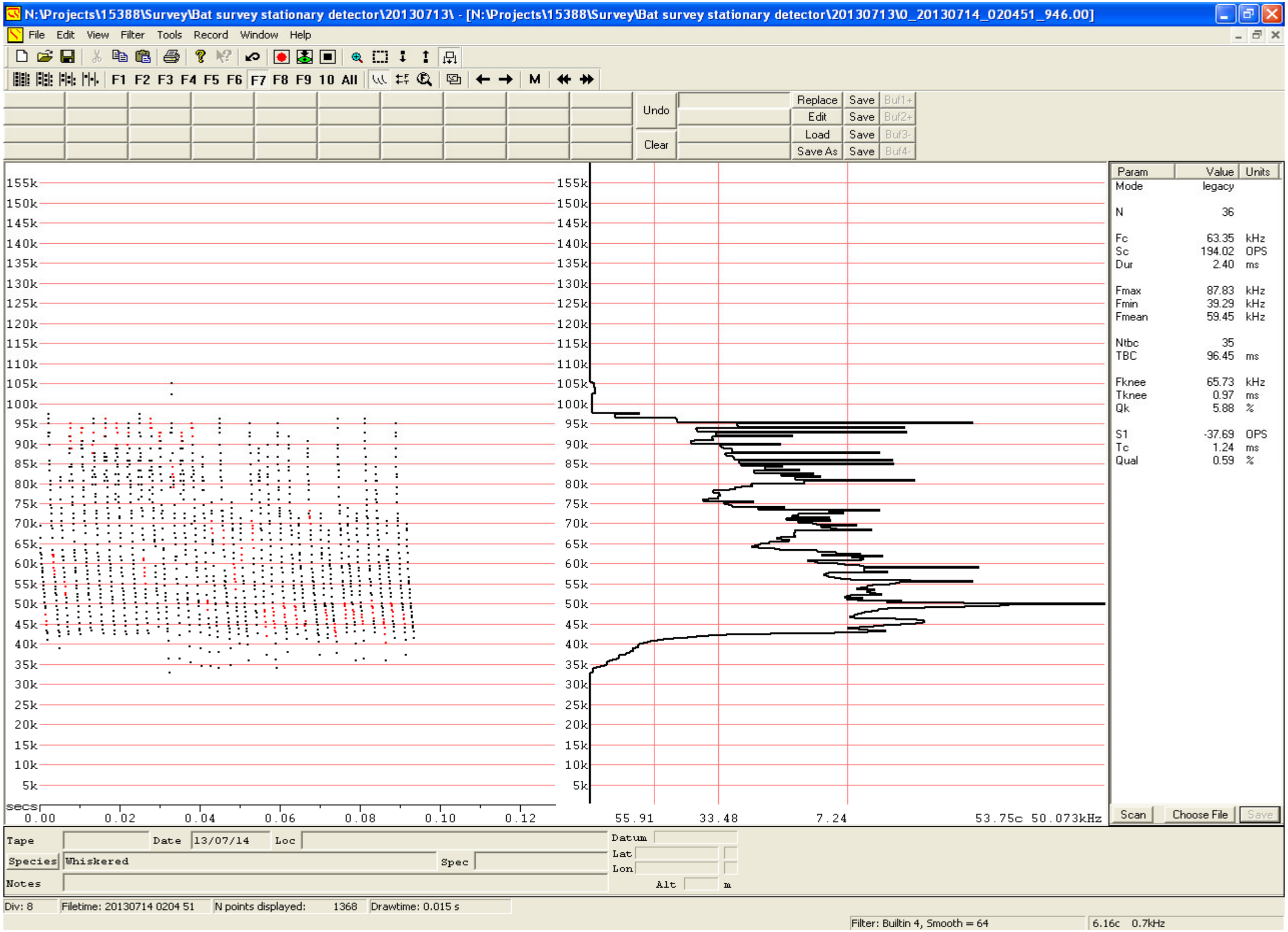

Figure 5B: Whiskered bat recorded during surveying.

REFERENCE DOCUMENTS

13 /51/0003 – response to RFI dated 28th February, 2013

Q3. *A full survey of badger sett/setts shall be conducted and report submitted. A Badger Derogation Licence would be required from the National Parks and Wildlife Service-for works within 50m (breeding season) or 30m (non-breeding season).*

The answer to Q.3 follows(over);

UPPERCHURCH WINDFARM BADGER SETT SURVEY

REFERENCE DOCUMENTS

13 /51/0003 – response to RFI dated 28th February, 2013

Further Information 13/51/0003 (22 No. wind Turbines at Upperchurch)

REFERENCE DOCUMENTS

Malachy Walsh and Partners

Engineering and Environmental Consultants

Upperchurch Windfarm Badger Sett Survey

15388

November 2013

Job number	Revision	Prepared by	Checked by	Status	Date
15388-6002	A	JK	MK	Final	20th November 2013

Table of Contents

Appendices

1 Introduction

Malachy Walsh and Partners were commissioned to conduct a survey for potential badger activity within the site of the proposed Upperchurch Windfarm as a response to a Request for Further Information sent by North Tipperary County Council (13/51/0003). The following report gives a detailed account of the badger survey conducted, in July and August 2013 at Upperchurch, Co. Tipperary.

2 Site Description

The proposed Upperchurch Windfarm site is located in north Co. Tipperary, approximately 1.9 km west of the village of Upperchurch and a further 18 km west of Thurles town. The study area is made up of four sections with an overall area of 12 km².

The surrounding local landscape is dominated by 'Pasture' with 'Forestry, 'Bog', 'Other Agricultural Land' and 'Other' land located to the south of the proposed windfarm site (NPWS, online mapping 2012). The area is underlain by Silurian Metasediments and Volcanics with subsoils consisting of "Sandstone and shales till Devonian/Carboniferous"

The four sections of the site are located on a series of small hills or drumlins that reach elevations between 363mOD and 411mOD where the peaks are generally at heights of 100m above the intervening lower terrain. The highest peak is that of Knockmaroe at an elevation of 411mOD.

The area originally would have had a shallow peat land cover but most of it has been reclaimed by deep ploughing and converted to pasture. The remaining peat areas are used mainly for commercial forestry. Some rock outcropping occurs, most notably at the northeast part of the site.

3 Legal and conservation status

Badgers and their setts are protected under the provisions of the Wildlife Act, 1976, and the Wildlife Amendment Act, 2000. It is an offence to intentionally kill or injure a protected species or to wilfully interfere with or destroy the breeding site or resting place of a protected wild animal. The National Roads Authority (NRA) produced a guidance document for badgers titled '*Guidelines for the treatment of badgers prior to the construction of national roads schemes'* (NRA, 2005). The following guidelines are taken from that document:

"The following provisions should apply to all construction works:

- *Badger sett tunnel systems can extend up to c. 20m from sett entrances. Therefore, no heavy machinery should be used within 30m of badger setts (unless carried out under licence); lighter machinery (generally wheeled vehicles) should not be used within 20m of a sett entrance; light work, such as digging by hand or scrub clearance should not take place within 10m of sett entrances.*

- *During the breeding season (December to June inclusive), none of the above works should be undertaken within 50m of active setts nor blasting or pile driving within 150m of active setts.*
- *Following consultation with the NPWS and badger experts, works closer to active setts may take place during the breeding season provided appropriate mitigation measures are in place, e.g. sett screening, restricted working hours, etc.*

In order to comply with these constraints:

- *All affected badger setts should be clearly marked and the extent of bounds prohibited for vehicles clearly marked by fencing and signage. Bunting is an option on a temporary basis. Hazard tape is inadequate as it is prone to deterioration and damage by wind or cattle etc.*
- *All contractors/operators on site should be made fully aware of the procedures pertaining to each sett on site.*
- *Construction activities within the vicinity of affected setts may commence once these setts have been evacuated and destroyed under licence from the NPWS. Where affected setts do not require destruction, construction works may commence once recommended alternative mitigation measures to address the badger issues have been complied with.*
- *In almost all circumstances, works close to badger setts may only be conducted under the supervision of a qualified expert under licence from the NPWS."*

4 Survey Methodology

A badger survey was conducted within the site boundary for the proposed Upperchurch Windfarm over three days between 3rd and 8th of July 2013. Habitats and features of interest adjacent to the site boundary were also considered during the survey. All field boundaries and potential landscape feature of interest to badgers were walked to record any potential signs of mammal activity. All records of mammal species were noted during the course of surveys. The site was searched for tracks and signs of mammals according to methodology described in *Animal Tracks and Signs* (Bang and Dahlstrom, 2001); and *The Mammal Detective* (Strachan, 1995).

5 Badger activity within the study area

An old disused single entrance badger (*Meles meles*) sett was recorded along a hedgerow approximately 250m south west of turbine T7. The entrance was overgrown and did not appear to have been used for a significant period of time. A potential single entrance badger sett was recorded along a field boundary 150m west of turbine T4. The entrance again exhibited signs that it hadn't been used for a significant period of time. No badger activity was noted during nocturnal surveys for bats although the habitats within the site offer potential habitat for badgers. Many of the sections of conifer plantations are extensive offering potential shelter for setts however no setts were recorded along their margins during surveys. During the field surveys in 2012 badger activity (tracks and droppings) was recorded in the south eastern section of the site. A trail was followed through a field which led to a gap in the hedgerow at the north eastern corner of the field where T7 is located. Fresh droppings were found at this site (GPS R96274 60423).

6 Other terrestrial mammals recorded within the study area

Fallow deer (*Dama dama*) are present within the study area and utilised habitats within the site boundary. The grassland fields and patches of heath/bog as well as hedgerows offer potential foraging habitat for the species. A small herd of 5 individuals including two juveniles were recorded on the 4th of July 2013 during surveys within an improved grassland field in Knockmaroe near the proposed location of turbine T19. The group once spotted retreated into the nearby conifer plantation for cover. Trails, prints, droppings and evidence of feeding were recorded at knockcurraghbola near turbine T8. It is considered likely that the species is utilising habitats throughout the site and the greater area with the stands of conifer plantation offering the protection of cover and shelter.

An Irish hare (*Lepus timidus Hibernicus*) was recorded within an agricultural field Knocknamena Commons. The species is present and potentially numerous within the study area. Rabbits (*Oryctolagus cunniculus*) are also present and common throughout the study area with frequent dropping recorded in Knockmaroe, knockcurraghbola, Shevry and Grouse hall.

Otter (*Lutra lutra*), hedgehog (*Erinaceus europaeus*), stoat (*Mustela erminia*), pine marten (*Martes martes*) and pygmy shrew (*Sorex minutus*) where not noted during the 2013 survey at the site, although all are known to be present in the locality. A pygmy shrew was observed just outside the south eastern section of the site during a bat survey in 2012 near Milestone.

Other mammals known to be present include fox (*Vulpes vulpes*). No den was found however they are likely to have a den near the site. Fox dropping were recorded during surveys at several locations within the site. Brown rat (*Rattus norvegicus*) and house mouse (*Mus musculus*) was not noted but they are widespread and numerous and may be present especially around the farmyards and around private houses in the local area. Wood mouse (*Apodemus sylvaticus*) were not recorded during the survey but are also likely to be present.

7 Conclusion

Malachy Walsh and Partners were commissioned to conduct a badger survey for the proposed Upperchurch Windfarm as a response to a request for further information from North Tipperary County Council.

Badger activity within the site, by the nature of the nocturnal behaviour of this mammal, has the potential to be under recorded during surveys. The clues and physical structures left by this species offers the greatest insight into their utilisation of a study area. A comprehensive assessment of the site has been carried out as part of this survey with a complete site walkover focussing exclusively on mammal tracks, trails, droppings, fur, signs of feeding activity as well as setts, den, burrows, forms, etc. The level of activity is not considered to be significant and the habitats within the site are common within the greater area. The species of terrestrial mammal including badger within the study area are not consider likely to be impacted by the proposed windfarm apart from the increase in noise and activity during construction phase which would be deemed a localised and temporary impact with species expected to return soon after construction.

7.1 Further recommendations

It is recommended that pre and post construction monitoring of badger activity within the site be carried out as part of the management of the site and this has been included in the ecological management plan. Construction shall also be limited to the footprint of the proposed development and the planning boundary thus maintaining the existing buffer between the proposed development and the old setts recorded during the survey.

If a new badger sett is discovered during construction works particularly vegetation clearance. Works shall be suspending within 50m of any newly discovered badger sett during the breeding season (*December to June inclusive*) and 30m outside the breeding season (*July to November inclusive*) pending an activity survey, consultation with the local NPWS Wildlife Ranger and receipt of a badger derogation licence.

8 References

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Whilde, T. (1993). Threatened mammals, birds, amphibians and fish in Ireland. *Irish Red Data Book 2: Vertebrates.* HMSO, Belfast.

Appendix A

Photographs

Plate 1: Disused badger sett approximately 250m south west of turbine T7

Plate 2: Disused badger recorded along a field boundary 150m west of turbine T4

Q4.*Section 4.1 of the Environmental Impact Assessment notes that noise levels at houses H2, H5, H7 and H9 may be exceeded having regard to the guidance contained in the DECLG Wind Energy Planning Guidelines (published 2006). It should be noted that wind turbines in proximity to these dwellings should have an appropriate noise reduced mode to mitigate such impacts. Taking the above into account you are advised to submit a revised Noise & Vibration Impact Assessment (Operational Phase & Construction Phase), which shall also address the following issues;*

(i) Results of a site-specific study identifying and quantifying potential vibration impacts as relates to proposed construction works e.g, borrow-pit blasting, etc.

(ii) Implementation of best practice procedures e.g. early warning system/NSL's, etc.

(iii) NSL shall not be differentiated on owners/occupiers 'financial interests' with 'dwellings' only differentiated on the basis of habitation potential e.g. dwelling in dilapidated state (roof falling in) would clearly not qualify.

(iv) Potential cumulative effects from proposed adjacent developments e.g. Plan Ref: 12510385.

(v) Proposals in relation to intended, defined, operating mode of each specific turbine (submit list).

(vi) In-depth, identification and consideration of potential noise/vibration and associated effects (dust) with outline of specific mitigation measures as perBS5228.

The answer to Q.4 follows (over);

UPPERCHURCH WINDFARM
REVISED NOISE & VIBRATION IMPACT ASSESSMENT

REFERENCE DOCUMENTS

13 /51/0003 – response to RFI dated 28th February, 2013

Further Information 13/51/0003 (22 No. wind Turbines at Upperchurch)

Malachy Walsh and Partners
Engineering and Environmental Consultants

Upperchurch Wind Farm

Revised Noise & Vibration Impact Assessment

15388

November 2013

EcoPower Developments

Job number	Revision	Prepared by	Checked by	Status	Date
15388	E	Peter Barry	Monica Reidy	FINAL	23/11/2013

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LIST OF TABLES

LIST OF FIGURES

1 INTRODUCTION

This revised report describes the potential noise and vibration associated with the construction and operation of the proposed Upperchurch wind farm. This document was prepared in response to Further Information Request no 4 as outlined below (relevant sections in this revised report are included in bold in brackets):

"*Section 4.1 of the Environmental Impact Assessment notes that noise levels at houses H2, H5, H7 and H9 may be exceeded having regard to the guidance contained in the DECLG Wind Energy Planning Guidelines (published 2006). It should be noted that wind turbines in proximity to these dwellings should have an appropriate noise reduced mode to mitigate such impacts.* ***(Please see table 9 and Section 2.4.2)***

Taking the above into account you are advised to submit a revised Noise & Vibration Impact Assessment (Operational Phase & Construction Phase) which shall also address the following issues:

- *(i)* *Results of a site-specific study identifying and quantifying potential vibration impacts as relates to proposed construction works e.g. borrow pit blasting, etc.* ***(Please see Section 3. Please Note, there will be no Blasting or Piling on Site. These are the primary sources of vibration on any construction site)***
- *(ii)* *Implementation of best practice procedures e.g. early warning system/NSL's etc* ***(Please see Section 2.5.1 for a description of Best Practice Measures regarding Construction Noise Mitigation, sourced from BS5228. As there will be no blasting on site, early warning systems are not required. NSL's or Noise Sensitive Locations are considered in detail in the impact assessment, throughout the chapter)***
- *(iii)* *NSL shall not be differentiated on owners/occupiers 'financial interests' with 'dwellings' only differentiated on the basis of habitation potential e.g. dwelling in dilapidated state (roof falling in) would clearly not qualify.* ***(Please see Section 2.4 and associated tables. Reference to landowners has been removed)***
- *(iv)* *Potential cumulative effects from proposed adjacent developments e.g. Plan Ref:12510385* ***(Please see Section 2.4.3****)*
- *(v)* *In-depth, identification and consideration of potential noise/vibration and associated effects (dust) with outline of specific mitigation measures as per BS5228.* ***(Please See Section 2.4.1, 2.5.1 and Section 3. BS 5228 has been referenced throughout the report where appropriate. Regarding Vibration, BS5228 typically applies to the control of Blasting and Piling activities, which will not be taking place.)***

Please also refer to the Construction Phase Environmental Management Plan.

Construction and operational noise associated with the Upperchurch Windfarm are discussed in Section 2, construction and operational vibration is discussed in Section 3 and dust in Section 4. Aerodynamic Modulation, Infrasound and Wind Farm Noise on Health associated with wind turbines have also been addressed in this report in Section 5. Furthermore the relocation of T22 has been included in this revised noise impact assessment.

2 REVISED NOISE ASSESSMENT

Construction noise will occur during excavation and earth moving, laying of roads and hard standings, transportation of materials and erection of the wind turbines. The construction phase will be phased and temporary.

The main sources of noise from a wind turbine include aerodynamic noise (rotating blades in the air) and mechanical noise (gearbox (if not a direct drive system) and generator).

Noise only occurs above the 'cut-in' wind speed and below the 'cut-out' wind speed. The typical 'cut-in' wind speed of a modern turbine is 3 meters per second (m/s) and the 'cut-out' wind speed is approximately 25 to 30 m/s. At this stage of the proposal the preferred turbine candidates has not yet been finalised. For the purpose of this assessment the sound power levels and octave banding associated with the Vestas V90 turbine were used. Ultimately the most appropriate turbine model and operating mode will be selected in order to achieve the noise limits set down in any planning condition.

2.1 METHODOLOGY AND ASSESSMENT CRITERIA

Construction noise is generally tolerated at higher levels, due to its temporary nature and the practicality of construction. The sound power levels of all the machinery expected to be in use during the construction phase were summed and the resultant noise propagation was calculated from a variety of distances from the total noise source. This can be considered a conservative approach as all the items of plant and machinery will not be in operation simultaneously or continuously.

In general the methodology used to assess the noise impact from wind farms includes extended measurements of the existing background noise levels (across a range of wind speeds) at nearby representative dwellings and comparisons against the predicted noise output from the wind farm, which also varies with wind speed. The methodology and planning guidance framework are described in the following sections.

2.1.1 Wind Farm Noise Planning Guidance

The primary guidance relating to windfarm noise assessment relate to the operational phase. These include the UK guidance document ETSU-R-97 and of course the current Irish Wind Farm Planning Guidance.

For the assessment of construction noise, it is common practice in Ireland to look to the British Standard (BS) 5228, Parts 1 and 2 Code of Practice for the Control of Noise and Vibration from Open and Construction Sites. Where relevant, BS 5228 is referenced, in particular for the provision of construction noise mitigation measures.

a) ETSU-R-97 – The Assessment and Rating of Wind Farm Noise (1997)

The assessment methodology was adopted from *ETSU-R-97 – The Assessment and Rating of Wind Farm Noise (1997)*[1]. This document is currently used as the industry standard in the UK and Ireland and the noise levels contained within the Irish Wind Energy Planning Guidelines are adapted from this document.

b) IoA Acoustics Bulletin Article, Prediction and Assessment of Wind Turbine Noise, March/ April 2009

The Institute of Acoustics Bulletin Vol. 34 no 2 contains an agreement, jointly authored by a number of consultants working in the wind turbine sector for developers, local authorities and third parties, on an agreed methodology for addressing issues not covered by ETSU-R-97. This includes a methodology for dealing with wind shear and an agreed method for noise predictions.

c) Department of the Environment, Heritage, and Local Government (DoEHLG) – Wind Energy Planning Guidelines (Department of the Environment, Heritage and Local Government 2006)

This document provides the framework for wind farm noise assessment in Ireland. It is evident that the assessment criteria in this document are adapted from *ETSU-R-97 – The Assessment and Rating of Wind Farm Noise (1997)*.

2.1.2 Prevailing Background Noise Levels

For the purpose of this assessmentnoise monitoring was carried out for period of two weeks at each of the measurement locations between July and August 2012. Given the number of dwellings in the area noise monitoring was undertaken at 10 locations (NM1 to NM10). The monitoring equipment used included:

a) **A Bruel and Kjaer (B&K) 2250 sound level meter** was used to measure background noise levels at the selected receptors. The microphone was mounted on a tripod at least 3m away from any reflective surfaces and at height of 1.2 meters (m). A wind shield was mounted on the microphone. An outdoor environmental noise enclosure protected the equipment from the elements.

b) **A Vantage Pro2 weather station** developed by Davis Instruments was used to monitor wind speeds, wind direction, temperature, humidity and rainfall rate throughout the measurement period. This data was logged in 10 minute intervals which were synchronised with the sound level meters.

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[1]A recent research report published by Hayes McKenzie reviewed the way noise assessments are being carried out as part of the application process for planning consent for wind turbines in England. It was reported that from the sample set reviewed the ETSU-R-97 methodology has been universally adopted for the assessment of noise from proposed wind farm developments with 100% of cases stating it to be the appropriate guidance.

Wind speed measurements were recorded at a height of 4m. However, wind speed varies with height above the ground level, increasing with increased height. In accordance with ETSU the values of wind speed were corrected to a height of 10m. Using equation (1) wind speeds measured at one height, can be corrected to the value that would have been measured at another height.

$$\frac{v_1}{v_2} = \frac{\ln\left(\frac{h_1}{z_0}\right)}{\ln\left(\frac{h_2}{z_0}\right)} \qquad (1)$$

where v_1 is the wind speed (m/s) at a height of h_1 meters above ground level,v_2 is the wind speed (m/s) at a height of h_2 meters above ground level, z_0 is the ground roughness length (m) .Some typical values for z_0 are presented in Table 1. For the Upperchurch case a roughness length of 0.05 was selected.

Table 1 Roughness length for various types of terrain (ETSU).

Type of Terrain	Roughness length z0
Water area, snow or sand surfaces	0.001m
Open, flat land, mown grass, bare soil	0.01m
Farmland with some vegetation	0.05m
Suburbs, towns, forests, many trees and bushes	0.30m

2.2 POTENTIAL IMPACT

The noise modelling software (Predictor, Version 7.1) is based on ISO 9613-2:1996 Acoustics – *Attenuation of sound during propagation outdoors* – Part 2: General method of calculation. This software was used to predict wind farm noise at all dwellings within 900m of the proposed wind farm. The data input into the model was defined by *IoA Acoustics Bulletin March/April 2009 – Prediction and Assessment of Wind Turbine Noise*andis presented in table 2.

The data used in the model is conservative in particular as it assumes all dwellings are downwind of all turbines simultaneously, which in practice cannot happen. For wind directions other than downwind, noise levels will be lower.

The predicted turbine noise L_{Aeq} has been adjusted by subtracting 2dB(A) to give the equivalent L_{A90} as suggested by ETSU-R-97.

Table 2 Model Input Data

Item	Description
Turbine	Vestas V90
Turbine Locations	GPS Co-ordinates
House Locations	Site Survey/ Geo-Directory Data
Acoustic Emission	Acoustic Specification Document
Hub Height	80m
Topography	Flat – No Landform Barriers
Ground Factor	Mixed (0.5)[Note 1]
Receptor Height	4m
Wind Direction	Downwind
Relative Humidity	70%
Temperature	10^{o}C

Note 1: The ground factor may be between 0 and 1, were 0 represents hard ground and 1 represents soft ground. Hard ground reflects sound and soft ground absorbs it.

The sound power levels for the Vestas V90, with typical octave band data was obtained from the Vestas Specification Document[2]are outlined in Table 3.

Table 3 Vestas V90 – Octave Banding and Sound Power Levels (SPL)

Wind Speed	Octave Band (Hz)								
	63	125	250	500	1000	2000	4000	8000	SPL dB
10 m/s	91.3	93.0	95.5	98.2	100.4	99.2	94.9	85.0	105.6
9 m/s	92.3	94.2	96.9	99.5	101.7	100.4	96.4	86.6	106.9
8 m/s	91.8	94.0	97.3	99.6	101.8	100.5	96.7	86.7	107.0
7 m/s	89.7	93.3	96.1	98.3	100.8	100.1	96.2	85.7	106.1
6 m/s	85.7	90.9	94.0	96.5	99.1	98.2	94.3	83.7	104.2
5 m/s	82.1	86.9	91.5	93.5	95.9	94.6	90.5	79.1	100.9

2.2.1 Noise limits and Assessment Criteria

2.2.1.1 Construction Phase Noise Limits

The impact of the construction works on the local dwellings has been predicted. The construction works will be of a short duration of 6 – 8 months. Higher noise limits apply to the construction works than to the operational phase as there must be a compromise between the practicality of construction and the temporary nature of the works. There are no mandatory noise limits for construction noise in Ireland. The most recent revision of *BS5228-1:2009 Code of practice for noise and vibration control on construction and open sites* outlines noise thresholds for significant impacts. These are outlined in Table 4.

Table 4 Threshold of significant effect at dwellings

Assessment category and threshold Value Period (L_{Aeq})	Threshold value in decibels (dB)
	Category A
Night time (23.00 – 07.00)	45
Evening and Weekends	55
Daytime (07.00 – 19.00) and Saturdays (07.00-13.00)	65

Table 4 can be used as follows: for the appropriate period (night, evening/weekends or day), the ambient noise level is determined and rounded to the nearest 5 dB. This is then compared with the total noise level, including construction. If the total noise level exceeds the appropriate category value, then a significant effect is deemed to occur.

[2]Document no.:0005-5233 V01, 2010-02-09

2.2.1.2 Operational Phase Noise Limits

The noise limits applied to the nearest dwellings were adopted from the Department of the Environment Heritage and Local Government (DoEHLG) – Wind Farm Energy Planning Guidelines. The noise limits have been defined as shown in Table 5.

Table 5 Day and Night Time Noise Limits

Daytime	Night time
Where the prevailing background noise level is less than 30dB, the greater of 35 - 40dB or plus 5dB above background Or Where the prevailing background noise level is greater than 30dB the noise limits are the greater of 45dB or plus 5dB above background.	43dB

For the purpose of this assessment where the prevailing background noise level is less than 30dB, the greater of 40dB L_{A90} or plus 5dB above background has been adopted.

2.3 EXISTING ENVIRONMENT

The wind farm is to be developed in a rural area 2 km west of Upperchurch Village, County Tipperary. The main sources of noise in the area and the existing noise environment include traffic on the local and regional road network, agricultural activity and other noise typically associated with a rural location.

The locations (GPS Coordinates) of all dwellings within 900m of the proposed wind farm have been provided by the client, Ecopower Developments. There are approximately 93 dwellings within 900m of the proposed development. In total noise monitoring was undertaken at 10 locations, referred to as N1 to N10. The location of the dwellings, noise monitoring locations and proposed turbines are illustrated on Figure 1.

It is not practice to undertake noise monitoring at all locations and it is accepted that representative locations can act as proxy locations for other dwellings or sensitive locations in the area. The background noise curves and noise limit curves at N1 to N10 can be applied appropriately to other locations in proximity, where a similar noise environment would be expected.

2.3.1 Derivation of Prevailing Background Noise

The variation in background noise level with wind speed was determined by correlating $L_{A90,10min}$ noise measurements taken over a period of time (2 weeks) with the average wind speeds measured over the same 10-minute periods and then fitting a curve to these data. The derived regression line (line of best fit) is the average background noise which occurs under different wind speed conditions. This process was repeated for the day and night time periods. The graphs in Appendix A illustrate the prevailing background noise levels across a range of wind speeds as derived from the two week noise monitoring period at each of the monitoring locations.

2.3.1.1 Summary of Background Noise Levels

A summary of the prevailing background noise levels at each wind speed at each noise monitoring location is presented in table 6 below. This is illustrated graphically in Appendix A.

Table 6 Summary of Prevailing Noise Levels

Location	Period	Approximate Prevailing Background Noise Level L90 dB(A) at wind speeds 3 to 12m/s (@10m)									
		3	4	5	6	7	8	9	10	11	12
N1	Day	33	34	35	35	36	37	37	39	40	41
	Night	33	34	35	36	37	38	39	40	41	42
N2	Day	35	36	36	37	38	39	40	41	42	44
	Night	34	35	36	37	38	40	41	43	44	45
N3	Day	26	28	30	31	34	35	36	37	38	40
	Night	25	26	27	30	33	34	36	40	42	45
N4	Day	26	27	28	29	30	31	33	35	36	37
	Night	25	25	26	27	30	31	34	36	38	41
N5	Day	34	36	37	39	41	44	45	46	50	51
	Night	32	34	36	38	40	44	46	51	55	56
N6	Day	36	40	43	45	47	50	51	55	56	56
	Night	36	40	43	46	49	50	52	54	55	55
N7	Day	28	30	32	34	35	36	37	39	40	41
	Night	28	30	31	33	34	35	35	36	36	36
N8	Day	33	34	36	37	40	44	44	46	46	46
	Night	32	35	36	37	40	41	42	43	44	44
N9	Day	34	35	36	36	36	36	36	36	36	36
	Night	34	35	35	35	35	35	35	35	38	45
N10	Day	32	33	34	35	36	38	40	42	43	43
	Night	29	31	33	34	36	37	40	41	43	43

It can be seen that in general the background noise levels exceed L_{90} 30dB(A) at all locations at wind speeds over 6m/s and for the majority of locations, over 4m/s.

2.3.2 Critical Wind Speed

The rate at which wind turbine noise increases with wind speed is lower than the rate at which background noise levels increase with wind speed. The impact of wind turbine noise is therefore likely to be greater at low wind speeds, when the difference between the noise of the wind turbine and the background noise is likely to be greater. In accordance with the Irish Wind Farm Planning Guidelines, where the prevailing background noise level is greater than 30dB the noise limits are the greater of 45dB or plus 5dB above background and at **night time -** 43dB to protect sleep inside properties at night. For the purposes of this report the lower limit of 43dB(A) has been conservatively applied.

Predictions have been undertaken at 8m/s which represents the likely critical wind speed. However noise predictions have been undertaken for all wind speeds for the purpose of comparison against the derived the prevailing background noise levels (see Appendix B).

2.4 LIKELY SIGNIFICANT IMPACT

2.4.1 Construction Phase

The construction works will require heavy earth moving machinery involved in overburden removal, and construction of the wind farm infrastructure including roads, foundations, hard standings and substation. Table 7 below is a typical list of plant and machinery involved in a wind farm construction of this size. Traffic generated by materials delivery to site and employee traffic will also contribute to the noise level. The noise levels from the equipment identified above have been sourced from BS5228 Noise Database for Noise and Vibration Control on Construction and Open Sites-1:2009.

Table 7 Sound Power Frequency Data for Typical Construction Plant Machinery

Plant and Machinery	Octave Banding (Hz)								Sound Power Level dB(A)	Sound Pressure Level @10mdB(A)
	63	125	250	500	1k	2k	4k	8k		
Telescopic Handler	86.8	86.9	85.4	92.8	98	96.2	88	78.9	102	71
Mobile Crane	84.8	90.9	93.4	90.8	95.0	95.2	88.0	79.9	101	70
30-50T Excavator (x2)	89.8	92.9	99.4	104.8	104	103.2	100	92.9	110	79
15-30T Excavator (x4)	99.8	98.9	104.1	100.8	101	100.2	96	86.9	109	78
12T Roller (x2)	94.8	98.9	99.4	108.8	104	100.2	97	90.9	111	80
Dump truck (x5)	89.8	94.9	99.4	98.8	105	102.2	97	87.9	109	78
Tractor & Trailer (x4)	97.8	100.9	98.4	103.8	104	104.2	96	88.9	110	79
15-20T Rubber Tired Excavator	78.8	80.9	86.4	91.8	94	92.2	91	79.9	99	68
Erection and Assist Crane (x2)	70.8	85.9	90.4	89.8	97	98.2	87	75.9	102	71
3-10T mini digger	85.8	86.9	90.4	90	95.0	90	92	84.9	100	69
Rock Breaker	83.8	96.9	103.4	109.8	117	118.2	118	114.9	123	92
Diesel Generator	84.8	88.9	79.4	81.8	84	80.2	77	66.9	92	61

The estimated programme of works for construction indicates a 6 to 8 month period. The construction works will be phased and all the noise sources presented in table 6 will not be in operation continuously or simultaneously for the duration of the construction phase. However for the purpose of this assessment a worst case scenario has been assumed and all the items of machinery have been modelled as if they were in operation continuously and simultaneously over the course of a twelve hour working day.

The results of the construction noise predictive modelling indicate that the appropriate threshold of significance **(65dB(A))** as outlined in BS5228-1:2009 will not be exceeded beyond 200m. There are no dwellings within this range. The results are illustrated in table 8 below. In reality all items of plant will not be operating at the same location and at the same time, therefore it is reasonable to conclude that the noise levels experienced by the receiving environment will be much lower.

Table 8 Theoretical Worst Case Scenario Construction Noise

Distance to receiver (m)	Theoretical Worst Case Scenario dB(A)
100	72
200	64
300	60
400	57
500	54

2.4.2 Operational Phase Predicted Results

Noise from the wind farm was predicted at all dwellings within 900m with the wind speed at the greatest sound power level to represent worst case scenario conditions, i.e. 8m/s. The results are presented in table 9.

Table 9 Predicted Worst Case Noise Results (Downwind) @ Maximum Noise Emission (8m/s)

- **Upperchurch Windfarm turbines only included in the assessment**

Name	Predicted Noise Level	Predicted Noise Level (with certain turbines in noise reduced mode)	Guideline Limit
H7 **(N10)***	46	43	43
H5	45	43	43
H2	45	43	43
H9	45	43	43
H11 **(N2)***	44	43	43
H49	44	43	43
H46	44	43	43
H15 **(N5)***	44	43	49**
H41 **(N4)***	44	43	43
H32	44	43	43
H31	43	42	43
H6 **(N3)***	43	43	43
H8 **(N6)***	43	43	49**
H4 **(N8)***	43	43	43
H51	43	42	43
H14	43	43	43
H30	43	42	43
H22	43	41	43
H24	43	42	43
H23	42	42	43
H33	42	42	43
H13	42	42	43
H29	42	42	43
H27	42	42	43
H20	42	40	43
H19	42	42	43
H40	42	42	43
H21	42	42	43
H17	42	42	43
H48	42	42	43
H48	42	42	43
H54	42	40	43
H18	42	41	43

H34	42	40	43
H39	42	40	43
H28	42	42	43
H16	42	41	43
H38	42	42	43
H25	42	41	43
H44	42	41	43
H12 **(N7)***	42	42	43
H3	42	41	43
H55	41	41	43
H79	41	40	43
H1 **(N1)***	41	41	43
H10	41	41	43
H56	41	41	43
H53	41	40	43
H62	41	40	43
H35	41	40	43
H64	41	39	43
H82	41	40	43
H70	41	41	43
H73	41	40	43
H45	41	40	43
H71	41	39	43
H52	41	41	43
H75	41	41	43
H68	41	39	43
H76	41	39	43
H26	41	40	43
H37	40	40	43
H91	40	39	43
H42	40	40	43
H43	40	40	43
H47	40	40	43
H36	40	39	43
H50	40	39	43
H58	39	39	43
H59	39	39	43
H78	39	39	43

H61	39	39	43
H69	39	38	43
H66	39	39	43
H6	39	39	43
H65	39	39	43
H72	39	39	43
H67	39	39	43
H93	39	38	43
H57	39	38	43
H63	39	38	43
H88	38	38	43
H90	38	38	43
H74	38	37	43
H77	38	38	43
H81	37	37	43
H83	37	37	43
H80	37	36	43
H85	37	37	43
H87	37	37	43
H84	37	36	43
H86	37	36	43

* **N1 to N10** denote the baseline background noise monitoring locations. These locations were selected as representative of other locations in the vicinity. These representative locations can be considered as proxy locations for other sensitive locations nearby, which would have a similar noise environment.

**5dB(A) above background noise at this wind speed

2.4.2.1 Discussion of Results

The results show that the guideline limit may be marginally exceeded at N7, H5, H2, H9, H11, H49, H46, H41, and H32. These results are likely an overestimate as no consideration of wind direction has been factored into the results. It must be noted that H2 is unoccupied and will be used as site offices for the project. In that regard they are not considered as a sensitive receptor, but the location has been included in the assessment for information purposes. Regardless, the noise limit criteria can be achieved at this location. The model assumes that all dwellings are downwind of all turbines simultaneously which in practice cannot happen. In reality the contribution of wind turbines to noise levels at local dwellings will be much less under upwind conditions. Current practice suggests that once in crosswind directions then the reduction may be around 2 dB(A) and when at sufficient distance upwind the reduction would be at least 10dB[3]. In addition at all other wind speeds noise levels will be lower. The results in table 8 (2nd column) are illustrated in Figure 2. It must also be noted that these results are based on the turbine running in normal operating mode. The selected turbine will operate in a mode that ensures compliance with the lower nighttime noise limit i.e. 43dB(A).

To demonstrate this, turbines have been modelled in the appropriate mode and the mitigated noise levels are also presented in table 9 (3rd column). The turbine operating in noise reduced modes are presented in table 10. Most models of wind turbines are available with noise reduced modes, often with up to 6 available modes. At this stage, the assessment is based on a worst case scenario and is likely an overestimate. The daytime limit of 45dB will not be exceeded at any location bar H7. The use of noise reduced modes can reduce the noise levels to comply with the lower nighttime limit of 43dB(A). Mitigation, if any, will not be required for all wind speeds. The mitigation below is designed for wind speeds of 8m/s, at which this turbine generates the loudest emissions.

Table 10 Mitigated Turbine and Operating Mode

Turbine	Operating Mode
T1	normal operating mode
T2	noise reduced mode 1
T3	noise reduced mode 3
T4	noise reduced mode 2
T5	noise reduced mode 1
T6	noise reduced mode 1
T7	noise reduced mode 1
T8	noise reduced mode 3
T9	normal operating mode
T10	noise reduced mode 1
T11	normal operating mode
T12	normal operating mode
T13	normal operating mode
T14	normal operating mode
T15	normal operating mode
T16	normal operating mode
T17	normal operating mode
T18	normal operating mode
T19	normal operating mode
T20	normal operating mode
T21	normal operating mode
T22	noise reduced mode 2

[3] JOR3-CT95-0091 'Development of a Wind Farm Noise Propagation Prediction Model', Bass JH, Bullmore A J, Sloth E, Final Report for EU Contract JOR3 CT95 0051, 1998.

2.4.2.2 Discussion of Results (Post Mitigation)

The noise predictions can be considered perhaps overly conservative as no account of wind direction or landform has been factored into results. Wind direction can have a significant effect on noise levels as noise levels at noise sensitive locations upwind of a noise source can be significantly less. With regards to this development the noise prediction software assumes a downwind propagation in all directions, and in reality receptors cannot be downwind of all turbines simultaneously.

Furthermore the final turbine selection has not been decided. In the absence of a preferred candidate, a worst case scenario was adopted in that there are quieter Vestas turbines models and other turbines manufacturer models available than was used for the purpose of this assessment. If a quieter turbine is selected the noise levels will be lower than presented in this report. Additionally the noise emissions for this candidate machine are warranted and it is sometimes the case that warranted noise level include a margin of safety of 1 to 2dB and in reality provided sound power levels used may be an overestimate.

2.4.3 Cumulative Impact

The cumulative impact was also considered, by including the proposed adjacent development (Planning Reference 12510385 – Milestone Wind Farm). The results of both wind farms operating in combination at the loudest sound emission are presented in table 11. The Upperchurch turbines have been run in noise reduced modes, whereas Milestone Windfarm turbines are running in normal operating mode.

Table 11 Cumulative Impact (Upperchurch and Milestone Wind Farms)

Name	Predicted Noise Level Cumulative Note 1	Predicted Noise Level (factoring in an adjustment for wind direction)	Guideline Limit
H7 **(N10)**	53	53	43
H5	44	42	43
H2	45	43	43
H9	44	42	43
H11 **(N2)**	43	43	43
H49	43	43	43
H46	43	43	43
H15 **(N5)**	44	42	49*
H41 **(N4)**	43	43	43
H32	43	43	43
H31	43	43	43
H6 **(N3)**	44	42	43
H8 **(N6)**	43	43	49*
H4 **(N8)**	43	43	43

H51	42	42	43
H14	44	42	43
H30	42	42	43
H22	42	42	43
H24	44	42	43
H23	42	42	43
H33	42	42	43
H13	42	42	43
H29	44	42	43
H27	43	43	43
H20	41	41	43
H19	42	42	43
H40	43	43	43
H21	43	43	43
H17	43	43	43
H48	43	43	43
H48	43	43	43
H54	42	42	43
H18	42	42	43
H34	42	42	43
H39	42	42	43
H28	42	42	43
H16	41	41	43
H38	43	43	43
H25	42	42	43
H44	41	41	43
H12 **(N7)**	42	42	43
H3	42	42	43
H55	42	42	43
H79	41	41	43
H1 **(N1)**	41	41	43
H10	41	41	43
H56	41	41	43
H53	42	42	43
H62	41	41	43
H35	40	40	43
H64	40	40	43
H82	41	41	43

H70	41	41	43
H73	41	41	43
H45	40	40	43
H71	41	41	43
H52	41	41	43
H75	41	41	43
H68	40	40	43
H76	41	41	43
H26	41	41	43
H37	41	41	43
H91	40	40	43
H42	40	40	43
H43	40	40	43
H47	40	40	43
H36	40	40	43
H50	40	40	43
H58	40	40	43
H59	39	39	43
H78	41	41	43
H61	40	40	43
H69	43	43	43
H66	40	40	43
H6	40	40	43
H65	40	40	43
H72	40	40	43
H67	39	39	43
H93	41	41	43
H57	41	41	43
H63	39	39	43
H88	38	38	43
H90	38	38	43
H74	39	39	43
H77	38	38	43
H81	38	38	43
H83	38	38	43
H80	39	39	43
H85	38	38	43
H87	38	38	43

H84	39	39	43
H86	38	38	43

Note 1: Upperchurch operating with noise reduced modes

* **N1 to N10** denote the baseline background noise monitoring locations. These locations were selected as representative of other residential properties in the vicinity. These representative locations can be considered as proxy locations for other sensitive locations nearby, which would have a similar noise environment.

**5dB(A) above background noise at this wind speed

2.4.3.1 Discussion of Results – Cumulative Impact

The predicted results (within the conservative parameters adopted for this assessment) indicate that in combination with the Milestone wind farm, the following receptors exceed the guideline limit i.e. H7, H5, H2, H9, H6, H14, H24, and H29. This is true for wind speeds of 8m/s which is considered the worst case scenario. At lower wind speeds the results will be lower and at higher wind speeds, noise levels are likely to be masked by higher background noise levels.

The most significant increase in noise level is at H7. This is as a result of the Milestone wind farm and not the proposed Upperchurch Wind Farm. Given the proximity of the Milestone wind farm to this location, the Upperchurch wind farm does not elevate noise levels above the Milestone Wind Farm alone contribution.

The nearest Milestone wind turbine is approximately 80m from this property. It is understood that an agreement has been reached between the developer of that wind farm and the owner of that property. H7 will be used as construction site offices for the Milestone Wind Farm. Should the Milestone development not proceed, the 43dB(A) limit can be achieved.

At the remaining locations i.e. H5, H2, H9, H6, H14,H24, and H29, the noise limit is exceeded marginally by between 0 to 1dB at H5, H2, H9, H6, H14, H29, H24 and H29 and by 2dB at H2. As discussed in section 4.1.2, the calculation parameters adopted in this assessment are conservative, particularly with regards to wind direction, and wind turbine sound power levels.

It is clear that receptors H2, H9, H6, H14, H15 H29, H24 and H29, cannot be downwind of all turbines east and west and north and south simultaneously. Current practice suggests that once in crosswind directions then the reduction may be around 2 dB(A) and when at sufficient distance upwind the reduction would be at least 10dB[4]. Therefore, adopting a still conservative 2dB reduction for wind direction attenuation demonstrates the noise limit can be achieved.

[4] JOR3-CT95-0091 'Development of a Wind Farm Noise Propagation Prediction Model', Bass JH, Bullmore A J, Sloth E, Final Report for EU Contract JOR3 CT95 0051, 1998.

2.4.4 Wind Farm Noise vs. Noise Limit Criteria

A scatter graph using the baseline noise data (see also Appendix A) and the derived 10 meter high wind speeds was generated and a trend line was added. It was then possible to derive the noise limit curve for each location using the trend line and noise limit criteria set out in table 5. This process was repeated for the day time and night time periods. Using the predicted L_{A90} across different wind speeds the turbine noise was plotted against the noise limit curves for N1 to N10. These curves are illustrated in Appendix B.

2.5 MITIGATION MEASURES

2.5.1 Construction Phase - Noise

The construction phase has the potential to cause significant disturbance to local noise sensitive areas. Outlined below are ways of reducing the amount of noise reaching the noise sensitive areas and are sourced from *BS528-1:2009,Code of Practice for noise and vibration control on construction and open sites*. The recommendations below are not exhaustive and best practice will be employed at all times to minimise noise emissions from the construction site. The plant and activities to be employed should be reviewed to ensure that they are the quietest available for the required purpose in accordance with best practicable means.

2.5.1.1 Community Relations

Good relations with people living and working in the vicinity of site operations are of paramount importance. It is suggested that good relations can be developed by keeping people informed of progress and by treating complaints fairly and expeditiously. An Environmental Monitoring Committee will be established for the construction phase of the Upperchurch Windfarm. The Committee shall include representatives of the developer, North Tipperary County Council, Inland Fisheries Ireland, the project Ecologist, and representatives of the local community. Monthly meetings will be held and issues such as project progress, works planned for the month ahead, e.g. scheduled concrete pours of bases, results of construction noise monitoring, traffic or haulage schedules and any community issues or queries will be discussed (Please refer to the Construction Phase Environmental Management Plan).

2.5.1.2 General Mitigation Measures

There are many general measures that can reduce noise levels during construction at source such as:

- Avoid unnecessary revving of engines and switch off equipment when not required.
- Keep internal haul routes well maintained and avoid steep gradients.
- Start up plant and vehicles sequentially rather than all together.
- Modification of existing plant and equipment, if required.
- As far as reasonable practicable sources of significant noise should be enclosed.
- Regular and effective maintenance of plant by trained personnel is essential.
- Audible reversing alarms on mobile plant and vehicles should be of a type which has a minimum noise impact on persons outside sites.

2.5.1.3 Noise Monitoring

It is recommended that noise monitoring is undertaken during the construction phase to ensure any limits set down by the planning authority are complied with and also to monitor the effectiveness of any noise attenuation measures being employed.

2.5.2 Operational Phase

Once operational it has been demonstrated that the wind farm can operate within limits of the wind farm planning guidelines. This assessment adopted robust and conservative parameters and it is likely the worst case scenario is an overestimate. For example there will be quieter wind turbine candidates available at the procurement stage. Regardless, the chosen candidate for this assessment can operate within the limits, although some mitigation restricted to certain wind speeds and direction in the form of noise reduced modes may be required.

In summary the mitigation measures presented, for the purpose of this assessment, are indicative, a worst case scenario and likely to be restricted to a wind speed of 8m/s. At this stage it has been demonstrated that mitigation options are available to restrict the noise levels to within appropriate limits. Once operational some, all or none of the measures may be required..

3 REVISED VIBRATION IMPACT ASSESSMENT

This section discusses the potential vibration around the construction and operational phases of the proposed development. Once operational vibrations from Wind Farms are not an issue and not perceptible. During construction of any project, vibration generally only becomes an issue if blasting or piling form part of the programme of works. General construction activities, such as excavation, earth moving, and turbine erection are not significant sources of vibration. Blasting and piling will not take place during construction.

3.1 METHODOLOGY AND ASSESSMENT CRITERIA

3.1.1 Construction Phase Vibration

There is no published Irish guidance relating to vibration during construction activities. Common practice in Ireland has been to use guidance from internationally recognised standards. Vibration standards come in two varieties: those dealing with human comfort and those dealing with cosmetic or structural damage to buildings. In both instances, the magnitude of vibration is expressed in terms of Peak Particle Velocity (PPV) in millimetres per second (mm/s).

BS5228 Part 2 – Vibration, gives recommendations for basic methods of vibration control relating to construction and open sites where work/ activities generate significant vibration levels, with particular reference to blasting and piling. There will be no blasting or piling at this site.

BS 6472: 1992 *Guide to Evaluation of human exposure to vibration in buildings (1Hz to 80 Hz)*; sets down vibration level at which minimal adverse comment is likely to be provoked from the occupants of the premises being subject to vibration. These are outlined in Table 12.

Table 12 Guidance on effects of vibration levels

Vibration Level	Effect
0.14 mm/s	Vibration might just be perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies people are less sensitive to vibration.
0.3 mm/s	Vibration might just be perceptible in residential environments
1.0 mm/s	It is likely that vibration of this level in residential environments will cause complaint, but can be tolerated if prior warning and explaining has been given to residents.
10 mm/s	Vibration is likely to be intolerable for any more than a very brief exposure to this level

The German standard DIN4150 provides limits below which it is very unlikely that there will be any cosmetic damage to buildings. Transient vibration should not exceed 3mm/s at low frequencies, for structures that are of great intrinsic value and are particularly sensitive to vibration. Allowable levels increase to 8mm/s at 50Hz and 10mm/s at 100Hz and above.

In order to ensure that there is no potential for vibration damage during construction, the National Roads Authority recommends that vibration from road construction activities be limited to the values set out in Table 13. These values have been derived through consideration of the various standards discussed above; compliance with this guidance should ensure that there is little to no risk of even cosmetic damage to buildings.

Table 13 Allowable vibration in order to minimise the risk of building damage

Allowable vibration velocity (Peak Particle Velocity) at the closest part of any sensitive property to the source of vibration, at a frequency of		
Less than 10Hz	10 to 50 Hz	50 to 100Hz (and above)
8 mm/s	12.5 mm/s	20 mm/s

Vibration is perceptible at around 0.5mm/s and may become disturbing or annoying at higher magnitudes in the case of nominally continuous sources of vibration such as traffic (in the order of 1mm/s). However, higher levels of vibration are typically tolerated for single events or events of short duration. Blasting and piling, two of the primary sources of vibration during construction, are typically tolerated at vibration levels up to 12mm/s and 2.5mm/s respectively, for example. This guidance is applicable to the day-time only; it is unreasonable to expect people to be tolerant of such activities during the night-time. **However, there will be no piling or blasting during the construction phase of this project.**

3.2 POTENTIAL IMPACTS

3.2.1 Construction Phase Vibration

On any construction site, blasting and piling are the main cause for concern when it comes to the potential for vibration. There will be no blasting or piling at the site. General site activates are not a source of significant vibration. Furthermore given the separation distance between the site and any dwellings, vibrations from general site activates as will take place during the construction of the wind farm will not be significant. There will be no significant impact from vibrations during the construction phase of the Upperchurch Wind Farm.

3.2.2 Operational Phase Vibration

A study of vibration around a modern wind farm was carried out for ETSU and reported in *ETSU W/13/00392/REP, Low Frequency Noise and Vibrations Measurement at a Modern Wind Farm*. The study found that vibration levels 100m from the nearest turbine were a factor of 10 less than those recommended for human exposure in sensitive buildings, such as hospitals or laboratories housing precision measurement instruments.

These findings were confirmed in July 2005 by the Applied and Environmental Geophysics Group of the School of Physical and Geographical Sciences at Keele University. Keele University undertook an assessment of the likely impact of ground borne vibrations from wind turbines on the seismic array at Eskdalemuir, Scotland.

Eskdalemuir, in the Scottish Borders, is in the location of a monitoring facility operated by the British Geological Survey where seismological, magnetic and other environmental parameters are monitored because the site is located in a very quiet and seismic environment. Testing showed that vibration can be detected several kilometres from the wind turbines. However, Keele University clarified the context of their results.

"The level of vibration from wind turbines is so small that only the most sophisticated instrumentation and data processing can reveal their presence, and they are almost impossible to detect. The Dun Law study was designed to measure effects of extremely low level vibration on one of the quietest sites in the world (Eskdalemuir) and one which houses one of the most sensitive seismic installations in the world. Vibrations at this level and in this frequency range will be available from all kinds of sources such as traffic and background."

In a recent letter to the press two of the authors of this report stated that 'to put the level of vibration into context, they are ground vibrations with amplitudes of about one millionth of a millimetre. There is no possibility of humans sensing the vibration and absolutely no risk to human health'.

3.3 EXISTING ENVIRONMENT

There are no significant sources of vibration in the area. The only potential for vibration may exist along the local road network. However, roads in good condition are generally not a source of significant vibration.

3.4 LIKELY SIGNIFICANT IMPACT

3.4.1 Construction Phase Vibration

There will be no significant sources of vibration during construction and there will be no threat to any structures from any vibration generated during construction. Vibration, if any, will be localised and will not propagate any significant distance including as far as the neatest nearest dwellings. Blasting and piling are the primary sources of vibration on any construction site and these activities will not be taking place during the construction of the Upperchurch Wind Farm.

3.4.2 Operational Phase Vibration

Once operational there will be no significant sources of vibration.

3.5 MITIGATION MEASURES

3.5.1 Construction Phase – Vibration

Vibration during construction works is not anticipated to be significant as there will be no significant sources of vibration during construction.

3.5.2 Construction Phase – Operational

No operational phase mitigation measures are required.

4 DUST

Although typically covered in the Air Quality chapter, Dust has been included in this revised report, as it forms part of the request for further information on noise and vibration. The section below outlines the guideline assessment criteria when considering the potential impact from dust and outlines mitigation measures to ensure dust emissions from the site are minimised and do not cause nuisance.

4.1.1 Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes (Dust Control)

The National Roads Authority (NRA) has published guidance for assessing dust impacts from road construction (‘*Guidelines for the Treatment of Air Quality during the Planning andConstruction of National Road Schemes*’). This has been used to determine the potential impacts from the proposed construction site operations.

Presented in Table 14 is a list of distances at which dust could be expected to result in a nuisance from construction sites for impacts such as soiling, Particulate Matter 10 microns in size ($PM_{10)}$ deposition and vegetation effects. These distances present the potential for dust impact with standard mitigation in place.

Table 14 Assessment Criteria for the impact of dust from construction with standard mitigation in place

Source		Potential distance for significant effects (distance from source)		
Scale	**Description**	**Soiling**	**PM_{10}**	**Vegetation**
Major	Large construction sites, with high use of haul roads	100m	25m	25m
Moderate	Moderate sized construction sites, with moderate use of haul roads	50m	15m	15m
Minor	Minor construction sites, with limited use of haul roads.	25m	10m	10m

4.1.2 Construction Phase Dust Emissions

The impact of fugitive dust emissions generated from these operations will depend on surface characteristics, wind direction, wind speed and other meteorological conditions such as rainfall. Dust generation will be greatest during dry windy weather and least during calm wet conditions.

The construction of the wind farm can be characterised as a moderate construction site. Therefore, dust is unlikely to cause an impact at sensitive receptors beyond 50m of the source (see Table 14), with standard mitigation measures in place. Accordingly there is no risk to any dwellings from significant dust deposition. The greatest potential for dust nuisance will occur along the access route to the wind farm site, and the construction of internal access roads near dwellings.

Ensuring loads of fill material are covered and damping down during dry windy weather will ensure fugitive dust from the site is kept to a minimum and does not cause nuisance.

4.1.2.1 Potential Impact on Sensitive Ecosystems

Dusts can be deposited on the leaves of plants reducing the photosynthetic potential. It is anticipated that once standard mitigation measures are in place there will be no significant impacts on ecosystems from dust.

4.1.3 Operational Phase Dust Emissions

Once operational there will be no further requirement for earth moving, excavation or fill material transportation. There will no dust emissions from the site once operational.

5 LOW FREQUENCY NOISE AND HEALTH

5.1 METHODOLOGY AND ASSESSMENT CRITERIA

5.1.1 Infrasound and Low Frequency Noise

Infrasound is the term generally used to describe sound below that at which is normally audible, at frequencies below 20Hz. At separation distances from wind turbines which are typical of residential locations, the levels of infrasound from wind turbines are well below the human perception level. Infrasound from wind turbines is often at levels below that of the noise generated by wind around buildings and other obstacles. Sounds at frequencies from about 20Hz to 200Hz are conventionally referred to as low frequency sounds. A report for the Department of Trade and Industry (DTI) in 2006 by Hayes McKenzie concluded that neither infrasound nor low frequency noise was a significant factor at the separation distances at which people lived.

5.1.2 Wind Farms Noise and Health

To date there is no published evidence to suggest a direct link between wind farms and health. The main publications supporting these views include.

a) Australian National Health and Medical Research Council (NHMRC) July 2010

"There is currently no published scientific evidence to positively link wind turbines with adverse health effects".

b) Wind Turbine Sound and Health Effects - An Expert Panel Review - American Wind Energy Association and Canadian Wind Energy Association December 2009

"There is no evidence that the audible or sub-audible sounds emitted by wind turbines have any direct adverse physiological effects.

The ground-borne vibrations from wind turbines are too weak to be detected by, or to affect, humans.

The sounds emitted by wind turbines are not unique. There is no reason to believe, based on the levels and frequencies of the sounds and the panel's experience with sound exposures in occupational settings, that the sounds from wind turbines could plausibly have direct adverse health consequences."

c) Renewable UK - Wind Turbine Syndrome - An independent review of the state of knowledge about the alleged health condition July 2010

"There is no reason to believe that the sounds from wind turbines could plausibly have direct adverse health consequence"

5.2 RESIDUAL IMPACTS

5.2.1 Noise

While noise from wind turbines may be audible at certain locations under certain meteorological conditions, noise levels willnot exceed the DoEHLG Wind Energy Planning Assessment Criteria designed for the protection of residential amenity at the majority of locations, once mitigation measures are employed.

5.2.2 Vibration

There will no residual vibration.

5.2.3 Dust

There will be no residual dust emissions.

5.3 CONCLUSION

5.3.1 Noise

An assessment of the likely noise impact of the proposed Upperchurch Wind Farm has been carried out.Typical downwind turbine noise levels at the closest residential locations to the site have been predicted based on provided sound power level data for a Vestas V90 wind turbine.The assessment has been carried out in accordance with methodology described in ETSU-R-97, Assessment and Rating of Noise from Wind Farms. To ensure a robust assessment, conservative parameters were adopted, in particular, for the purpose of noise predictions. It is likely that predicted results are likely an overestimate. Regardless, it has been demonstrated that mitigation measures can be effectively employed to achieve the appropriate derived planning limit of L_{A90} 43dB.

5.3.2 Vibration

There will be no significant sources of vibration employed on the site during construction. Accordingly there will be no significant impact from vibration during the construction phase. Similarly, once operational there will be no significant sources of vibration.

5.3.3 Dust

In conclusion, during the construction phase, once standard mitigation measures are in place, the potential for dust emission is minimised and there will be no significant impact from dust emissions.

Once operational, there will be no further potential for dust emissions.

Figure 1 Wind Farm and all dwellings within 900m

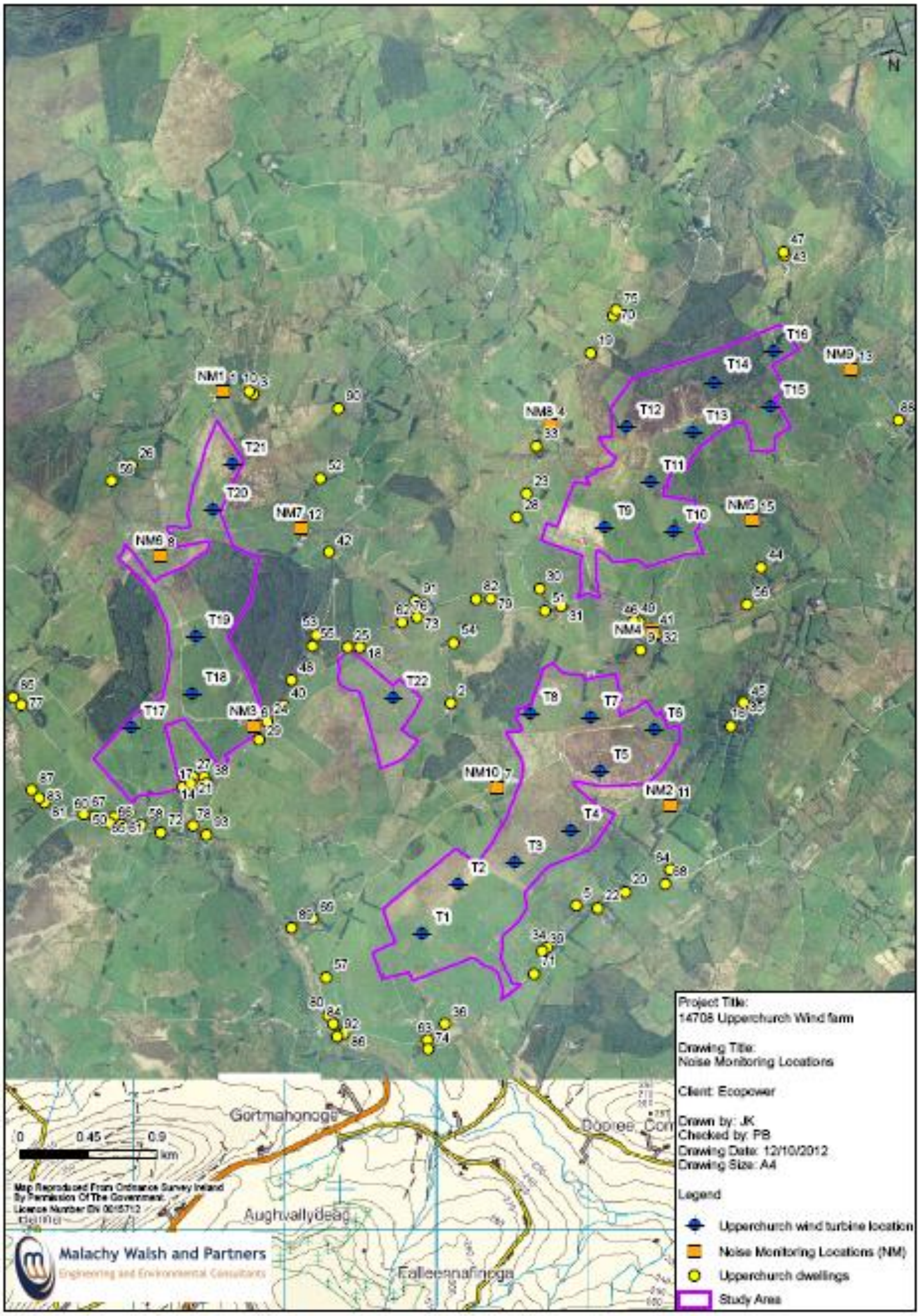


Figure 1 Predicted Noise Level at 8m/s (with turbines in noise reduced modes, all areas outside shading are below L90 43dB(A)

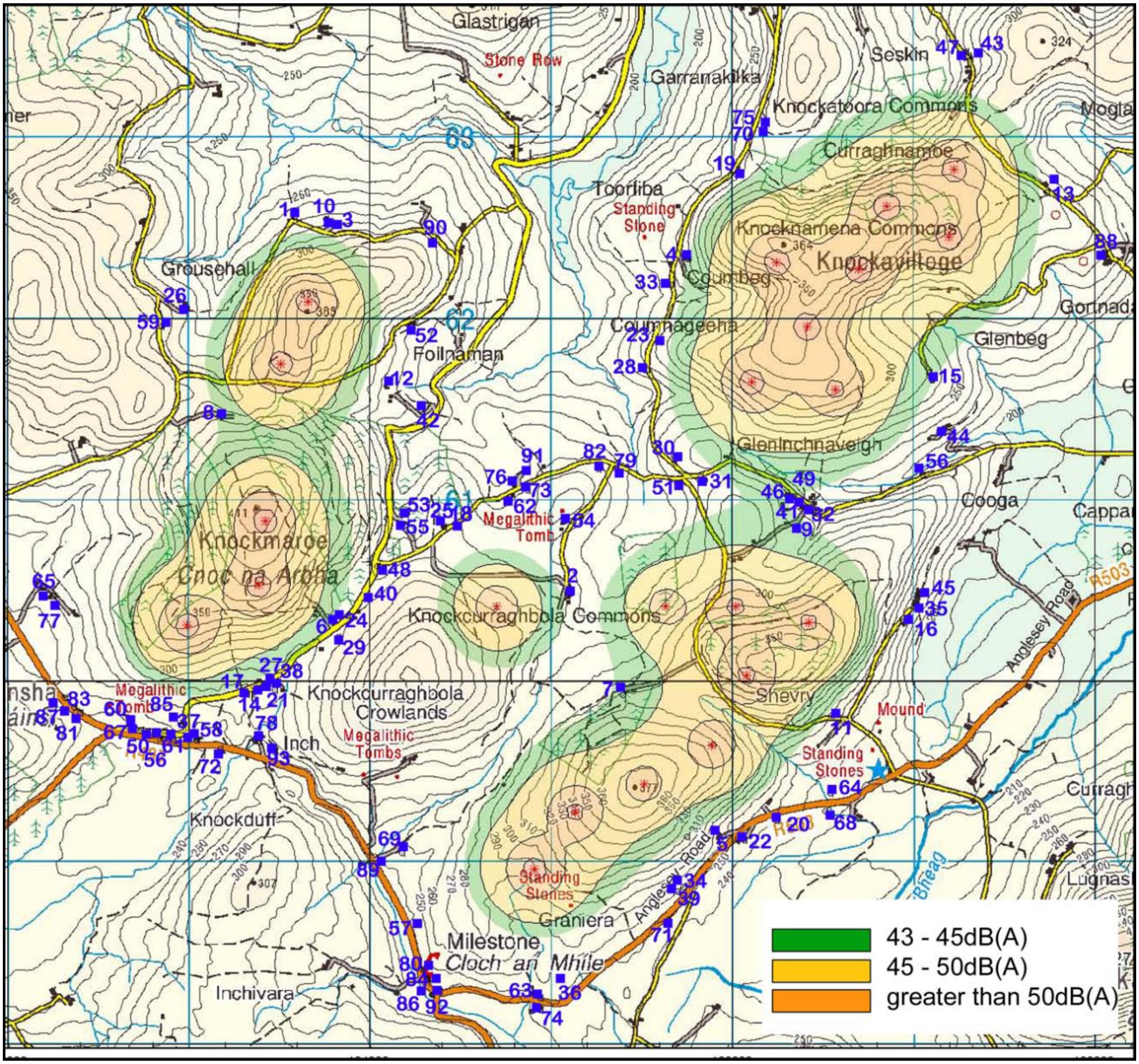
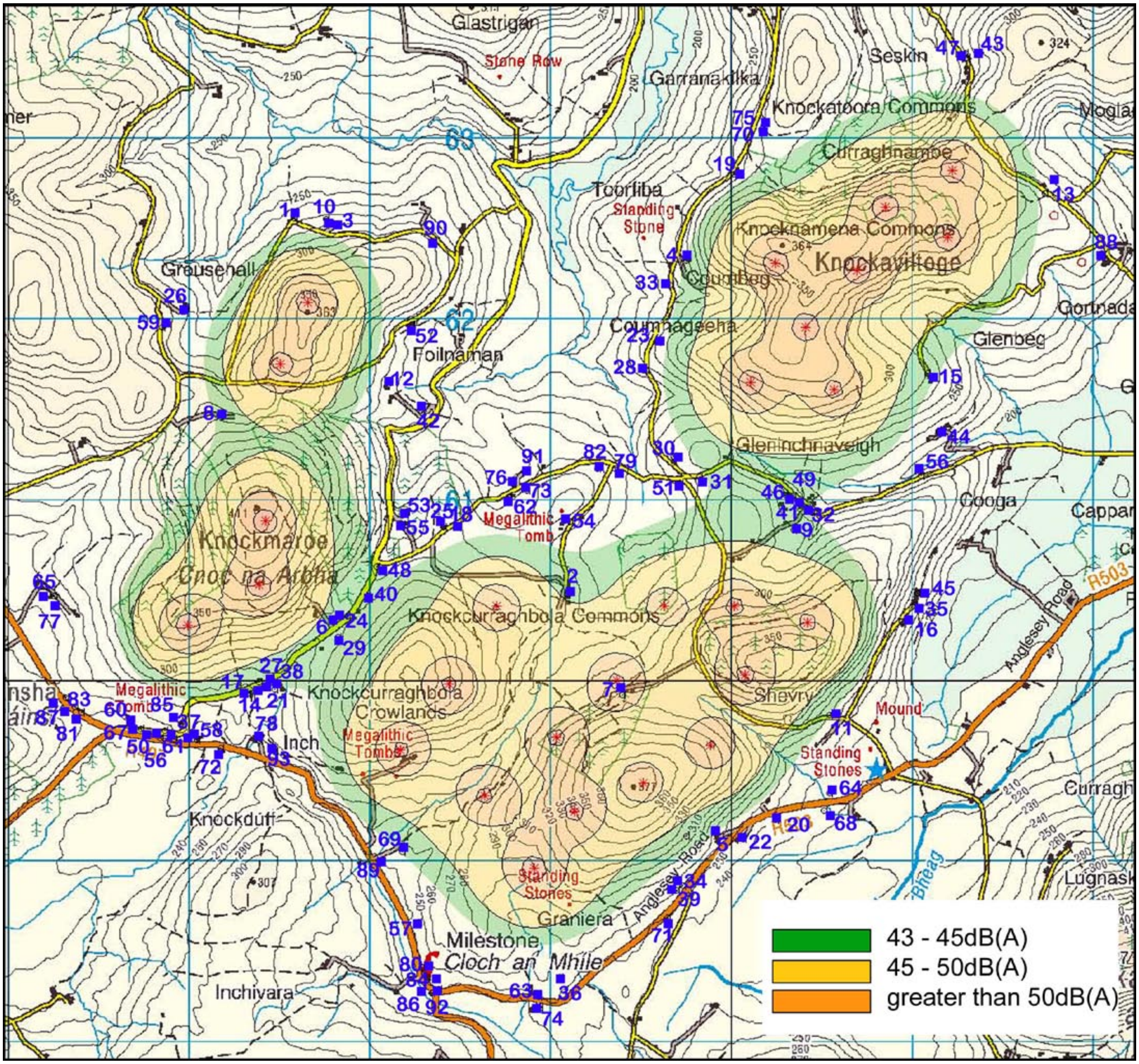


Figure 3 Cumulative Impact



5.4 REFERENCES

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Australian National Health and Medical Research Council (NHMRC) July 2010

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JOULE project JOR3-CT95-0051 '*Development of a wind farm Noise Prediction Model'.*

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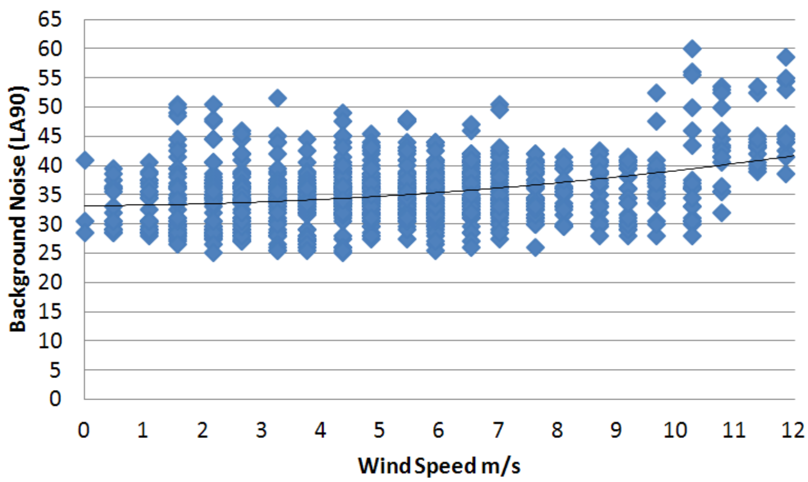
W/45/00656/00/00 .*The Measurement of Low Frequency Noise at Three UK Windfarms.* Department of Trade and Industry, 2006.

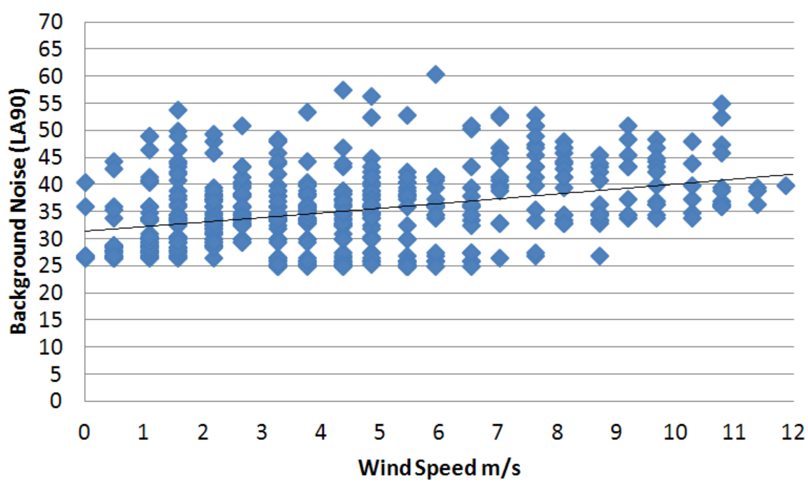
Appendix A

Prevailing Background Noise Levels at NM1 to NM10

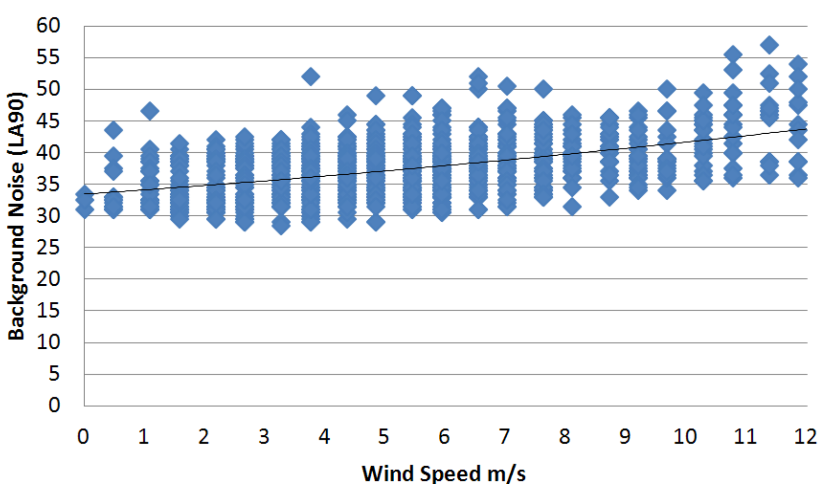
Location N1 Daytime Prevailing Background Noise Level



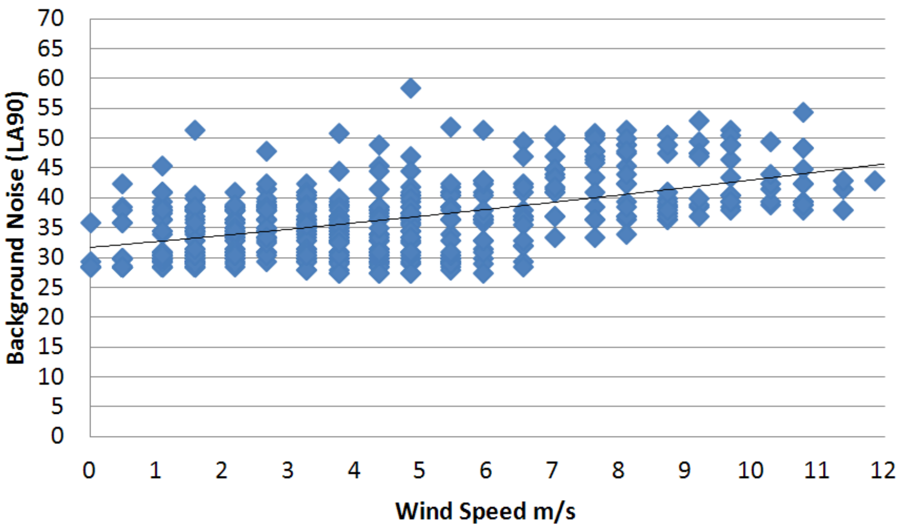
Location N1 Night time Prevailing Background Noise Level



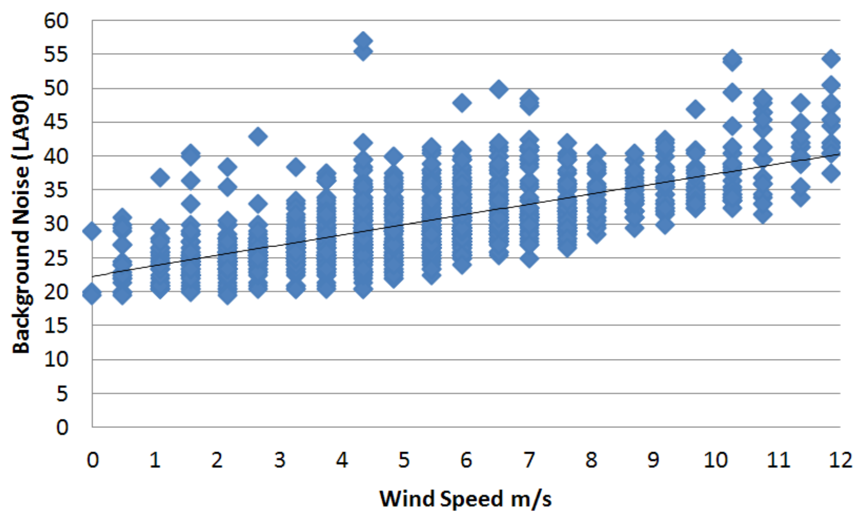
Location N2 Day time Prevailing Background Noise Level



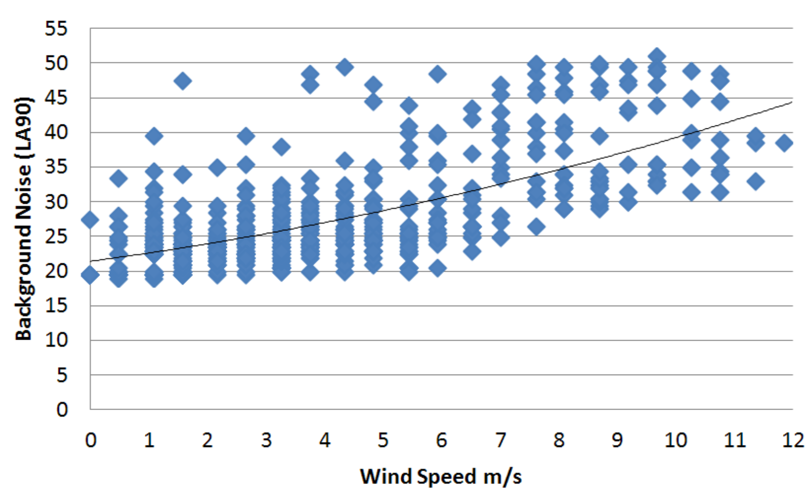
Location N2 Night time Prevailing Background Noise Level



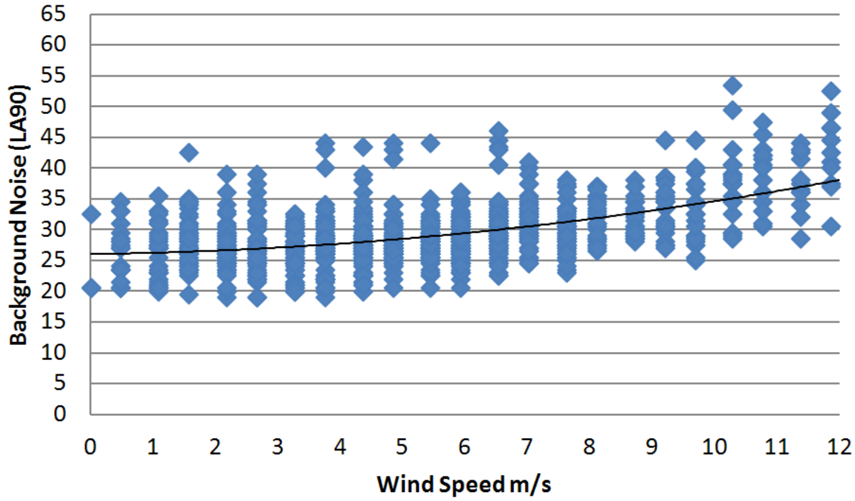
Location N3 Day time Prevailing Background Noise Level



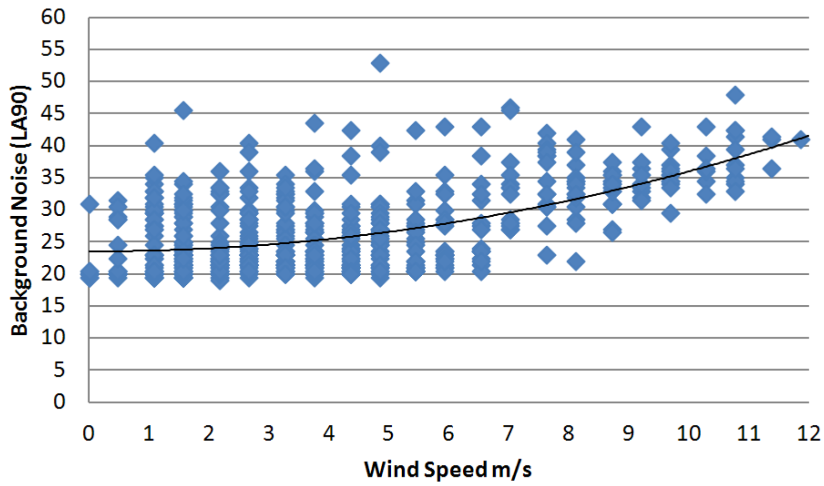
Location N3 Night time Prevailing Background Noise Level



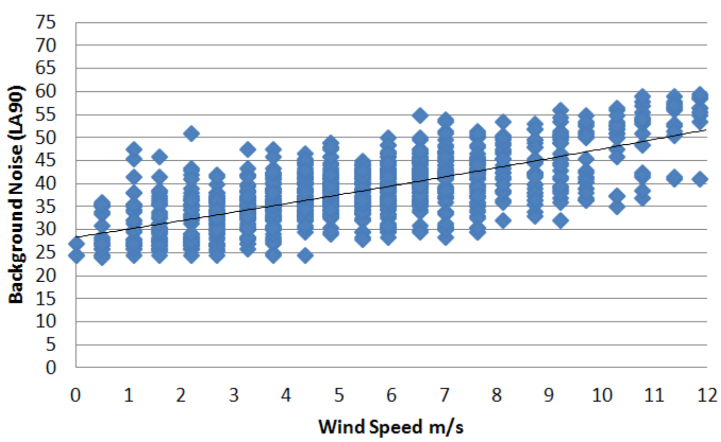
Location N4 Day time Prevailing Background Noise Level



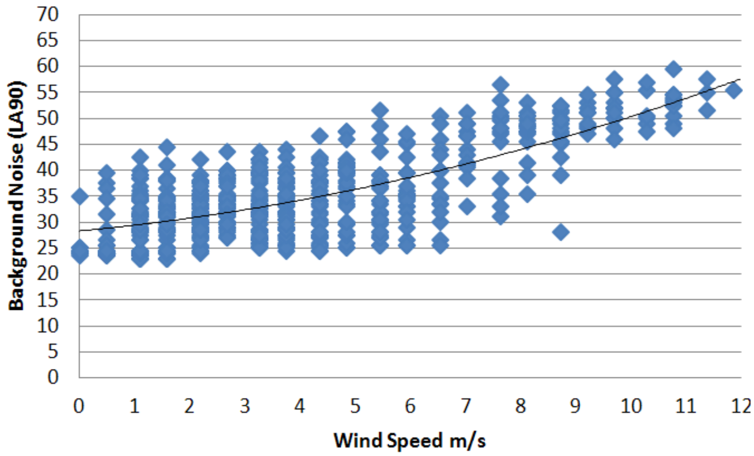
Location N4 Day time Prevailing Background Noise Level



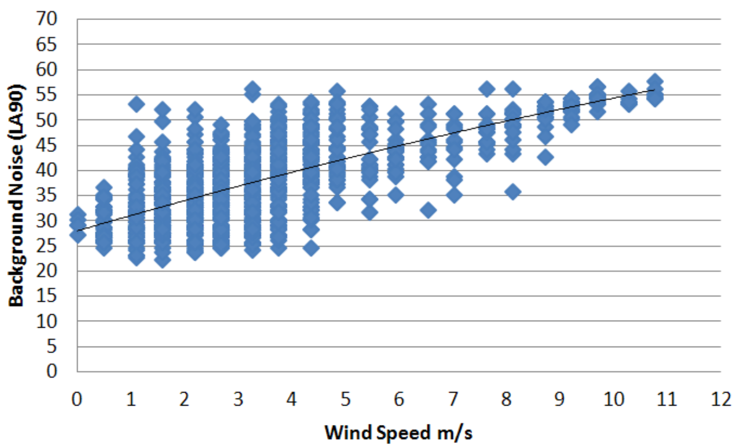
Location N5 Night time Prevailing Background Noise Level



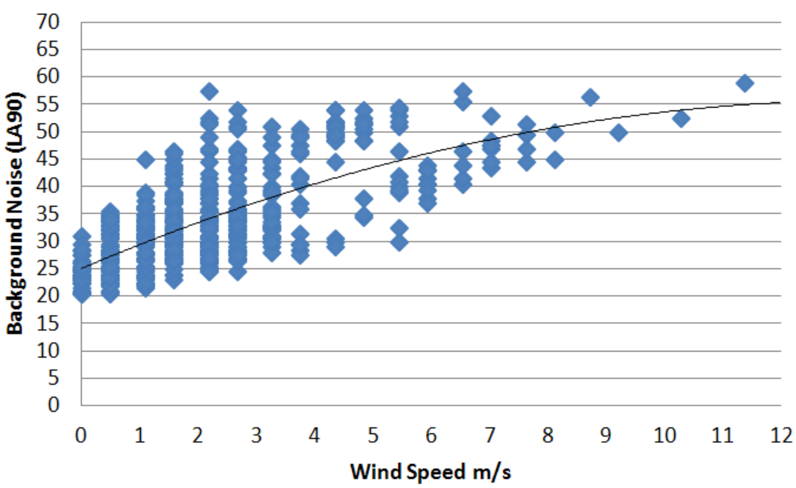
Location N5 Day time Prevailing Background Noise Level



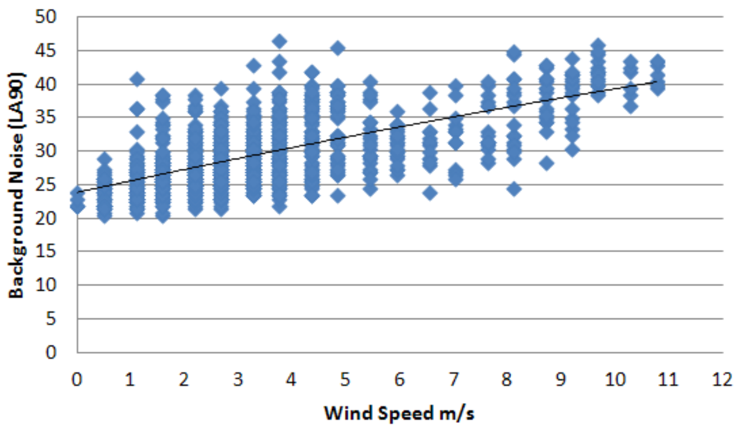
Location N6 Day time Prevailing Background Noise Level



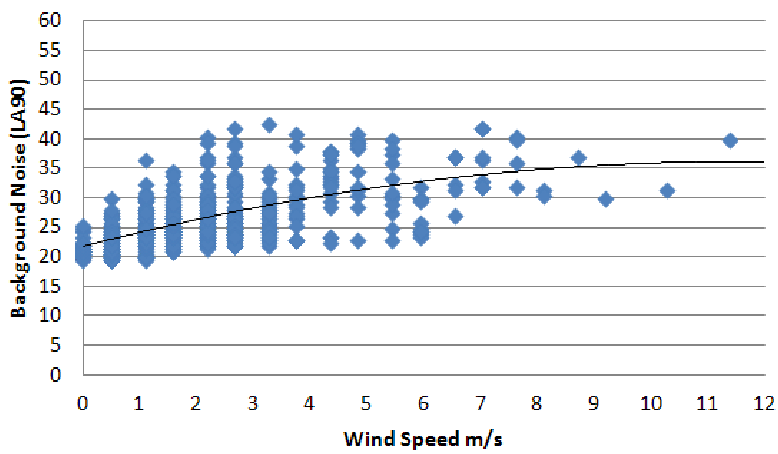
Location N6 Night time Prevailing Background Noise Level



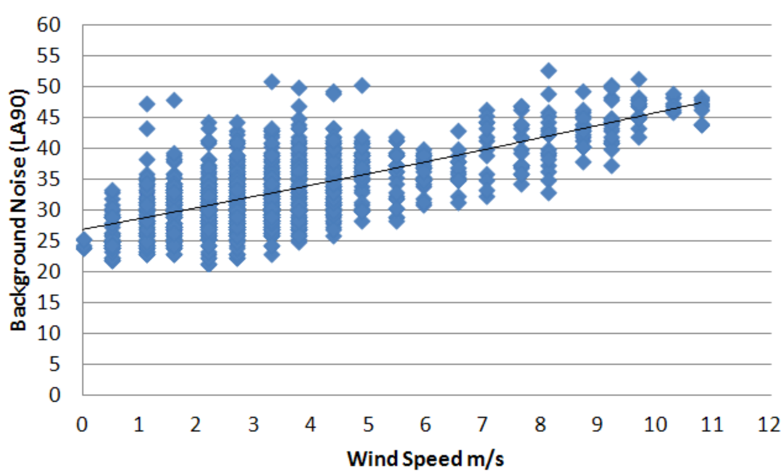
Location N7 Day time Prevailing Background Noise Level



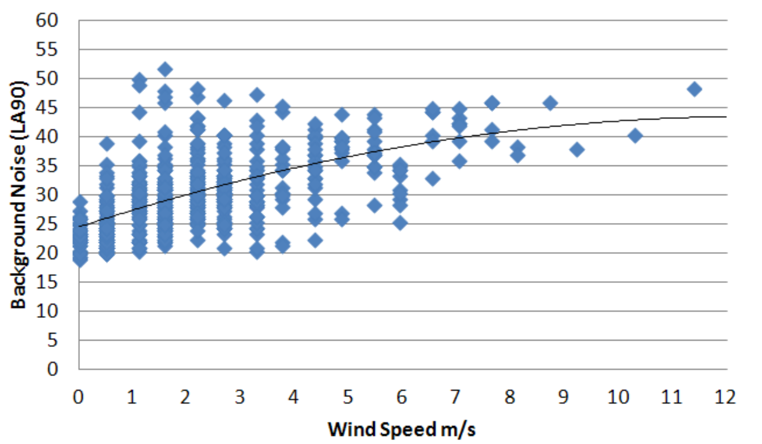
Location N7 Night time Prevailing Background Noise Level



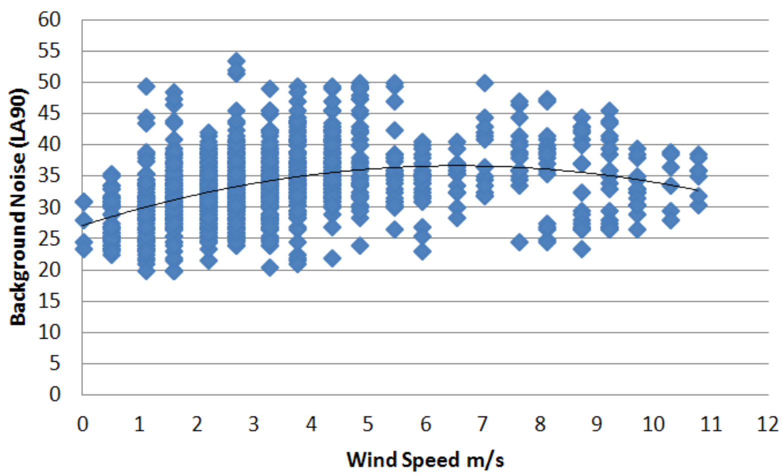
Location N8 Day time Prevailing Background Noise Level



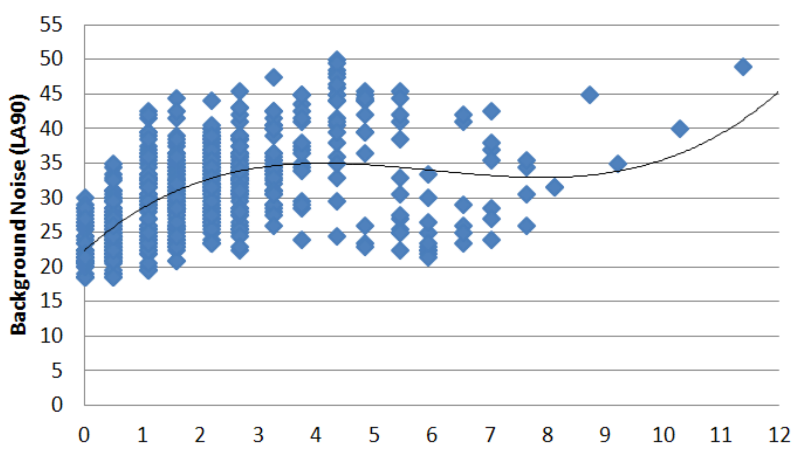
Location N8 Night time Prevailing Background Noise Level



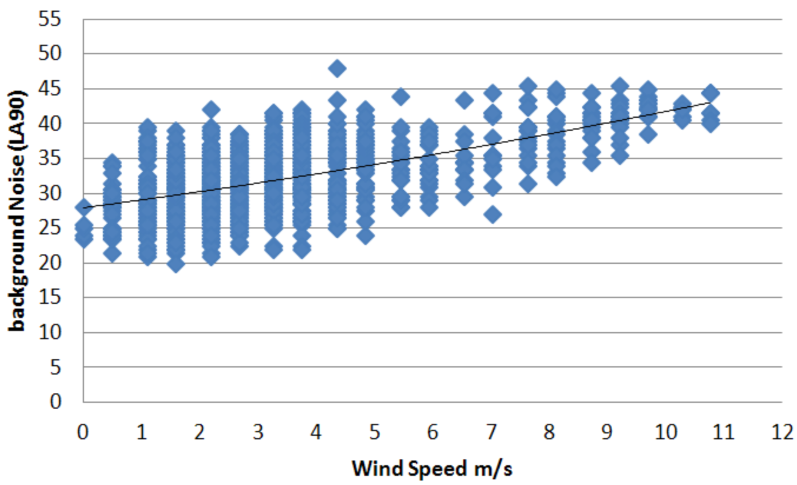
Location N9 Day time Prevailing Background Noise Level



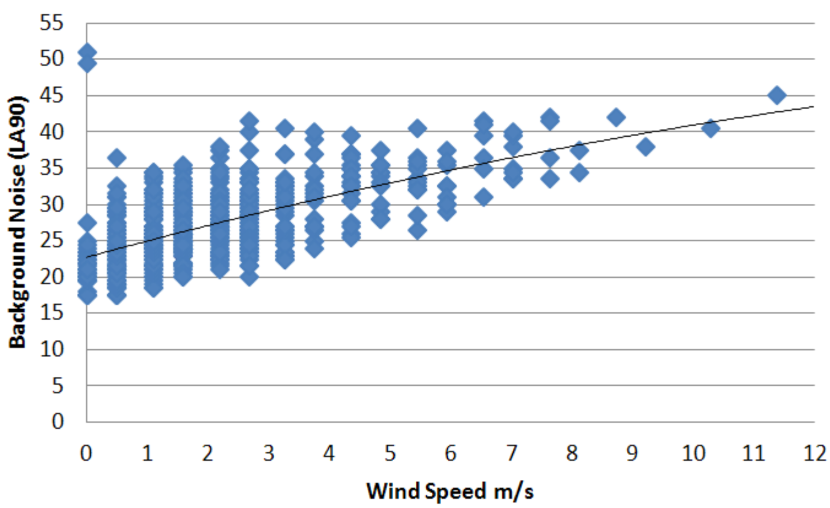
Location N9 Night time Prevailing Background Noise Level



Location N10 Day time Prevailing Background Noise Level



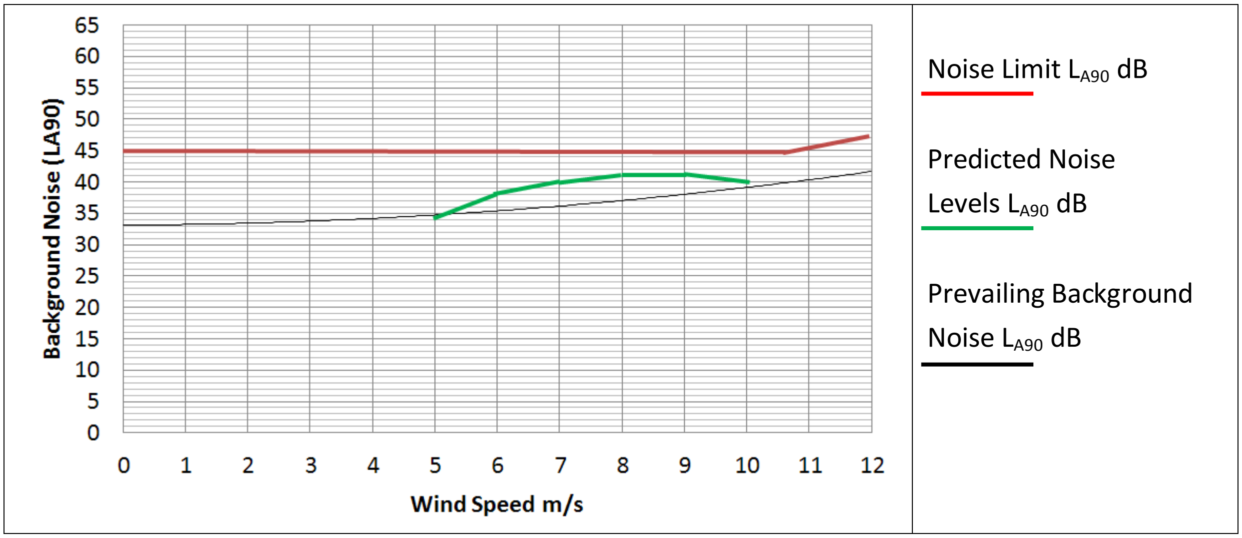
Location N10 Might time Prevailing Background Noise Level



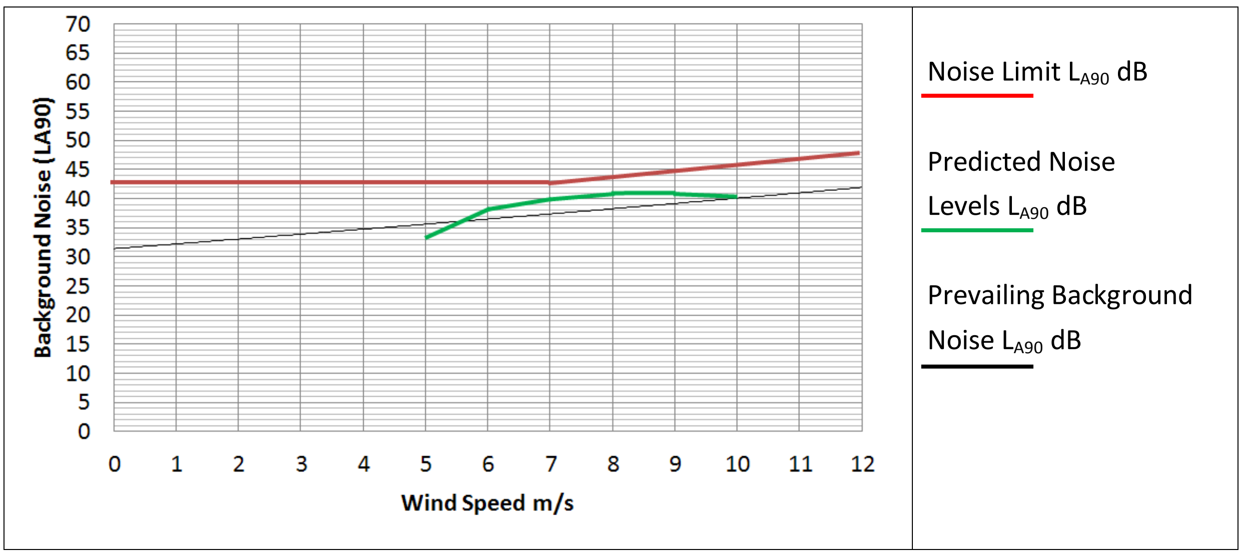
Appendix B

Noise Limit Curves

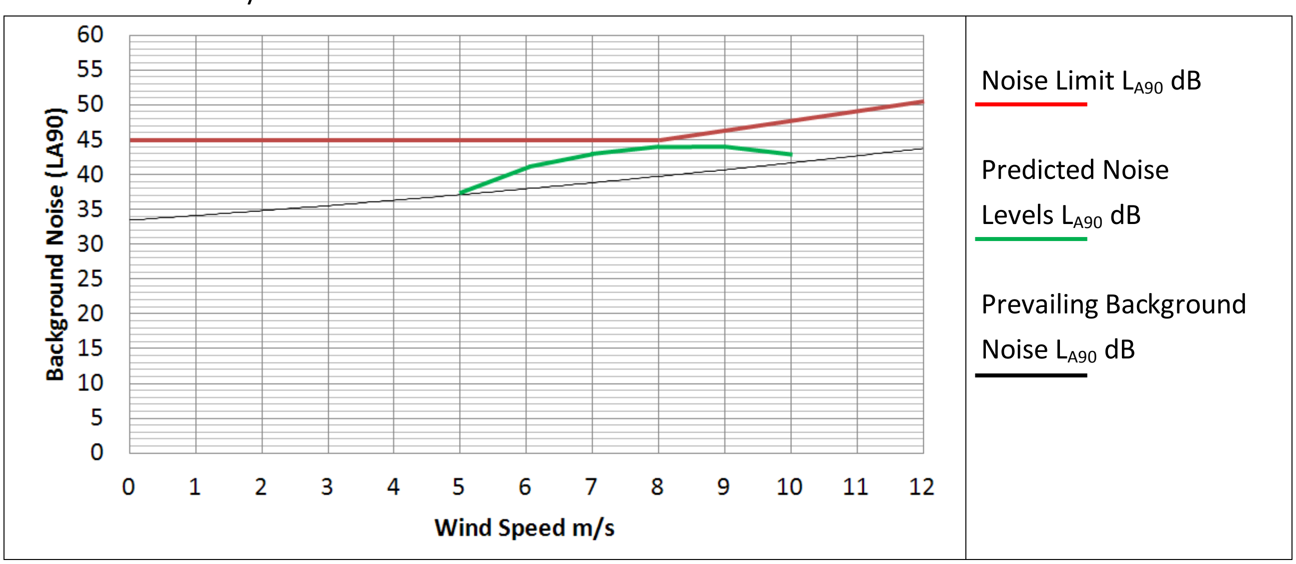
Location N1 Daytime Noise Limit Curve



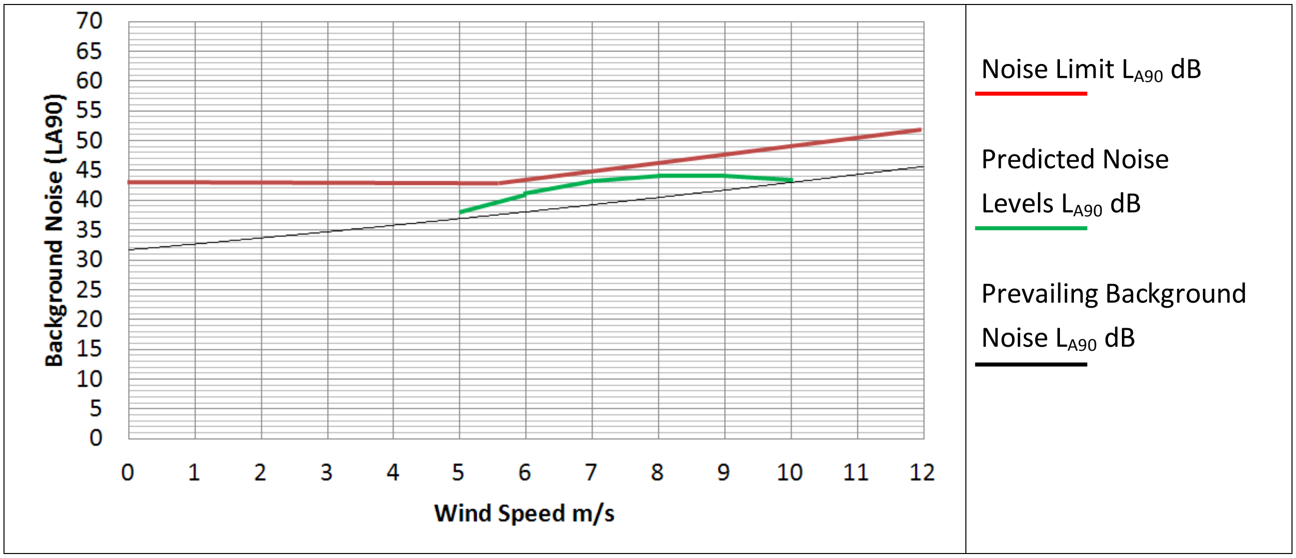
Location N1 Night time Noise Limit Curve



Location N2 Day time Noise Limit Curve



Location N2 Night time Noise Limit Curve



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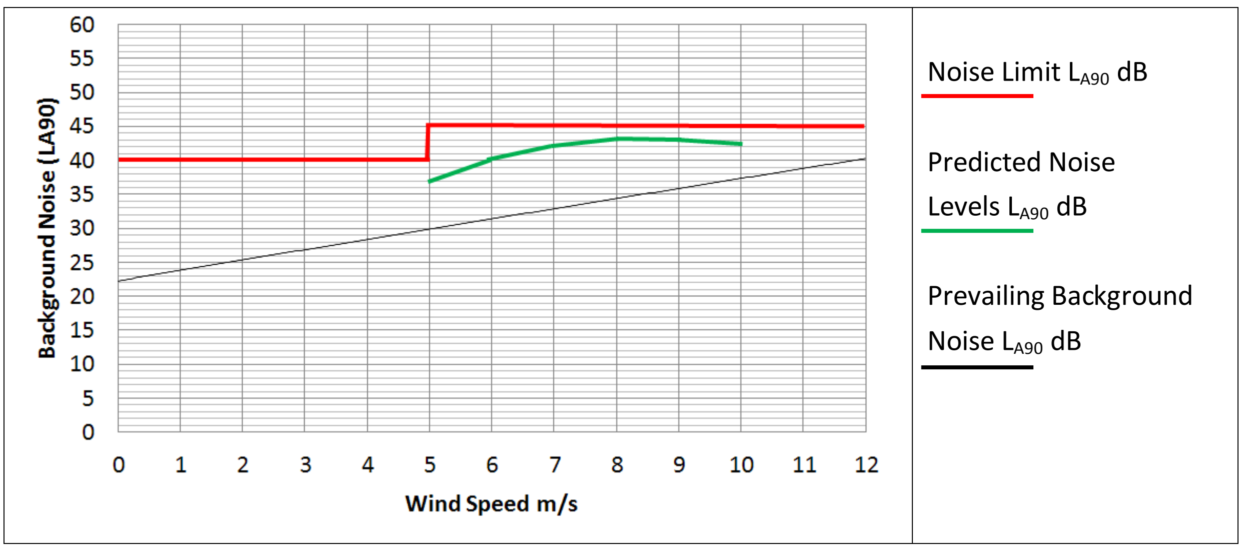

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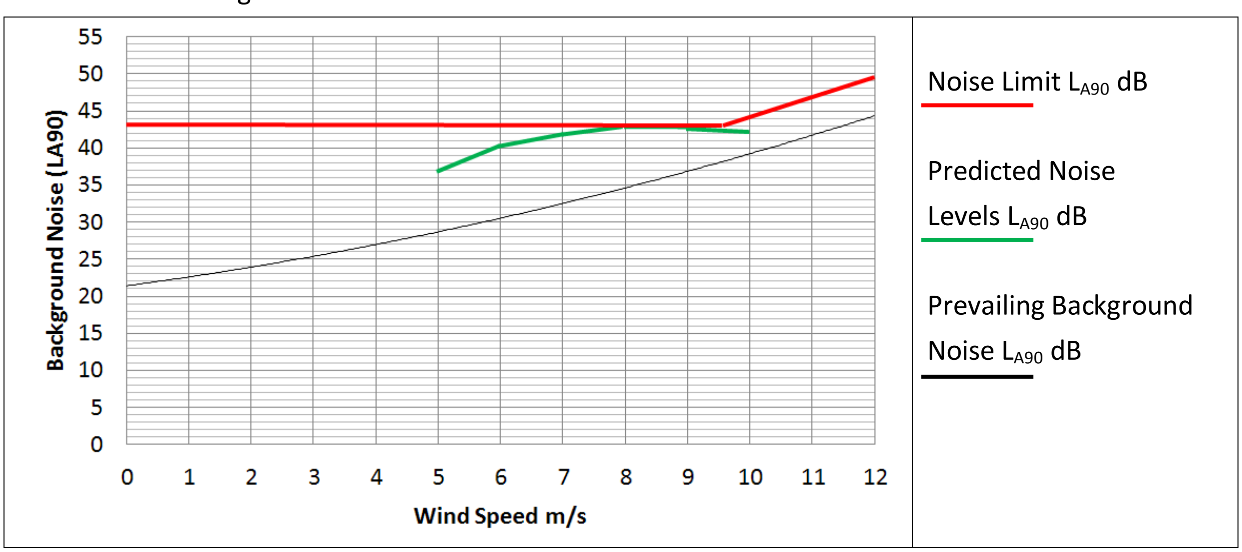

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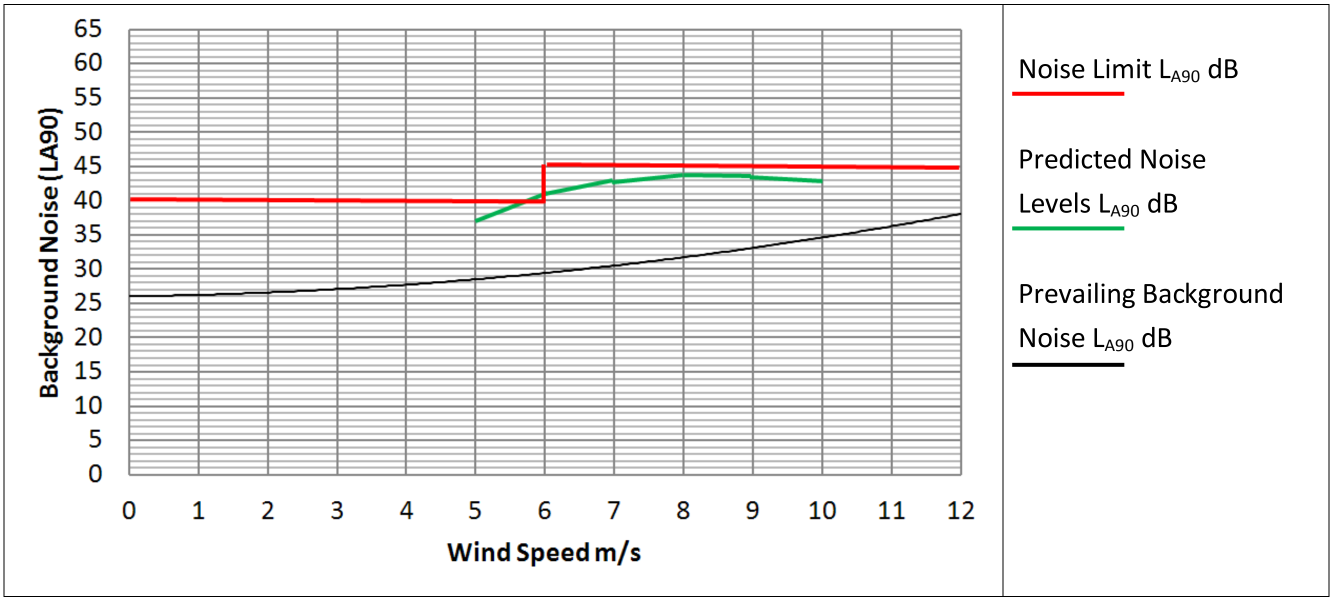

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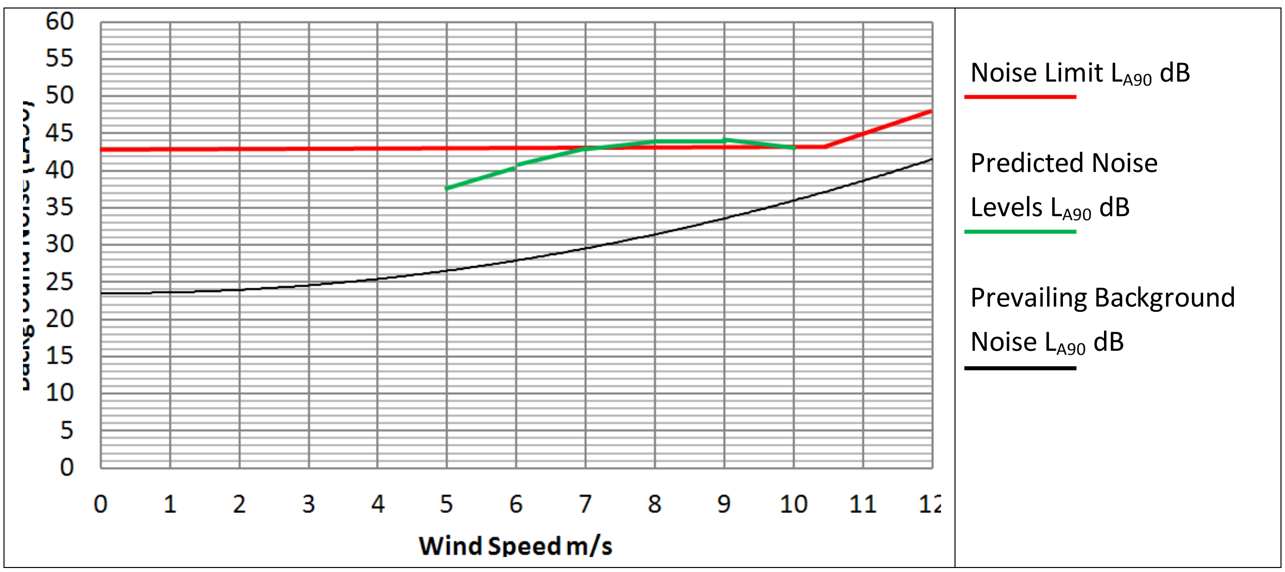

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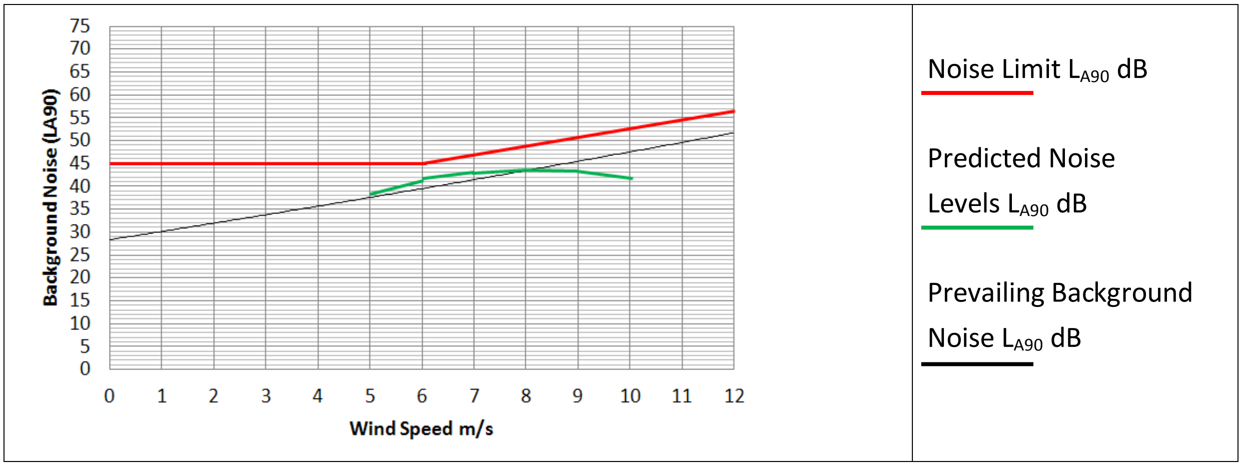

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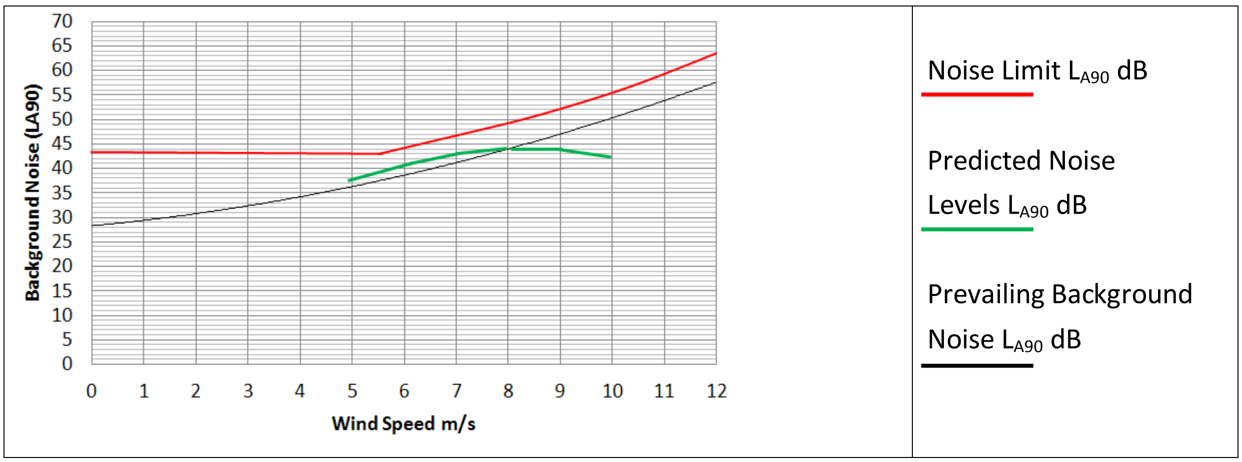

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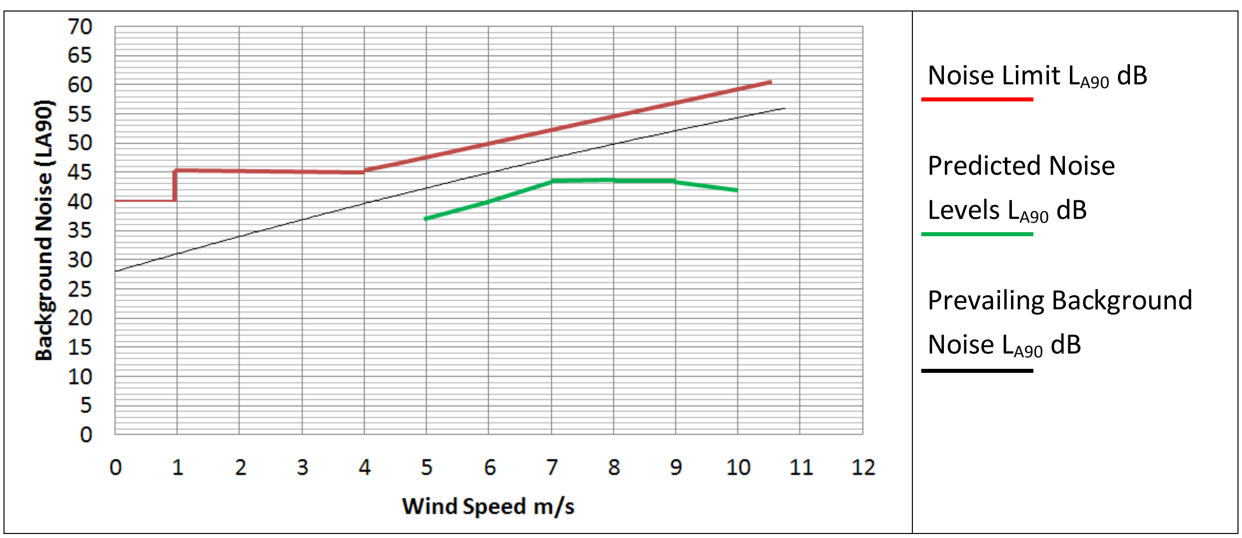

REFERENCE DOCUMENTS

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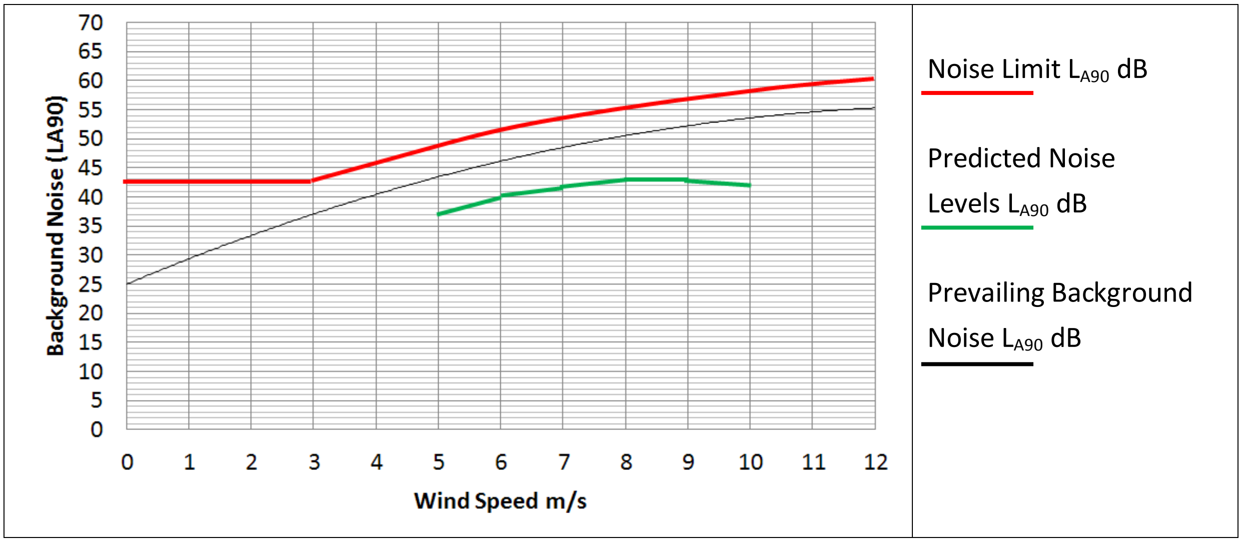

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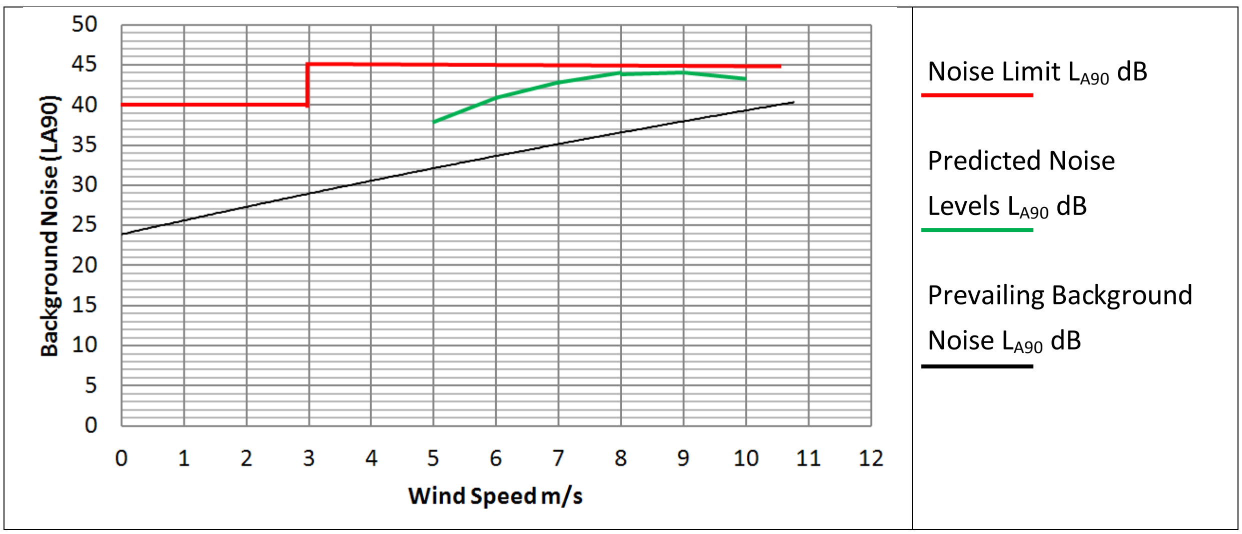

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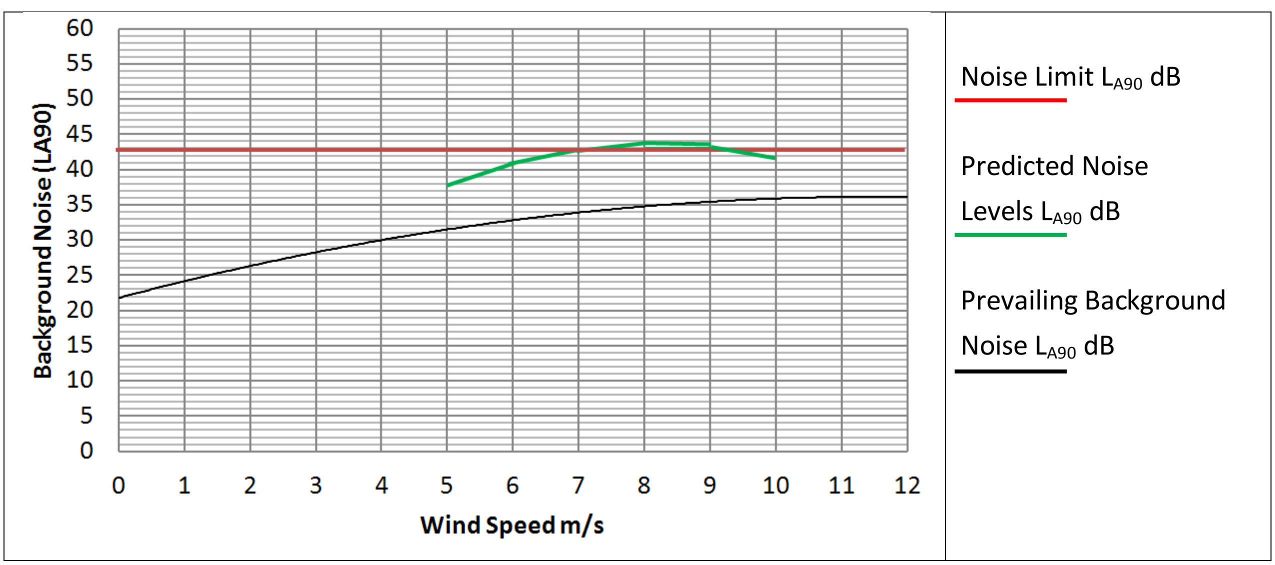

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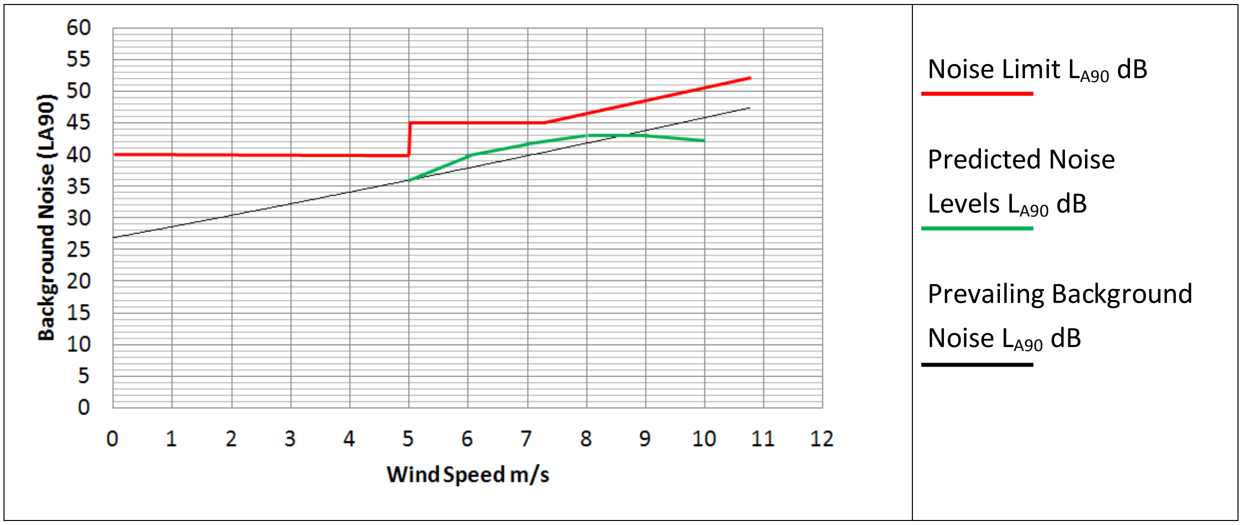

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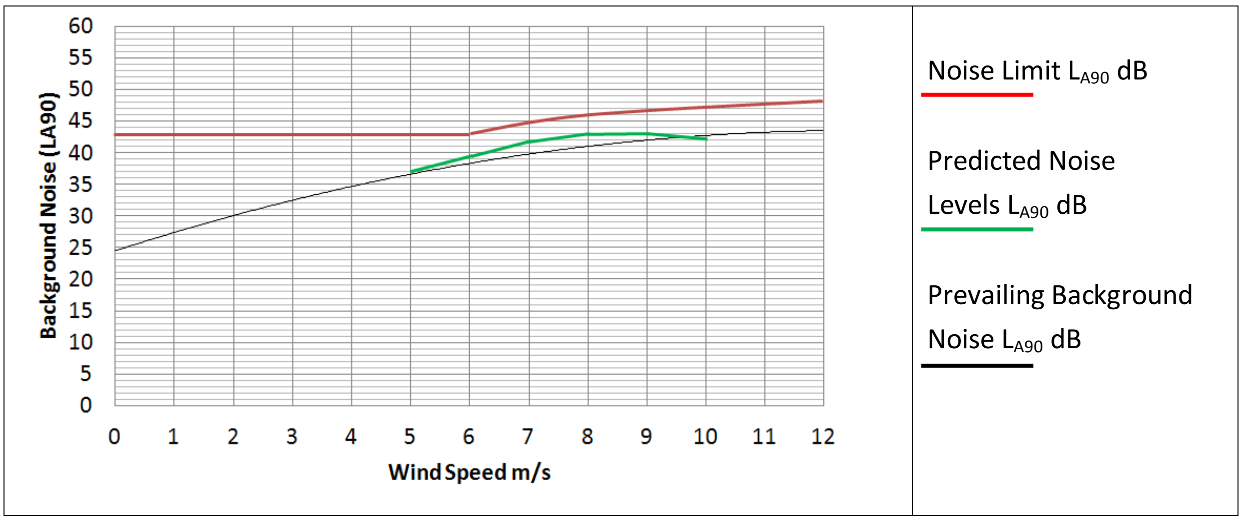

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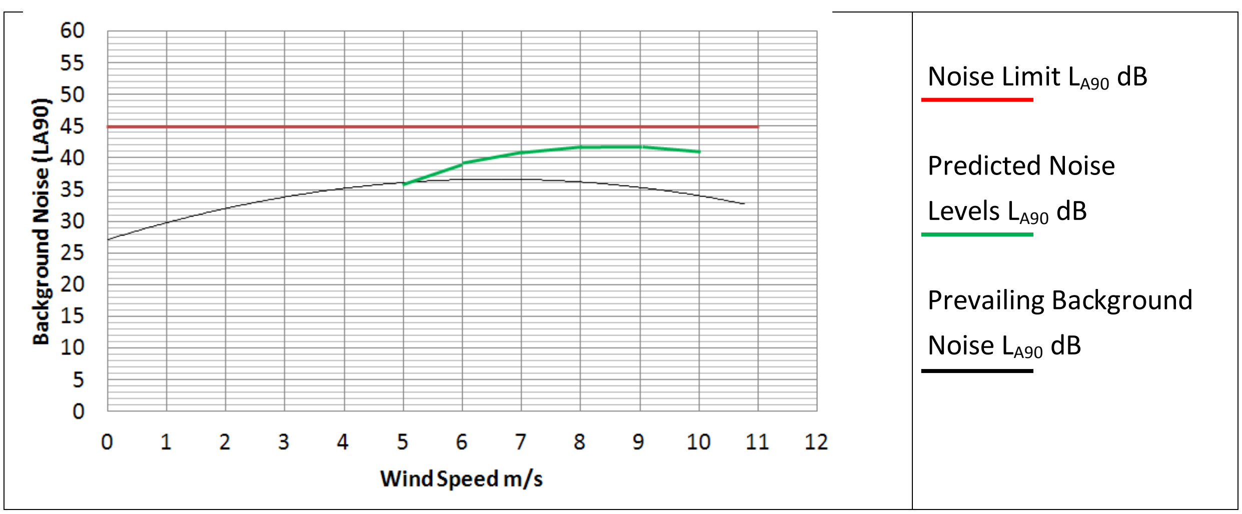

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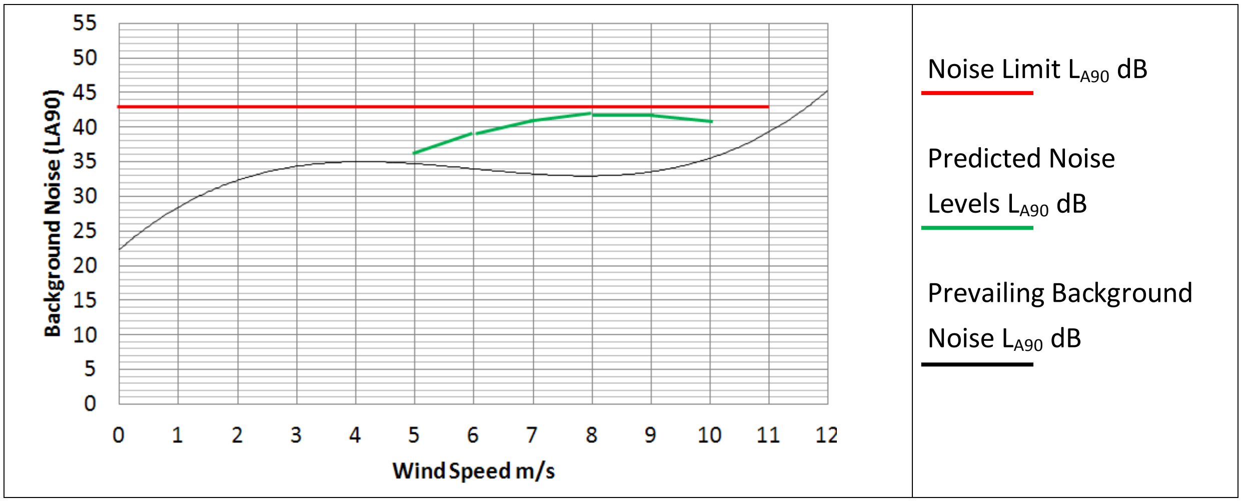
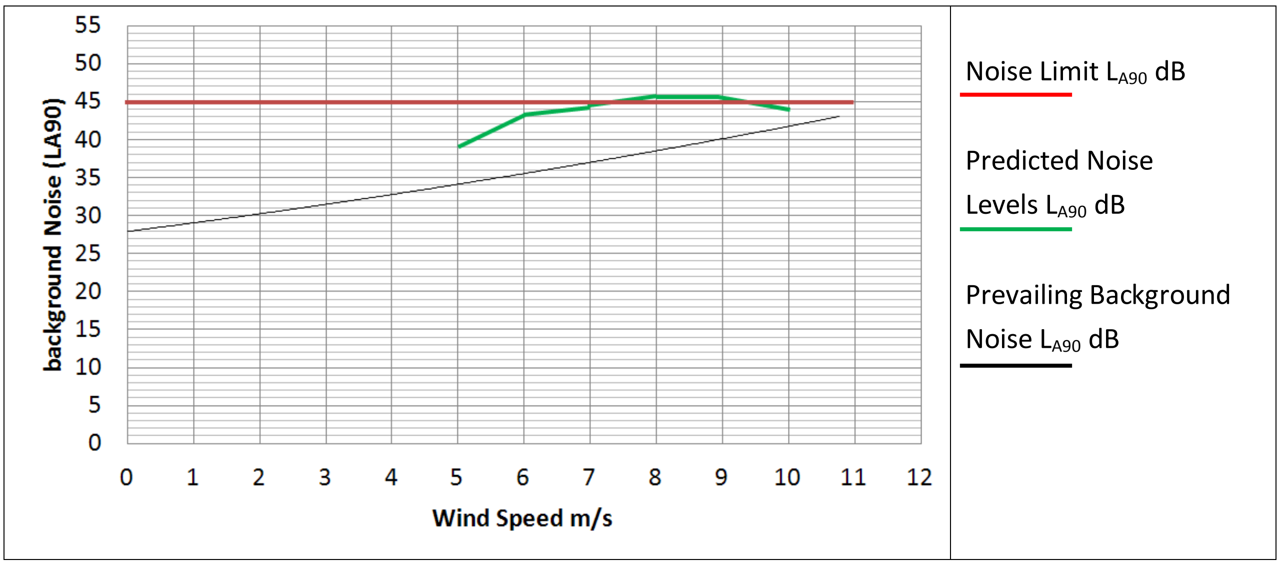


Location N10 Day time Noise Limit Curve



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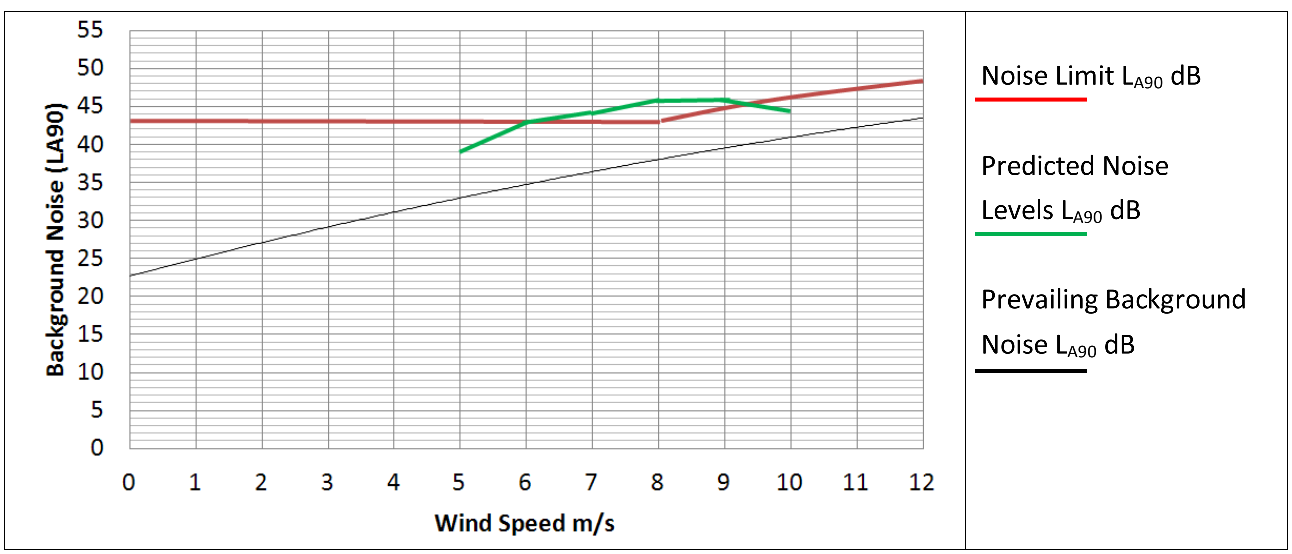

13 /51/0003 – response to RFI dated 28th February, 2013

Q5.*You are advised that a preliminary Ecological Management Plan (EcMP) in relation to the construction and operational phases of all relevant aspects of the proposed development shall be submitted. The plan shall deal with the management and implementation methodology associated with all relevant ecological issues, constraints and proposed mitigation measures/propositions as identified in the EIS and documents submitted as part of this application. In addition, the Plan shall include for specific proposals in relation to the intended removal of ~360m of hedgerow and its replacement taking into account optimisation on species connectivity (bats, birds, mammals etc.) hedgerow species type, variation and quantity etc.*

The answer to Q.5 follows (over):

- UPPERCHURCH WINDFARM ECOLOGICAL MANAGEMENT PLAN
- Appendix 1: Hen Harrier Habitat Area – Individual Field photographs, management measures and restrictions
- Appendix 2: National Parks and Wildlife Service Farm Plan Scheme
- Appendix 3: Landowner consent letters
- Appendix 4: Hen Harrier Habitat Area Matrix
- Appendix 5 – Consent Letters for Habitat compensation areas

Note: *Ecological Management Plan and Appendices comprise the answer to Q.1 (a) also.*

13 /51/0003 – response to RFI dated 28th February, 2013

Further Information 13/51/0003 (22 No. wind Turbines at Upperchurch)

REFERENCE DOCUMENTS

Malachy Walsh and Partners
Engineering and Environmental Consultants

Upperchurch Wind Farm Ecological Management Plan

15388

November 2013

Job number	Revision	Prepared by	Checked by	Status	Date
15388-6004	A	JK	JA	Final	26th November 2013

MWP ENVIRONMENT AND PLANNING

Table of Contents

1 Introduction

The Ecological Management Plan for the Upperchurch Wind Farm site provides a framework for the enhancement of ecological features within the site. The plan outlines management to be carried out over a five year period, in addition to long-term management of the site.

Ecological Management Plans for wind farm sites are becoming more common place in Ireland, in recognition of the management objectives of such sites to include, not only wind energy production, but also nature conservation. By their very nature, wind farms in Ireland are often located in remote upland areas.

2 Site Description

The proposed Upperchurch Wind Farm site is located in north Co. Tipperary, approximately 1.9 km west of the village of Upperchurch and a further 18 km west of Thurles town. The study area is made up of four sections with an overall area of 12 km^2.

The surrounding local landscape is dominated by 'Pasture' with 'Forestry, 'Bog', 'Other Agricultural Land' and 'Other' land located to the south of the proposed wind farm site (NPWS, online mapping 2012). The area is underlain by Silurian Metasediments and Volcanics, with subsoils consisting of "Devonian/Carboniferous sandstone and shale till".

The four sections of the site are located on a series of small hills or drumlins that reach elevations of between 363mOD and 411mOD, where the peaks are generally at heights of 100m above the intervening lower terrain. The highest peak is that of Knockmaroe, at an elevation of 411mOD.

The area originally would have had a shallow peat land cover but most of it has been reclaimed by deep ploughing and converted to pasture. The remaining peat areas are used mainly for commercial forestry. Some rock outcropping occurs, most notably at the northeast part of the site.

3 Environmental Management Plan

An Environmental Management Plan (EMP) has been prepared as part of this further information request to collate and manage the proposed and agreed mitigation measures, monitoring and follow-up arrangements and management of impacts. The EMP is a preliminary plan which has to be finalised by the appointed contractor. An EMP provides a commitment to mitigation and follow-up monitoring and reduces the risk of pollution and improves the sustainable management of resources. The environmental commitments of the proposed development will be managed through the EMP and will need to be secured in contract documentation and arrangements for construction, and later development stages, so that it can be ensured they are implemented. While the EMP will mainly address the construction phase, a separate early operation EMP has also been drafted which addresses many of the monitoring requirements of the Ecological management plan.

The Ecological Management Plan for the Upperchurch Wind Farm has been developed to enhance ecologically valuable features within the site.

4 Hen harrier displacement and /or disturbance

There is the potential that the hen harriers recorded utilising habitats within the site (upland blanket bog, heath, wet grassland and pre-ticket conifer plantation) during ornithological surveys may be displaced and/or disturbed due to the increased noise and human activity during the construction phase of the development. It is considered likely that the species shall return to the site following the construction of the proposed development. Table 1 below illustrated the operational period of the proposed wind farm based on the year of construction. The earliest estimated construction date for the proposed wind farm is 2017.

Table 1: Operational timeframe for the proposed wind farm based on the year of construction

Year of construction	Life of the wind farm
2017	2017 - 2042
2018	2018 - 2043
2019	2019 - 2044
2020	2020 - 2045
2021	2021 - 2046
2022	2022 - 2047
2023	2023 - 2048
2024	2024 - 2049

When estimating the potential area of displacement during the operational phase of the wind farm the findings of Pearce-Higgins *et al*. (2009) (*The distribution of breeding birds around upland wind farms* published in the Journal of Applied Ecology) was consulted. The paper outlines the findings of a study conducted in the UK which measured the potential impact of displacement to bird species as a result of wind farms. Following the erection of the turbines hen harrier previously utilising habitats avoided suitable habitat by a distance of between 250 – 500 m from each turbine. A buffer of 250 m around each turbine was used to calculate the total amount of potential foraging habitat loss due to displacement.

For the purpose of calculating this potential displacement area the proposed wind farm was grouped in five different zones labelled A to E. The turbine numbers within each cluster are presented in Table 2. .The table below details the areas of suitable habitat around all 5 zones i.e. wet grassland, heath / bog and conifer plantation potentially utilised by hen harrier within the 250 m buffer. Direct habitat loss outside of the 250m buffer within the footprint of the development was also considered.

Project Title:
15388 Upperchurch Wind farm

Drawing Title:
Habitats within 250m buffer of proposed turbines.
Clusters (A-E)

Client: Ecopower

Drawn by: JK
Checked by: JonK
Drawing Date: 12/11/2013
Drawing Size: A4

Legend

- Upperchurch Turbine Locations
- Upperchurch Turbine Locations 250m Buffer
- Upland/Eroding River & Stream (FW1)
- Drainage Ditches (FW4)
- Hedgerow (WL1)
- Treeline (WL2)
- Buildings & Artificial Surfaces (BL3)
- Spoil & Bare Ground (ED2)
- Improved Agricultural Grassland (GA1)
- Improved Agricultural Grassland (Wet) (GA1)
- Acidic Grassland (GS3)
- Wet Grassland (GS4)
- Upland Blanket Bog (PB2)
- Upland Blanket Bog + Acidic Grassland Mosaic (PB2 + GS3)
- Upland Blanket Bog + Wet Heath mosaic (PB2 + HH3)
- Conifer Plantation (WD4)

0 0.375 0.75 km

N

Map Reproduced From Ordnance Survey Ireland
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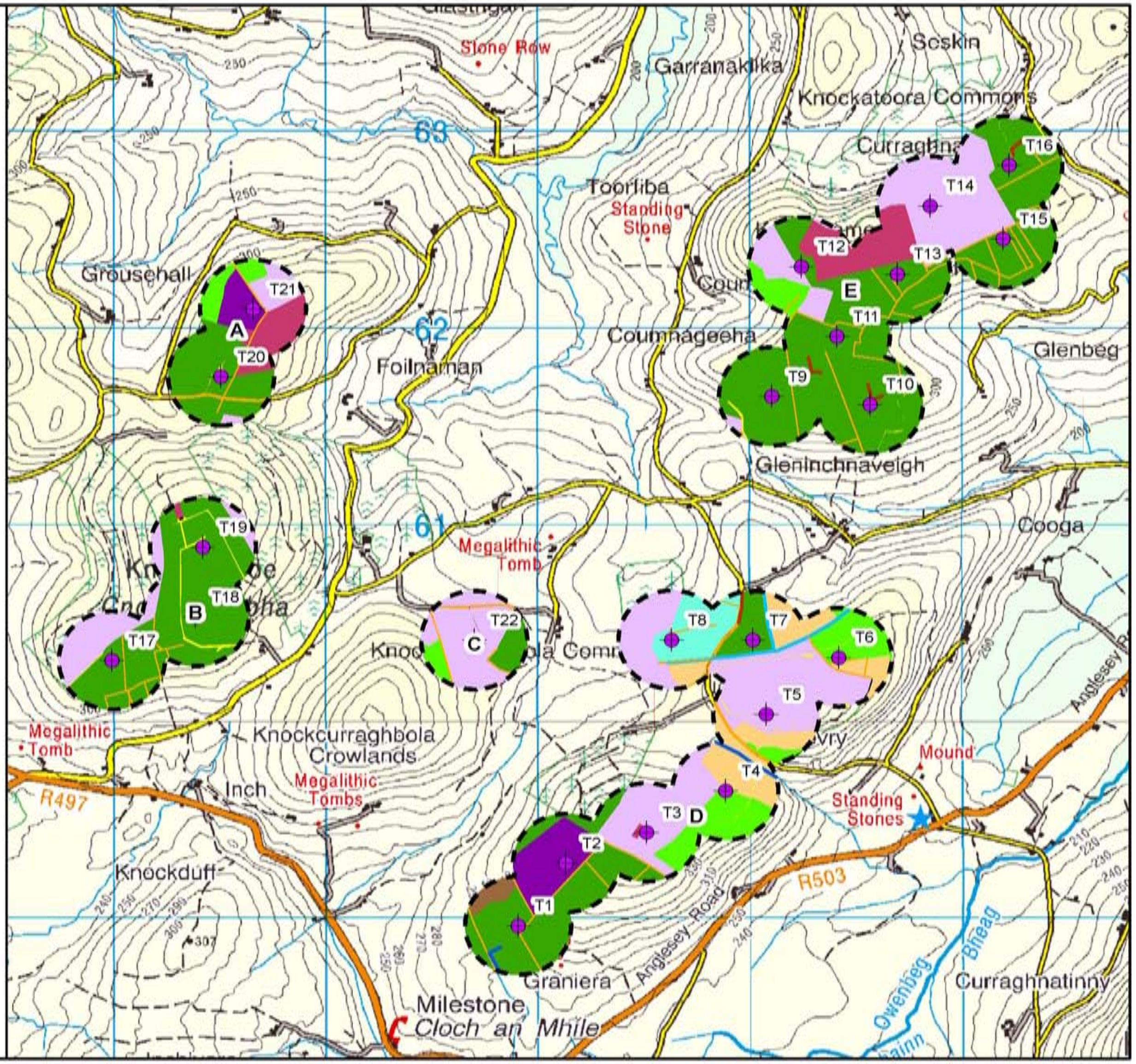


Table 2: Turbines groupings within the each zone

Zone name	Turbine numbers
Zone A	T20 and T21
Zone B	T17, T18 and T19
Zone C	T22
Zone D	T1, T2, T3, T4, T5, T6, T7 and T8
Zone E	T9, T10, T11, T12, T13, T14, T15 and T16

The relative difference is down to the temporary nature of suitable hen harrier habitat in conifer plantations within the displacement buffer and the footprint of the development. It is accepted the conifer plantations are only utilised by hen harrier between years 2 and 10 of each rotation. Once the canopy becomes enclosed the habitat is not suitable for hen harrier. There are a total of 8 different landowners with conifer plantation within the displacement area. Planting years for stands of conifer plantation ranged from 1973 up to more recent plantations planted in 2007. The average life of conifer plantation is approximately 45 years before harvesting with the second rotation planted 2-5 years after. If particular stands of conifer plantation are older than 10 years with enclosed canopy (unsuitable habitat) during the construction of the proposed wind farm and remain closed for the lifetime of the wind farm, than no mitigatory habitat is required. Table 3 below outlines the summary of conifer plantation within the study area.

The area of compensatory habitat required for conifer plantation was calculated, within the displacement buffer and directly within the footprint of the proposed wind farm, based on the number of years it offers potential habitat for hen harrier. The total number of years each section of conifer plantation is within the favourable stage for hen harrier (years 2 to 10 after planting) was calculated over the lifetime of the wind farm based on a range of construction years. The ratio or percentage of this timeframe was calculated by dividing this figure by 25 years the total period the wind farm would be operational. The area of compensatory habitat required for conifer plantation was calculated by multiplying this ratio by the total area of each section of conifer habitat. Table 4 below outlines the total areas of mitigatory habitat required for the loss of conifer plantation based on the first years of operation.

Ratio of each section of conifer plantation over the life of the wind farm

Total years between (years 2 to 10) for each section of conifer plantation / 25 years (the life of wind farm)

Area of compensatory habitat required for each section

Individual ratio x area of each section of conifer plantation

Table 3: Summary of conifer plantation within the both the 250m buffer zone from each wind turbine and infrastructure outside the buffer zone.

Zone	Turbine No.	Total area of conifer plantation (Hectares)	Year planted	Timeframe within the 2 to 10 year window (1st rotation)	Year of planting 2nd rotation (45 yrs)	Within the 2 to 10 year window (2nd rotation)
Area of conifer plantation within 250m buffer from turbines						
Zone A	**20 to 21**	0.5100	1984	1986 to 1994	2034	2036 to 2044
		3.7600	Between 1995 and 2000	Estimate 1998 to 2006	2037	2042 to 2050
Zone B	**17 to 19**	9.2700	1973	1975 to 1983	2018	2023 to 2031
		0.5000	1984	1986 to 1994	2034	2036 to 2044
Zone C	**22**	14.2600	2004	2006 to 2014	2049	2054 to 2062
		0.8700	2006-2007	2008 to 2016	2051	2053 to 2061
Zone D	**1 to 8**	17.7000	2005-2006	2007 to 2015	2050	2055 to 2063
		22.6200	Pre 1995	Estimate 1993-1994 to 2002	2037	2042 to 2050
		6.5000	Pre 1995	Estimate 1995 to 2003	2030	2035 to 2043
Zone E	**9 to 16**	6.2400	1999/2000	2002 to 2010	2044 to 2045	2049 to 2057
		0.5000	2003-2004	2006 to 2014	2049	2054 to 2062
		9.0300	1999	2002 to 2010	2044	2049 to 2057
		15.1271	Pre 1995	Estimate 1995 to 2003	2030	2035 to 2043
Areas of conifer plantation outside the 250m buffer but within the footprint of the wind farm						
Zone C	-	0.04	2006-2007	2008 to 2016	2051	2053 to 2061
Zone C	-	0.018	2004	2006 to 2014	2049	2054 to 2062
Zone D	-	0.256	2005-2006	2007 to 2015	2050	2055 to 2063
Zone E	-	0.157	2003-2004	2006 to 2014	2049	2054 to 2062

Table 4: Calculated area of componsatory habitat required for the loss of conifer plantation for each year of construction.

Construction year	Total Area of displacement habitat required (Hectares)
2017	10.32
2018	12.28
2019	13.38
2020	14.43
2021	15.49
2022	16.54
2023	17.60
2024	19.26

The table below details the areas of other habitat types of value for hen harrier around all turbines i.e. wet grassland, heath / bog and acid grassland, potentially utilised by hen harrier within the 250 m buffer. A calculation of the potential loss of other habitat types of value for hen harrier across all twenty two turbines for the 25 year life of the wind farm has indicated that the total extent of displaced hen harrier foraging habitat within the site is 84.27 Hectares.

Table 5: Area (Hectares) of potential hen harrier habitat within each 250m buffer zone

Habitat Type (Fossitt Code)	Zone A	Zone B	Zone C	Zone D	Zone E	Total
Acid Grassland (GS3)	3.72	-	1.67	17.64	3.85	26.88
Wet Grassland (GS4)	-	-	-	20.75	12.10	32.85
Upland Blanket Bog (PB2)	6.80	0.21	-	0.28	-	7.29
Upland Blanket Bog + Acidic Grassland (PB2 + GS3)	-	-	-	2.03	-	2.03
Upland Blanket Bog + Wet Heath mosaic (PB2 + HH3)	4.31	-	-	10.92	-	15.23
Total Area (Hectares)	**14.83**	**0.21**	**1.67**	**51.62**	**15.95**	**84.27**

The total area of potentially valuable hen harrier habitat to be lost and / or altered due to its proximity directly within the footprint of the proposed development but outside the 250m buffer zone for individual turbine was also considered. Table 6 below summarises the total areas of each habitat type.

Table 6: Potential hen harrier habitat outside the 250m buffer zone within the footprint of the development

Habitat Type (Fossitt Code)	Area (ha)
Dry calcareous and neutral grassland (GS1)	0.03
Wet Grassland (GS4)	0.32
Upland Blanket Bog (PB2)	0.10
Total Area (Hectares)	**0.46**

The table below details all habitat types, potentially utilised by hen harrier within the 250 m buffer and the footprint of the proposed development. A calculation of the potential loss of other habitat types of value for hen harrier across all twenty two turbines for the 25 year life of the wind farm has indicated that the total extent of displaced hen harrier foraging habitat within the site is 95.05 Hectares.

This is based on a scenario that the wind farm is constructed in 2017. The total area of mitigatory habitat required increases each year after 2017 due to the proposed life time of the wind farm extending into the favourable window for individual sections of conifer plantation within the displacement area. Table 7 below gives the estimated total displacement area (in Hectares) from 2017 to 2024.

Table 7: The estimated displacement area (in Hectares) from 2017 to 2024

Year of construction	2017	2018	2019	2020	2021	2022	2023	2024
Good habitat within 250m buffer around turbines	84.27	84.27	84.27	84.27	84.27	84.27	84.27	84.27
Footprint of development outside buffer	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46
Conifer Plantation - 2nd and 10th year after planting	10.32	12.28	13.38	14.43	15.49	16.54	17.60	19.26
Total Area (Hectares)	**95.05**	**97.01**	**98.11**	**99.16**	**100.22**	**101.27**	**102.33**	**103.99**

The habitats within the proposed site are, however considered to be of low value for breeding hen harrier and there are no records of the species breeding within the site. The foraging habitats within the 250m buffer lie outside the boundary of the SPA, and are relatively common throughout the greater area, and there are other suitable habitats nearby, which could be used by the species. The closest turbine to the SPA boundary is located 490m from the boundary of the *Slievefelim to Silvermines SPA* (Site Code 4165).

5 Management plan objectives

5.1 *Requirement for a suitably qualified ecologist*

A suitably qualified ecologist will be required to oversee this Ecological Management Plan over the life time of the wind farm. All site actions and monitoring measures will be required to be undertaken by the developer and under the supervision of the ecologist to achieve the objectives of the plan.

5.2 *Upperchurch hen harrier scheme*

5.2.1 *Alternative hen harrier habitat*

In order to mitigate the loss of potential foraging habitat for hen harrier, due to the construction of the wind farm at Upperchurch, it is proposed to provide alternative habitat, adjacent to the area of development. When deciding upon suitable mitigatory habitat, two factors have been considered;

- The alternative (mitigatory) habitat must benefit from management to improve its value as suitable foraging habitat for hen harrier;
- The land must not be within the 250m buffer from turbines or within the footprint of the development;
- The proximity of the SPA to the mitigatory habitat must be considered, so that the mitigatory habitat chosen, acts as a continuation of the SPA

Bearing in mind these factors, at total of 128 Hectares of land has been put forward as alternative habitat. The habitat types are a mixture of wet grassland and improved grassland. (See Figure 1 and Figure 2 included in Appendix 1 Hen Harrier Habitat Area – Individual Field photographs, management measures and restrictions) The management plan for alternative hen harrier habitat was prepared with reference to relevant best practice management guidelines, especially the National Parks and Wildlife Service Farm Plan Scheme (Department of Environment, Heritage and Local Government, 2010) attached in Appendix 2. The list of signatures of landowners signed up for the scheme is presented in Appendix 3. A list of the proposed alternative habitat areas are presented in Table 8 below.

Table 8: Habitat type and area (hectares) of each field within the proposed alternative habitat area

Field code	Habitat type	Area (Hectares)
GK1	Wet grassland	1.6
GK2	Agricultural grassland with riparian corridor	3.3
GK3	Wet agricultural grassland with riparian corridor	2.3
GK4	Wet agricultural grassland	1.7
GK5	Agricultural grassland	2.4
GK6	Wet grassland with riparian corridor	2.2
GK7	Wet agricultural grassland with riparian corridor	1.6
GK8	Wet agricultural grassland	0.8
JQ1	Wet agricultural grassland	3.5
JQ2	Wet agricultural grassland with riparian corridor	2.4
JQ3	Wet agricultural grassland with riparian corridor	2.9
JQ4	Wet agricultural grassland with riparian corridor	4.6
JQ5	Wet agricultural grassland with riparian corridor	1.6
JQ6	Wet agricultural grassland	1.3
JQ7	Wet agricultural grassland	1
JQ8	Wet agricultural grassland with riparian corridor	1.8
JQ9	Wet agricultural grassland with riparian corridor	1.2
JQ10	Wet agricultural grassland with riparian corridor	1.7
JQ11	Wet agricultural grassland	1.7
JQ12	Wet agricultural grassland	2.6
SR1	Wet grassland	2.8
MC1	Wet agricultural grassland	3.5
MC2	Wet agricultural grassland	3.5
MC3	Wet agricultural grassland	5.4
GR1	Improved agricultural grassland	2.4
GR2	Willow scrub and wet grassland	0.4
GR3	Wet agricultural grassland with riparian corridor	3.0
GR4	Wet agricultural grassland with riparian corridor	9.1
GR5	Wet agricultural grassland	9.4
PQ1	Wet agricultural grassland	2.1
PQ2	Wet agricultural grassland	4.5
PQ3	Wet agricultural grassland	4.7
PQ4	Wet agricultural grassland	5.9
PQ5	Wet agricultural grassland	9.8
VD1	Wet agricultural grassland	3.3
VD2	Wet agricultural grassland	2.4
VD3	Wet agricultural grassland	1.1
AR1	Wet agricultural grassland with enclosure and riparian corridor	5.0
MR1	Wet agricultural grassland	2.2

5.2.2 *Protocol for site management*

The objectives of the proposed management plan are as follows:

- To allow improved grassland swards to revert back to wet grassland and more semi natural grassland habitats;
- To improve cover for hen harrier within large open fields by the creation of hedgerows and woodland enclosures;
- To improve riparian corridors by the planting of willow, alder and other suitable native broadleaved species. These corridors shall be fenced off to limit potential ingress by livestock; and
- To manage rush coverage, scrub and improve coverage (hedgerows and enclosures) within wetter habitats to optimise their value to hen harrier.

The following general measures and restrictions will be put in place to ensure the proposed alternative habitat meets the criteria of the Upperchurch hen harrier scheme. The specific list of proposed measures and restrictions for each field is outlined in more detail in Appendix 1 of this report.

Measures:

- Land will be allowed to revert back to wet grassland;
- Achieve 30 - 70% rush coverage optimum;
- Rush coverage is controlled with grazing;
- Rush coverage is controlled with cutting, usually every second year;
- Target stocking level: minimum of 0.6 LU/Ha, maximum of 1.6 LU/Ha;
- Grassland field over 2ha: Plant 25m of hedge per hectare;
- Grassland field over 4ha: Plant 100m of hedge per hectare for each hectare over 4haor fence off an enclosure between 0.1 to 0.3ha for each hectare over 4ha.Mark some lines of electric fence with plastic fliers so that they are more visible to the hen harrier;
- Enhance riparian corridor: Plant willows, alder and other suitable native broadleaved species; and
- Enhance riparian corridor: Erect fencing to make stockproof and exclude access to river by animals.

5.2.3 *Grazing levels*

Continued grazing of the land is essential to maintain the appropriate sward within fields and not allow excessive stands of scrub or rush to dominate the habitat. Guidance target stocking rate on wet grassland/rough pasture is a minimum of 0.6 LU/hectare (NPWS Farm plan scheme, Appendix 2). There is no specific figure given for the upper limit of planned stocking density but it is recommended that it must not be at a level that would constitute management as improved agricultural grassland (on average between 2-3.5 LU/ha).

It is suggested that a proposed upper stocking limit for grazing be reduced to 1.6 LU/ha within improved agricultural grassland, rank (wet) improved agricultural grassland and wet grassland for the first two years of the plan. The quality of the habitat available after the implementation of these measures will be assessed by the project ecologist.

5.2.4 *Rush management*

The recommended optimal range for rush cover within hen harrier habitat is within the range of 30–70%. Dense covering of rushes is allowable but not to the point where rushes are falling over or matting the ground. Appropriate grazing levels will go much of the way in maintaining the rush cover within the optimal range. However, active management may be required to further ensure the quality of habitat. Rushes shall be cut on a two year cycle. Annual surveys by the project ecologist during the first five years in particular will assess the need for cutting within each section of habitat. In fields where wet grassland and rushes will need time to establish, the first cut will not be carried out until the Year 2 or 3 of the scheme. If the establishment of rush is slow in particular areas, cutting will not take place to allow further time for the habitat to become established.

5.2.5 *Nutrient management*

The use of chemical and/or organic fertilisers within a grassland site may be permitted at certain locations but not if it is counterintuitive to the objective of the management of the area for hen harrier. This will be assessed by the project ecologist.

5.2.6 *Weed control*

The control of noxious weeds required a part of land management for grazing (e.g. ragwort, etc) currently exists and may need some degree of continuation. The spraying and broadcast application of herbicide will not be permitted. Herbicides will be applied via spot or wipe on treatments.

5.2.7 *Restrictions*

Supplementary to the active management measures certain restrictions shall also apply. The following restrictions will apply to farmers within the Upperchurch hen harrier scheme:

- Limited spreading of fertiliser.
- Limited spreading of lime.
- No burning.
- No excavation of drains or reclaiming heath or bog.
- No removal of hedgerows.

- No recreational off-roading with vehicles.
- No use of poisons or stupefying baits
- No new forestry plantation.

With the spread of fertiliser grass species outcompete herb species so it is important to restrict the use of fertiliser to allow plant species, particularly those of wet grassland, to flower and seed.

Lime spreading is undertaken in upland areas to reduce the acidity of the soil, however, in the context of biodiversity improvements it is important to limit its application to allow plants to flower and seed.

Upland burning is undertaken to control scrub and enrich the soil, however, it can have a significant impact on wildlife. Therefore, burning will not be permitted.

Drains facilitate the drying of the land and reduce the water table. A relatively high water table is required to encourage the development of wet grassland therefore this practice will be prohitited.

The reclamation of bog, which is habitat loss, will not be permitted.

It will not be permitted to remove hedgerow which is an important ecological corridor and food for small birds, which are food source for hen harrier. 2.8km of new hedgerow will be developed with this scheme.

Recreation of off-road vehicles can cause damage through rutting and damage valuable habitat. It will not be permitted.

The use of poisons or bait will not be permitted.

While forestry is of value to the hen harrier, it is only of value during the early years, 2-10, when the canopy is open to hunting hen harrier. Once the canopy closes at the end of the pre-thicket stage it is no longer of use until its next rotation, which could be 30 years away.

5.2.8 Monitoring of the plan

The continually monitoring of the hen harrier scheme especially in the early years when measures are initiated is crucial for the plan to be fully successful. Annual inspections shall be carried out for the first five years of the scheme by the project ecologist. The project ecologist shall assess the proposed alternative habitats, raise any specific issues which need to be addressed and discuss with landowners any further measures required. A report will be prepared annually and submitted to National Parks and Wildlife Services for comment. After five years, inspections shall be carried out every three years of the scheme by the project ecologist with a report prepared outlining the progress of the scheme and any further recommendation required as well as details of future monitoring required. This report will then be submitted to National Parks and Wildlife Services for comment.

In addition to this hen harrier workshops will be delivered by the project ecologist at the initiation of the scheme. It is proposed that all landowners participating in the plan as well as those involved in the wind farm development will attend a series of hen harrier workshops which will be developed and delivered by the project ecologist. A suitably qualified representative from NPWS will be invited to deliver part of the information day/course. The aim of the workshop will be to advise landowners on the importance of the conservation of the hen harrier, the proper and full implementation of the plan and fully explain the measures and the restrictions set down in the plan.

*5.3 **Mitigation measures for all bird species***

5.3.1 Construction phase

The proposed locations of the wind turbines have been carefully planned to avoid important wildlife habitats. The following measures are designed to reduce the predicted impacts on bird populations:

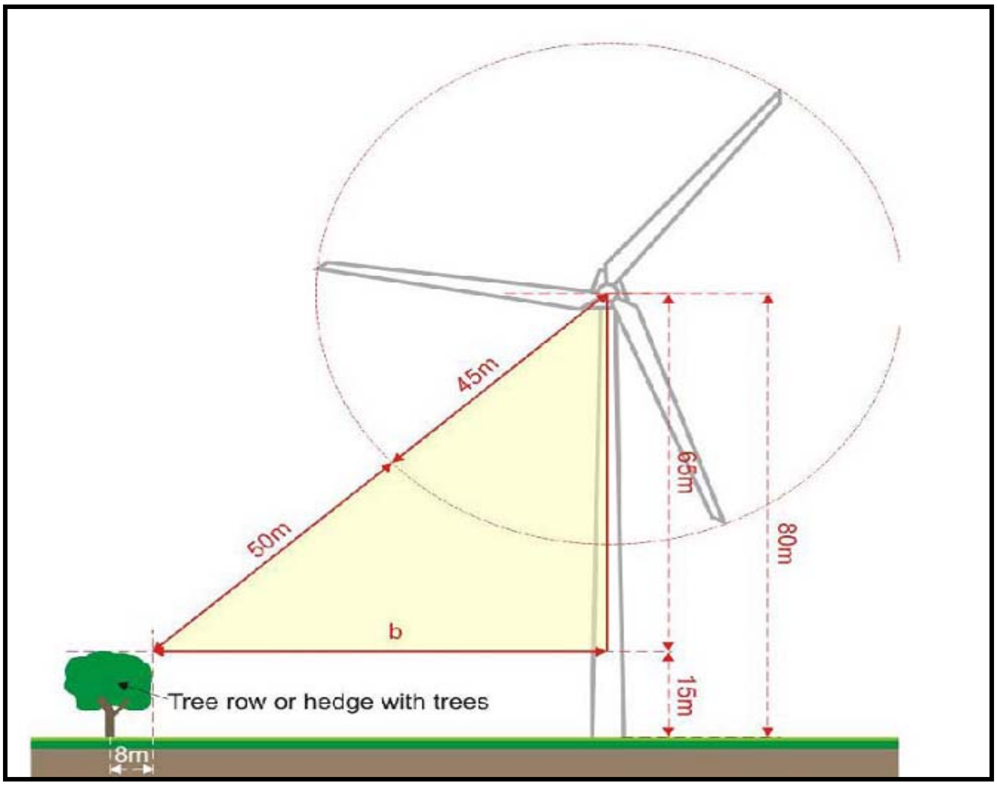
- Pre-construction monitoring will be undertaken within the site, and will continue during the construction phase.
- Vegetation clearance, including the felling of trees, scrub and hedgerow, will be undertaken outside the breeding bird period (1st April to the 31st of August).
- Work should begin before the breeding season begins to ensure that incubating birds or birds with young are not displaced by work commencing during the breeding season.
- Damage to or loss of trees will be kept to a minimum, during the construction phase.
- Machinery must be kept on roads and hardstanding areas, and aside from advancing roads, should not move onto habitats beyond the proposed development footprint, in order to prevent unnecessary damage or disturbance.

5.3.2 Operational Phase

The use of "white lights" on the turbines will be avoided, as these can attract night flying birds such as migrants, and insects, which in turn, can attract bats.

*5.4 **Mitigation measures for bats***

Natural England (2012) has advised that predicted harm to bats can be minimised by altering locations of turbines within a site. According to Natural England (2012) "*To minimise the risk to bat populations, our advice is to maintain a 50 m buffer around any feature (trees, hedges) into which no part of the turbine intrudes. This means that the edge of the rotor-swept area needs to be at least 50 m from the nearest part of the habitat feature. Therefore, 50 m should be the minimum stand-off distance from blade tip to the nearest feature. It is incorrect to measure 50 m from the turbine base to habitat feature at ground level as this would bring the blade tips very close to the canopy of a tall hedgerow tree and potentially put bat populations at risk. Instead, it is necessary to calculate the distance between the edge of the feature and the centre of the tower*." These distances were taken into account during the design phase of the wind farm.



$b = \sqrt{\{(50 + bl)^2 - (hh - fh)^2\}}$

where:

b = the distance on the ground between the edge of the canopy and the turbine (m)

bl = blade length (m)

hh = hub height (m)

fh = feature height (m)

Five of the twenty two turbines (T3, T9, T12, T14, and T22) will require the felling of some conifer plantation for the installation of turbine and or hardstanding areas. While enclosed conifer plantations are of low value to bat species, the area of clear-felling required was calculated using the recommended formula. It is recommended that this distance be taken into account when applying for the felling licence, should the proposed wind farm receive planning. The calculations shown below give an example of the recommended distance for felling of trees within a plantation, with an average tree height of 5m:

$b = \sqrt{\{(50 + 45)^2 - (85 - 5)^2\}}$

$b = \sqrt{2625}$

$b = 51.2m$

Foraging activity was recorded along hedgerows and treelines within the study area, and at the site of a cluster of farm buildings, east of the turbine T22. The two small streams within the site also offer potential habitat for bats. The following mitigation measures will be carried out to increase the value of the study area for bats:

- Bat boxes shall be erected within the study area, at suitable locations deemed favourable, as a result of the pre- and post-construction bat surveys.
- Native species (including hawthorn, blackthorn, hazel and oak) will be planted along new hedgerows within the site, to increase their value as foraging habitat to bats. Native species offer higher quality habitat for invertebrates, the main prey item for bat species. All planting and hedgerow reinstatement will be carried out following the guidelines and recommended methodology referenced in Knowles, (1995) and JNCC, (2001).
- Gaps within existing hedgerows shall be planted with native species, to encourage the use of hedgerows as flight paths.

5.4.1 Haulage routes

If any local bridge is to be strengthened, prior to use for haulage of construction materials for this development, it shall first be surveyed for bat presence, prior to any upgrading or maintenance works. Bats, especially Daubenton's, regularly use bridges for roosting and are vulnerable within such structures, due to infilling of crevices, during which they may be entombed. If bats are found, subject to safety considerations, some crevices beneath the bridge shall be retained for their continued use, according to best practice bat mitigation measures for bridge works (see National Roads Authority 2006a/2006b). Any maintenance or upgrading works, including pressure grouting or re-pointing of bridges, shall only proceed after an inspection of the structure for potential bat roosts, and will be in accordance with best practice guidelines and statutory procedures. Mature trees that require felling should along haulage routes should also be surveyed for potential bat roosts bats. Any mitigation measures carried out to mitigate the potential impact to bats along haulage routes will be conducted under the terms of an appropriate NPWS wildlife derogation licence.

5.5 Habitats and Stream Crossings

There will be one new stream crossing required for the proposed development, and a stream crossing method statement will be developed, in consultation with the Inland Fisheries Ireland.

5.6 Enhancement of site suitability for dragonflies/damselflies and amphibians

5.6.1 Rationale and objective

A Surface Water Management Plan has been developed to manage sediment runoff from exposed soil/peat and drainage during the construction and early operational phases of the proposed wind farm, this plan is appended to the Construction Environmental Management Plan submitted with this further information reply. Sediment ponds are an element of this plan and will be constructed at regular intervals to attenuate sediment. It is proposed that a number of suitable sediment ponds are kept *in situ* once construction has been completed, as these ponds could provide optimum habitat for dragonfly and damselfly species and other insects, birds and amphibians. Health and safety issues will have to be taken into consideration with fencing and signs recommended to alert people to potential dangers.

Some modification may be required to make selected ponds suitable. Most animals (insects, birds and amphibians) prefer the shelter provided by the vegetation which grows in very shallow water around the margins of ponds. Therefore, the best wildlife ponds will have very gently sloping sides, providing extensive areas of very shallow water (just a few centimetres in depth). This enables a wide band of emergent vegetation to become established around the margins of the pond (See Figure 1). If the pond is large enough, it will have a deep central area at least 1-1.5 m deep (see Figure 2). This deep area will help prevent emergent vegetation from taking over the pond completely.

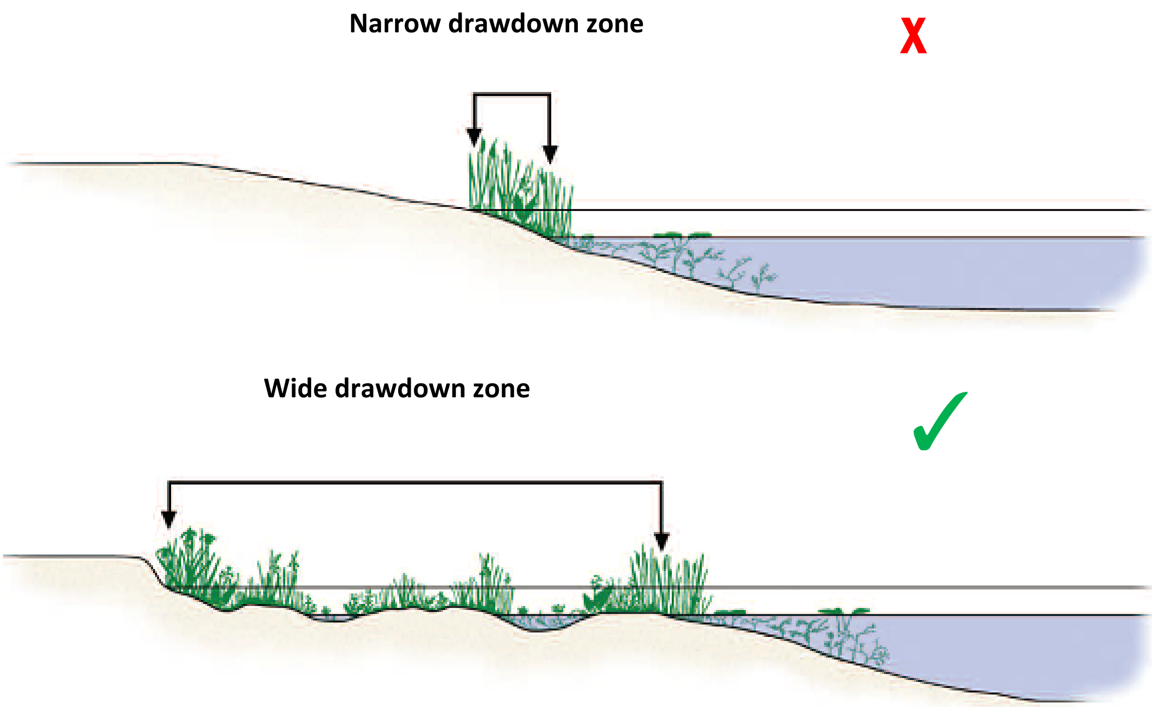


Figure 1: Create broad undulating drawdown zones – they are one of the most valuable areas for wildlife (Pond Conservation, 2013).

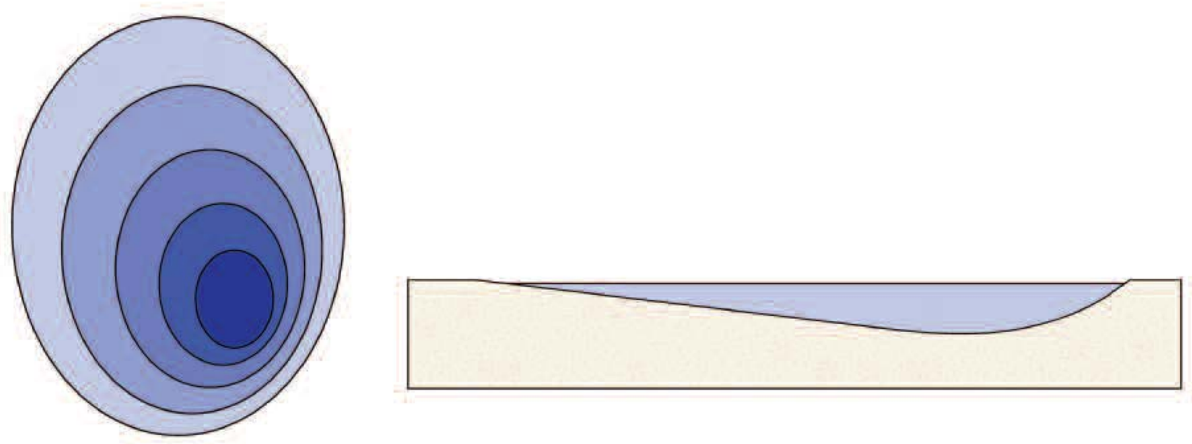


Figure 2: Asymmetric profile – useful to combine shallow water areas with greater depth (Pond Conservation, 2013).

5.6.2 Management action

1. A number of suitable sediment ponds will be retained *in situ* and may require modification as specified, in order to enhance the suitability of the site for insects, birds and amphibians.

5.7 Hedgerow Removal

Approximately 360m of good quality hedgerows will be removed as part of the construction of infrastructure. As part of the proposed development, approximately 360m of new hedgerow will be planted to mitigate this loss of habitat. Approximately 2.8km of new hedgerows shall also be created as part of the hen harrier management scheme. Existing hedgerows in poor condition will be planted with native species, to increase there ecological value. This measure shall improve existing corridors within the site. The location of these hedgerows will be sited to ensure the connectivity of existing corridors will be maintained and will be designed by the project ecologist during the construction phase of the wind farm. Native species will be replanted within the proposed new hedgerows. A list of potential species is presented in Table 8 below.

Table 9: List of species to be used for new hedgerows.

Common name	Latin name
Ash	*Fraxinus excelsior*
Bay Willow	*Salix pentandra*
Black Alder	*Alnus glutinosa*
Blackthorn/Sloe	*Prunus spinosa*
Crab apple	*Malus sylvestris*
Common/Wild Cherry	*Prunus avium*
Downey Birch	*Betula pubescens*

Common name	Latin name
Goat Willow	*Salix caprea*
Grey Willow	*Salix atrocinerea*
Hawthorn	*Crataegus monogyna*
Mountain Ash/Rowan	*Sorbus aucuparia*
Pedunculate Oak	*Quercus robur*
Sessile Oak	*Quercus petraea*
Wych Elm	*Ulmus glabra*
Yew	*Taxus baccata*

5.8 *Enhancement of keyhole felled areas*

5.8.1 Rationale and objective

Areas of existing conifer plantation will require permanent felling, in order to accommodate wind farm infrastructure and the erection of turbines. A large part of the felled area will not be required to accommodate the elements of wind farm infrastructure. This area will be allowed to naturally regenerate and be managed for nature conservation purposes. The main aim is to restore the conditions that allow wet heath, upland blanket bog, wet grassland and scrub vegetation to recover on these felled areas, within the site.

The different tree felling methods will have an influence on the success of the restoration, and it is proposed that this be undertaken, with prior consultation with the project ecologist. Restoration will be achieved by the felling of conifer trees and blocking selected drains, to locally increase the water table.

In the event that the natural establishment of vegetation is slow, it is proposed to harvest seeds from purple-moor grass (*Molinia caerulea*) and other suitable species from a suitable location outside the site, and plant them within the bare felled areas.

5.8.2 Management actions

1. Selected drains will be blocked.
2. Natural establishment of wet grassland, scrub and possible wet heath vegetation will be allowed.
3. Where natural establishment of vegetation is slow, purple-moor grass (*Molinia caerulea*) and other suitable species will be planted within the bare felled areas.
4. The removal of excess brash and trees off site, and disposal at an appropriate location, to minimise nutrient leaching to the soil and watercourses.

6 Monitoring

6.1 Rationale

It is recognised that the success of any management plan depends to a large extent on an effective monitoring strategy. In addition, recording and monitoring can significantly contribute to the furthering of technical knowledge, which can then be applied to future similar projects.

In the case of Upperchurch Wind Farm, monitoring over an initial 5-year period will be very important; in order to determine the extent of establishment of desired habitats.

The full scope and timing of these surveys will be drawn up in consultation with NPWS, prior to the completion of the construction phase.

6.2 Vegetation monitoring

The process of blanket bog and wet heath establishment, as well as the establishment of wet grassland, scrub and wet heath areas within the felled areas, will be monitored by setting up a number of permanent vegetation monitoring quadrats. These will be surveyed during years 1, 2, 3 and 5. At the end of the 5-year vegetation monitoring, the data will be analysed and long-term monitoring or management will be proposed, if necessary.

6.3 Habitat Monitoring

Site visits by an appointed ecologist will be made to Upperchurch Wind Farm during the same years as the vegetation monitoring, in order to assess the status of the habitats at the site and whether any adjustment of the management plan is necessary.

6.4 Water Quality monitoring

Water quality monitoring will take place during the construction phase of the Upperchurch Wind Farm and for years 1, and 2 of operation. Monitoring of water quality parameters will be conducted monthly in Year 1. If thresholds are not exceeded in Year 1, then the effort may be reduced in Year 2. The scope of this monitoring will be developed in consultation with Inland Fisheries Ireland. Water sampling will include the following tests:

- Biological water quality analysis - Q sampling; and
- Physio-chemical water quality analysis.

6.5 Ornithological surveys

It is recommended that pre-construction surveys are undertaken, particularly during the breeding season. Post-construction surveys are also recommended, in order to assess the proposed mitigation measures and the potential impact of the proposed development to ecology. Three years of post construction survey shall include the following elements:

- Vantage point surveys

- Use of the hen harrier mitigatory habitat area
- Transect surveys
- Fatality searches

6.6 Monitoring of mammals

Pre-construction mammal surveys are recommended, including:

- Terrestrial mammal surveys, particularly, for badger, to determine whether the sett layout that was encountered, has altered.
- Pre-construction monitoring of the bat activity within the proposed site.

It is recommended that three years of post-construction surveys are carried out for the following elements:

- Post-construction monitoring of the badger sett identified and badger activity within the proposed site.
- Post-construction monitoring of the bat activity within the proposed site.
- Fatality searches, to incorporate any potential bat mortalities recorded.

7 Environmental auditing and maintenance

Routine inspections and maintenance of sediment and erosion control measures, fuel management measures and other mitigation measures (see the Construction Environmental Management Plan, Appendix I), incorporated into the design of the proposed wind farm, to be carried out. These inspections will take place regularly during the construction phase and during the operational life of the project.

8 Conclusions

An Ecological Management Plan was developed in order to enhance the existing value of habitats within the proposed site boundary. The overall management plan is summarised here in a tabulated format, for clarity.

Table 10: Summary of management actions

No.	Management Action	When	Main Target Habitat/Species
1	Timing of construction outside of the breeding season, near sensitive bird areas.	During construction	Hen harrier birds
2	Construction to begin before the breeding season, where possible.	During construction	Breeding birds
3	Damage or loss of trees will be kept to a minimum during the construction phase.	During construction	Birds/fauna
4	Surveys for bat roosts under bridges which require upgrading works along the turbine delivery route. Mature trees that require felling along haulage routes should also be surveyed for bats.	Pre-construction	Bats
5	Pre-construction bat surveys of any mature trees felling and structures demolished.	Pre-construction	Bats
6	Ensure during the felling works that the calculated buffer distance for bats between turbines and the edge of conifer plantations and hedgerows is installed.	During construction	Bats
7	Environmental auditing and maintenance, to ensure mitigation measures remain effective.	Pre, during and post-construction	-
8	Enhancement measures for hen harrier – alternative habitat	Pre, during and post-construction	Habitats / hen harrier
9	A number of suitable sediment ponds will be retained in situ and may require modification, in order to enhance the suitability of the site for invertebrates and amphibians.	Post-construction	Dragonflies, damselflies and amphibians
10	Creation and upgrading of 360m of hedgerows	Post-construction	Habitats and fauna including bats, hen harrier, and other bird species

No.	Management Action	When	Main Target Habitat/Species
11	Installation of bat boxes	Post-construction	Bats
12	Establishment of permanent quadrats in the felled areas and habitats altered during the construction phase.	Post-construction	Habitats
13	Selected drains to be blocked in felling areas to promote wet grassland, heath and bog.	Post-construction	Wet grassland, scrub and wet heath
14	Natural establishment of wet grassland, scrub and possibly wet heath and bog vegetation, will be allowed.	Post-construction	Wet grassland, scrub and wet heath
15	Where natural establishment of vegetation is slow, purple-moor grass (*Molinia caerulea*) and other suitable species will be planted within the bare felled areas.	Year 1	Purple-moor grass (*Molinia caerulea*) and other suitable species

Monitoring requirements include the establishment of permanent quadrats in the deposition and felled areas, in order to monitor the process of vegetation establishment and to take action where failure or poor progress is evident. Monitoring surveys will also be carried out for hen harrier, bats, badgers and water quality.

9 References

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Appendix 1

Hen Harrier Habitat Area

– Individual Field photographs,

Management measures and restrictions

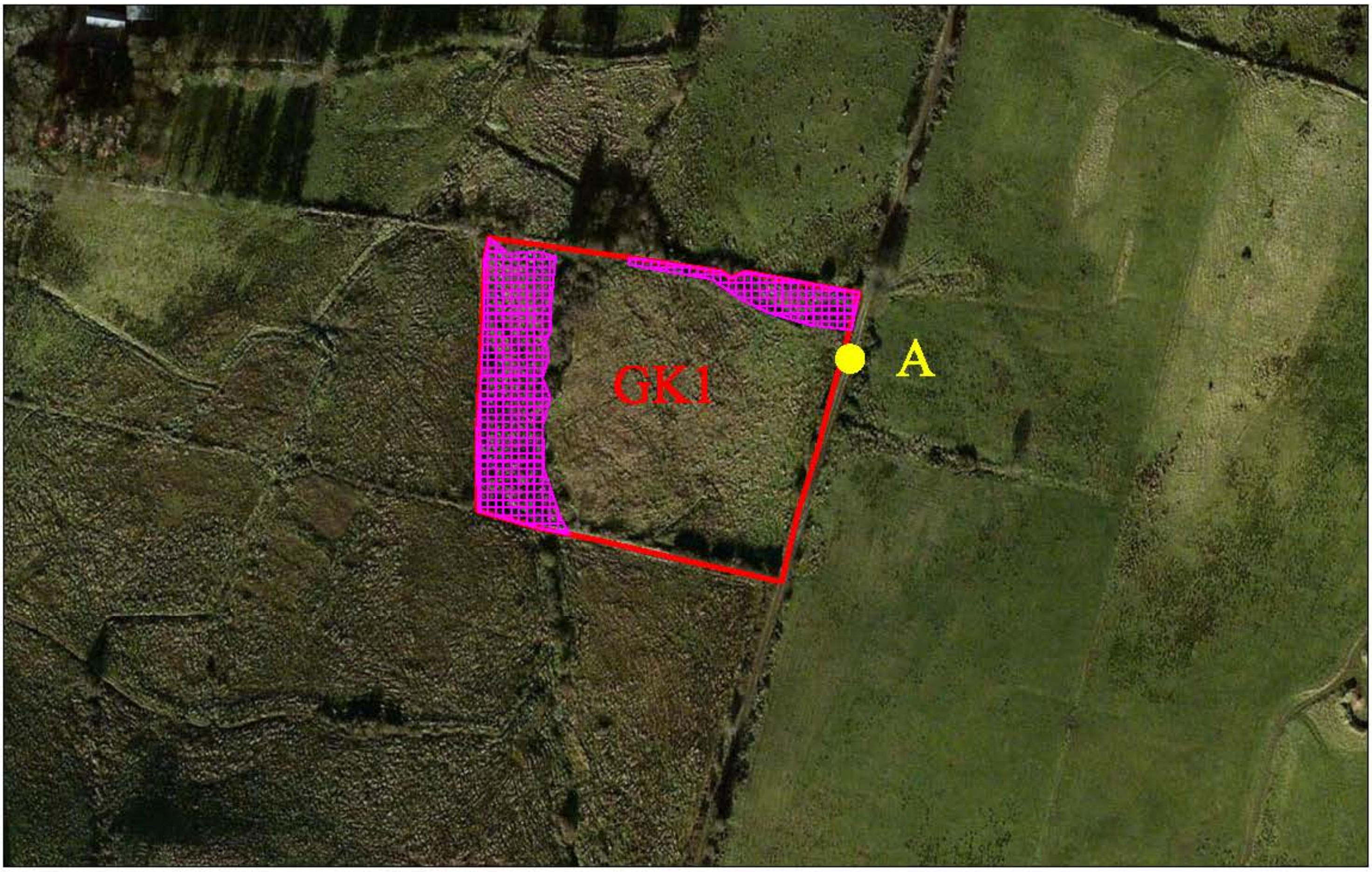
REFERENCE DOCUMENTS

REFERENCE DOCUMENTS

Photographs of Field GK1

Photograph A looking west

Field ID: GK1



Field Description: Wet grassland

Field Size: 1.6Ha

Measures:

- Achieve 30 - 70% rush coverage.
- Rush coverage is controlled with cutting every second year.
- Rush coverage is controlled with grazing.
- Minimum stocking level of 0.6 LU/Ha and maximum stocking level of 1.6 LU/Ha (to be reviewed by project ecologist in year 3).
- Mark some lines of electric fence with plastic fliers so that they are more visible to the hen harrier.
- Fence off two enclosures (Total 0.4Ha) and plant with native broadleaved species.

Restrictions:

- Limited spreading of fertiliser.
- Limited spreading of lime.
- No burning.
- No excavation of new drains or reclaiming heath or bog.
- No removal of hedgerows.
- No recreational off-roading with vehicles.
- No use of poisons or stupefying baits.
- No new forestry plantation.

Field Map Index:

Field Boundary

New hedgerow planted with suitable shrub and trees such as Willow, Gorse, Birch, Mountain Ash.

Areas to be planted with woody scrub such as Willow, Alder, Birch

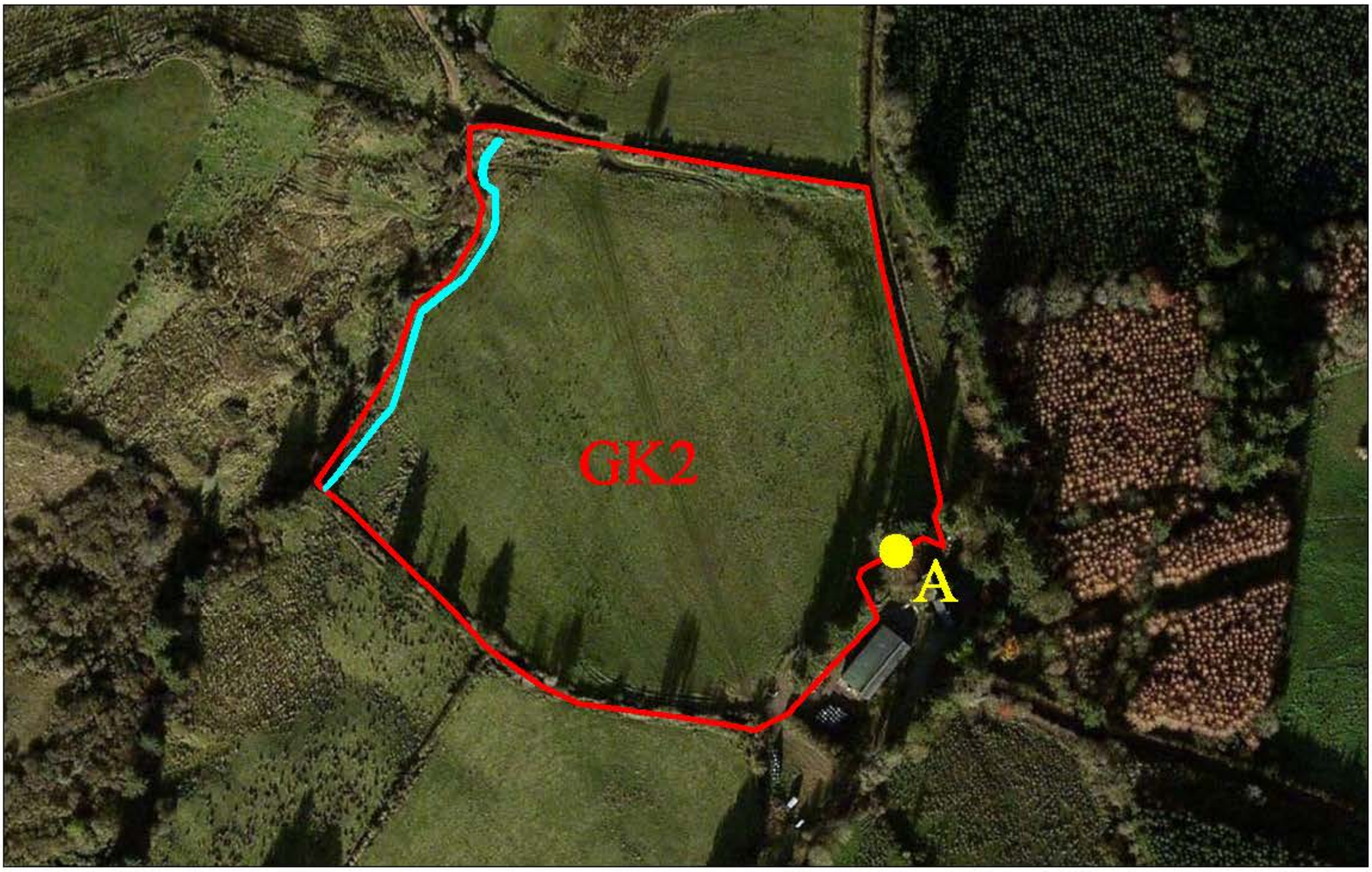
Areas to be planted with woody scrub and suitable trees. Stockproof fencing will be erected to exclude access by livestock.

A Photograph Locations

Photographs of Field GK2

Photograph A looking west-northwest

Field ID: GK2



Field Description: Agricultural grassland with a riparian corridor

Field Size: 3.3Ha

Measures:

- Minimum stocking level of 0.6 LU/Ha and maximum stocking level of 1.6 LU/Ha (to be reviewed by project ecologist in year 3).
- Mark some lines of electric fence with plastic fliers so that they are more visible to the hen harrier.
- Enhance riparian corridor: Plant native broadleaved species.
- Enhance riparian corridor: Erect fencing to make stockproof and exclude access to river by livestock.

Restrictions:

- Limited spreading of fertiliser.
- Limited spreading of lime.
- No burning.
- No excavation of new drains or reclaiming heath or bog.
- No removal of hedgerows.
- No recreational off-roading with vehicles.
- No use of poisons or stupefying baits.
- No new forestry plantation.

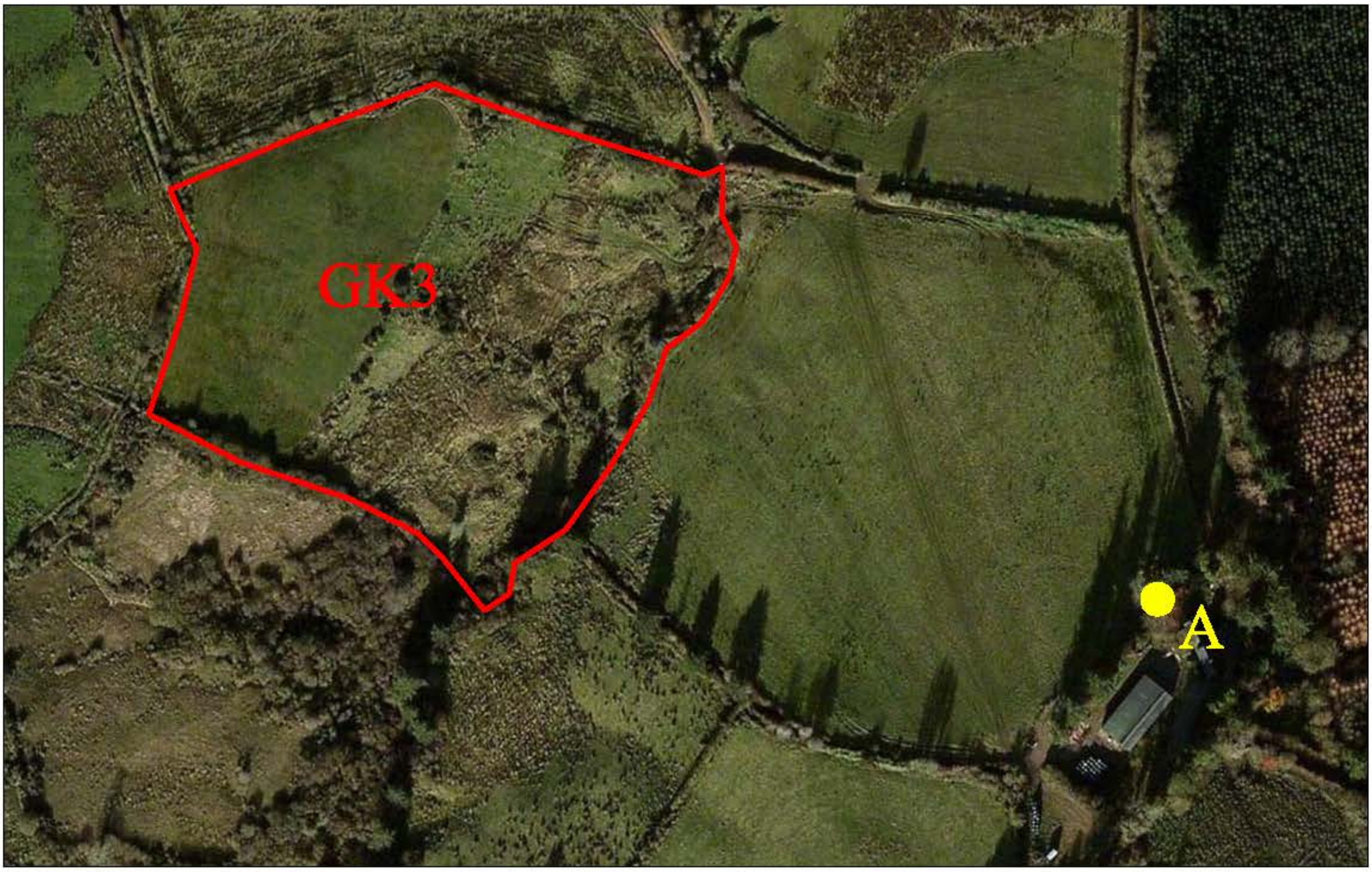
Field Map Index:

(red line)	Field Boundary
(light green line)	New hedgerow planted with suitable shrub and trees such as Willow, Gorse, Birch, Mountain Ash.
(cyan line)	Areas to be planted with woody scrub such as Willow, Alder, Birch
(magenta dotted line)	Areas to be planted with woody scrub and suitable trees. Stockproof fencing will be erected to exclude access by livestock.
A	Photograph Locations

Photographs of Field GK3

Photograph A looking west-northwest

Field ID: GK3



Field Description: Mix of agricultural grassland and wet grassland with a riparian corridor

Field Size: 2.3Ha

Measures:
- Eastern half of the field will be allowed to revert back to wet grassland.
- Achieve 30 - 70% rush coverage on eastern section.
- Rush coverage is controlled with cutting every second year.
- Rush coverage is controlled with grazing.
- Minimum stocking level of 0.6 LU/Ha and maximum stocking level of 1.6 LU/Ha (to be reviewed by project ecologist in year 3).
- Mark some lines of electric fence with plastic fliers so that they are more visible to the hen harrier.
- Enhance riparian corridor: Erect fencing to make stockproof and exclude access to river by livestock.

Restrictions:
- Limited spreading of fertiliser.
- Limited spreading of lime.
- No burning.
- No excavation of new drains or reclaiming heath or bog.
- No removal of hedgerows.
- No recreational off-roading with vehicles.
- No use of poisons or stupefying baits.
- No new forestry plantation.

Field Map Index:

Field Boundary

New hedgerow planted with suitable shrub and trees such as Willow, Gorse, Birch, Mountain Ash.

Areas to be planted with woody scrub such as Willow, Alder, Birch

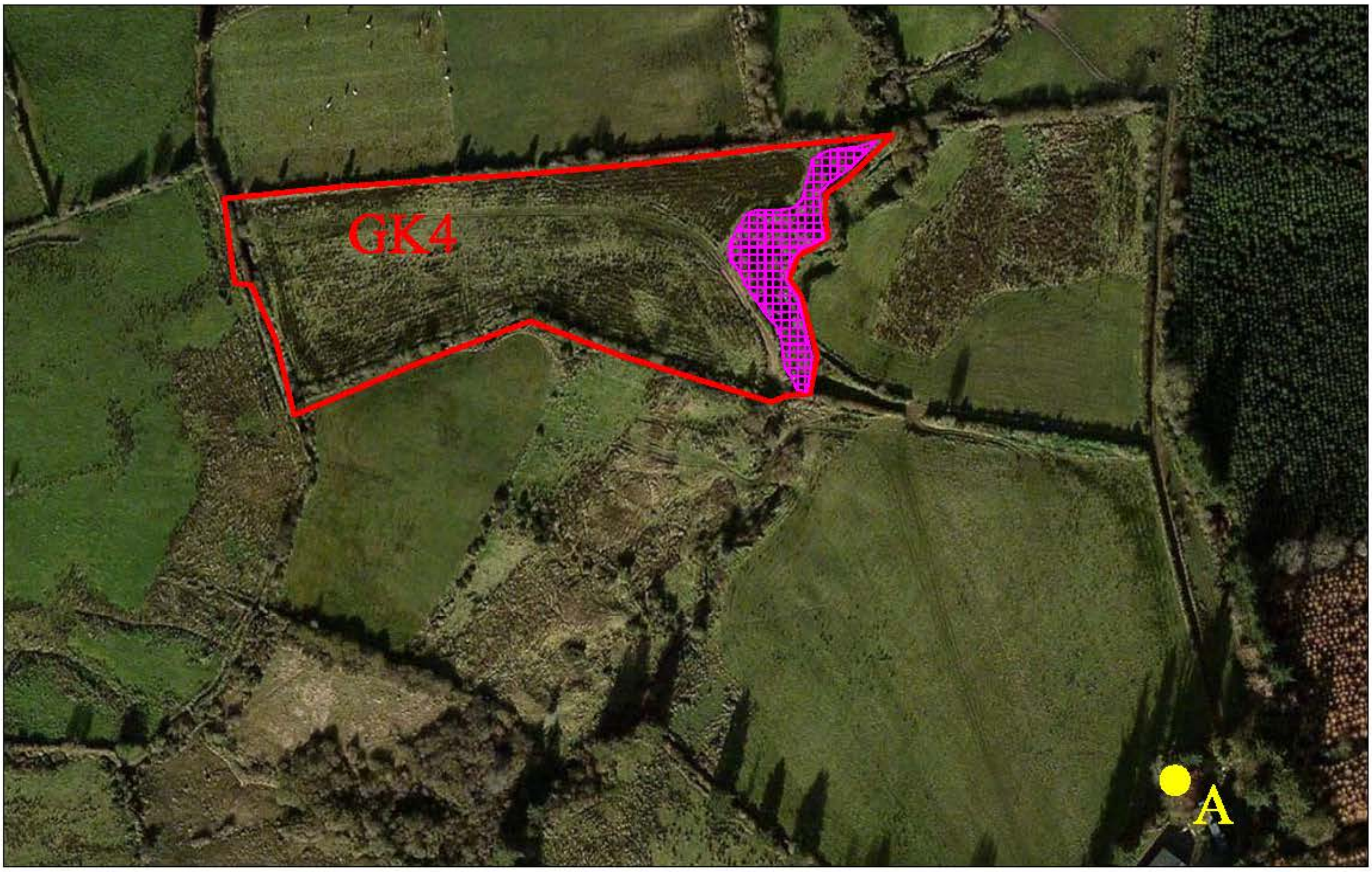
Areas to be planted with woody scrub and suitable trees. Stockproof fencing will be erected to exclude access by livestock.

A Photograph Locations

Photographs of Field GK4

Photograph A looking northwest

Field ID: GK4



Field Description: Wet grassland
Field Size: 1.7Ha

Measures:
- Rush coverage is controlled with cutting every second year.
- Rush coverage is controlled with grazing.
- Minimum stocking level of 0.6 LU/Ha and maximum stocking level of 1.6 LU/Ha (to be reviewed by project ecologist in year 3).
- Mark some lines of electric fence with plastic fliers so that they are more visible to the hen harrier.
- Enhance riparian corridor: Plant native broadleaved enclosure (0.15Ha)
- Enhance riparian corridor: Erect fencing to make stockproof and exclude access to river by livestock

Restrictions:
- Limited spreading of fertiliser.
- Limited spreading of lime.
- No burning.
- No excavation of new drains or reclaiming heath or bog.
- No removal of hedgerows.
- No recreational off-roading with vehicles.
- No use of poisons or stupefying baits.
- No new forestry plantation.

Field Map Index:

Field Boundary

New hedgerow planted with suitable shrub and trees such as Willow, Gorse, Birch, Mountain Ash.

Areas to be planted with woody scrub such as Willow, Alder, Birch

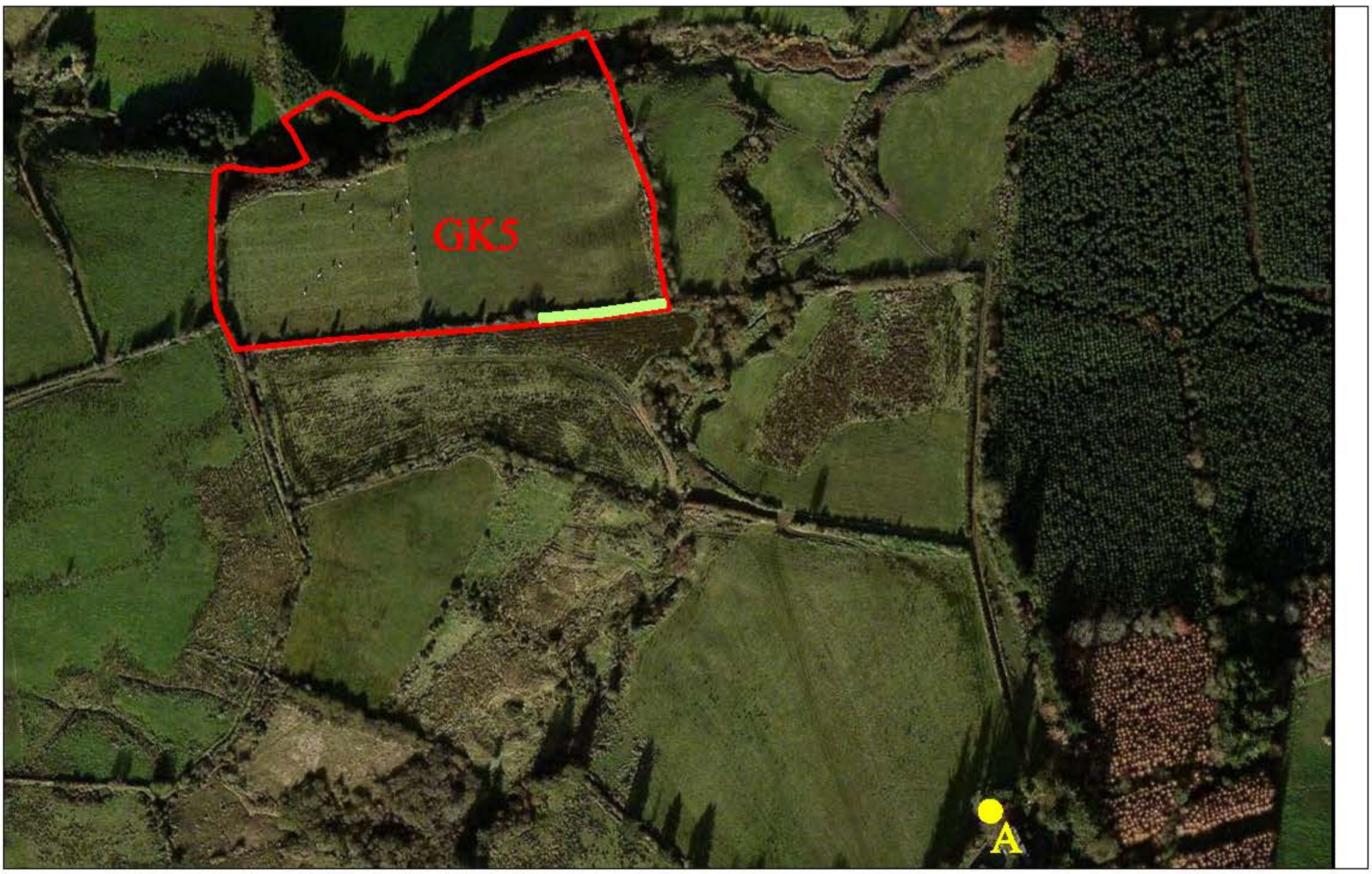
Areas to be planted with woody scrub and suitable trees. Stockproof fencing will be erected to exclude access by livestock.

A Photograph Locations

Photographs of Field GK5

Photograph A looking north-northwest

Field ID: GK5



Field Description: Agricultural grassland.

Field Size: 2.4Ha

Measures:
- Minimum stocking level of 0.6 LU/Ha and maximum stocking level of 1.6 LU/Ha (to be reviewed by project ecologist in year 3).
- Mark some lines of electric fence with plastic fliers so that they are more visible to the hen harrier.
- Plant 60m of hedgerow

Restrictions:
- Limited spreading of fertiliser.
- Limited spreading of lime.
- No burning.
- No excavation of new drains or reclaiming heath or bog.
- No removal of hedgerows.
- No recreational off-roading with vehicles.
- No use of poisons or stupefying baits.
- No new forestry plantation.

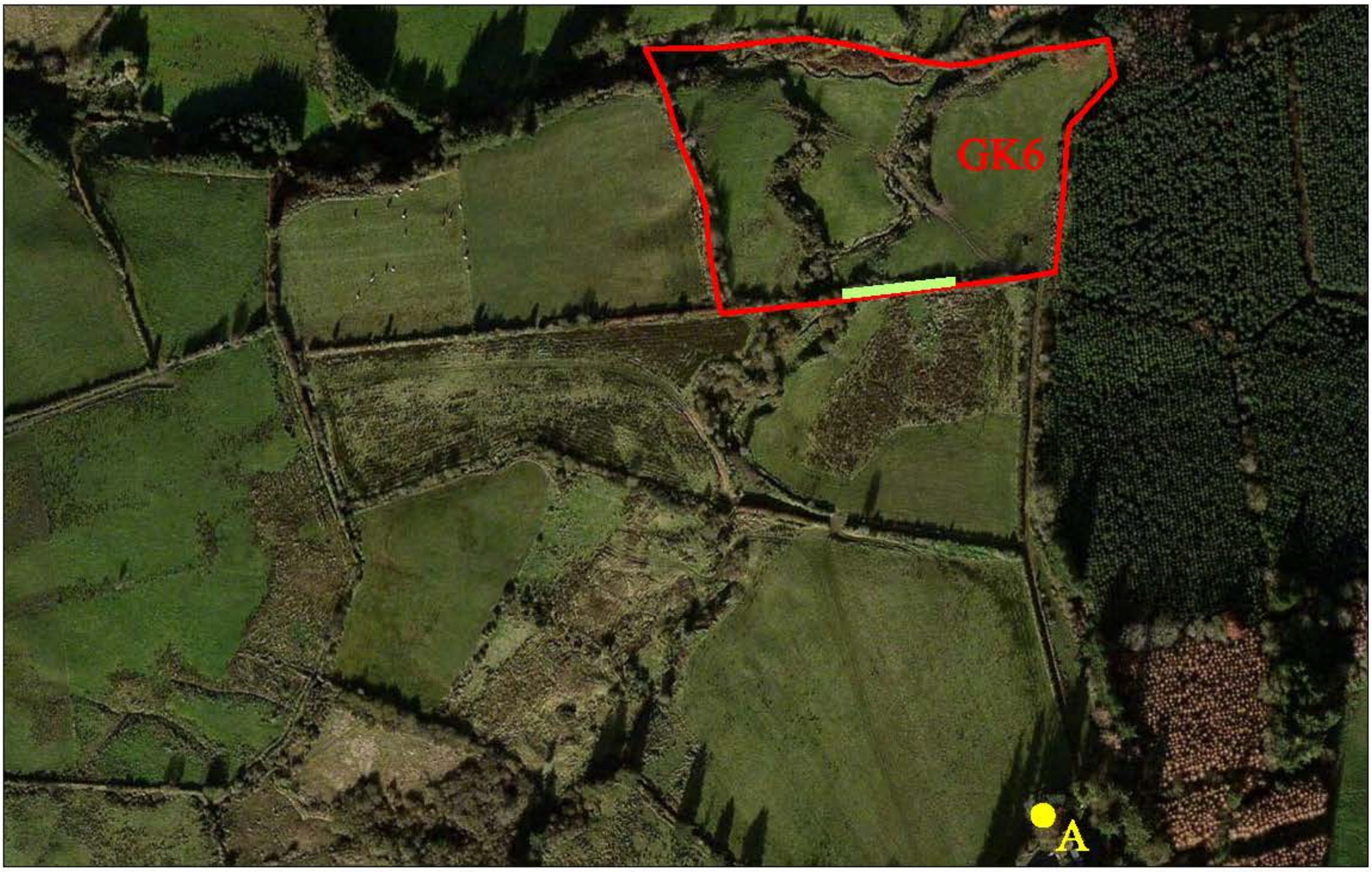
Field Map Index:

- Field Boundary
- New hedgerow planted with suitable shrub and trees such as Willow, Gorse, Birch, Mountain Ash.
- Areas to be planted with woody scrub such as Willow, Alder, Birch
- Areas to be planted with woody scrub and suitable trees. Stockproof fencing will be erected to exclude access by livestock.
- A Photograph Locations

Photographs of Field GK6

Photograph A looking north-northwest

Field ID: GK6



Field Description: Wet grassland with a riparian corridor

Field Size: 2.2Ha

Measures:
- Field will be maintained as wet grassland.
- Achieve 30 - 70% rush coverage.
- Rush coverage is controlled with cutting every second year.
- Rush coverage is controlled with grazing.
- Minimum stocking level of 0.6 LU/Ha and maximum stocking level of 1.6 LU/Ha (to be reviewed by project ecologist in year 3).
- Mark some lines of electric fence with plastic fliers so that they are more visible to the hen harrier.
- Plant 55m of hedgerow
- Enhance riparian corridor: Erect fencing to make stockproof and exclude access to river by livestock.

Restrictions:
- Limited spreading of fertiliser.
- Limited spreading of lime.
- No burning.
- No excavation of new drains or reclaiming heath or bog.
- No removal of hedgerows.
- No recreational off-roading with vehicles.
- No use of poisons or stupefying baits.
- No new forestry plantation.

Field Map Index:

Field Boundary

New hedgerow planted with suitable shrub and trees such as Willow, Gorse, Birch, Mountain Ash.

Areas to be planted with woody scrub such as Willow, Alder, Birch

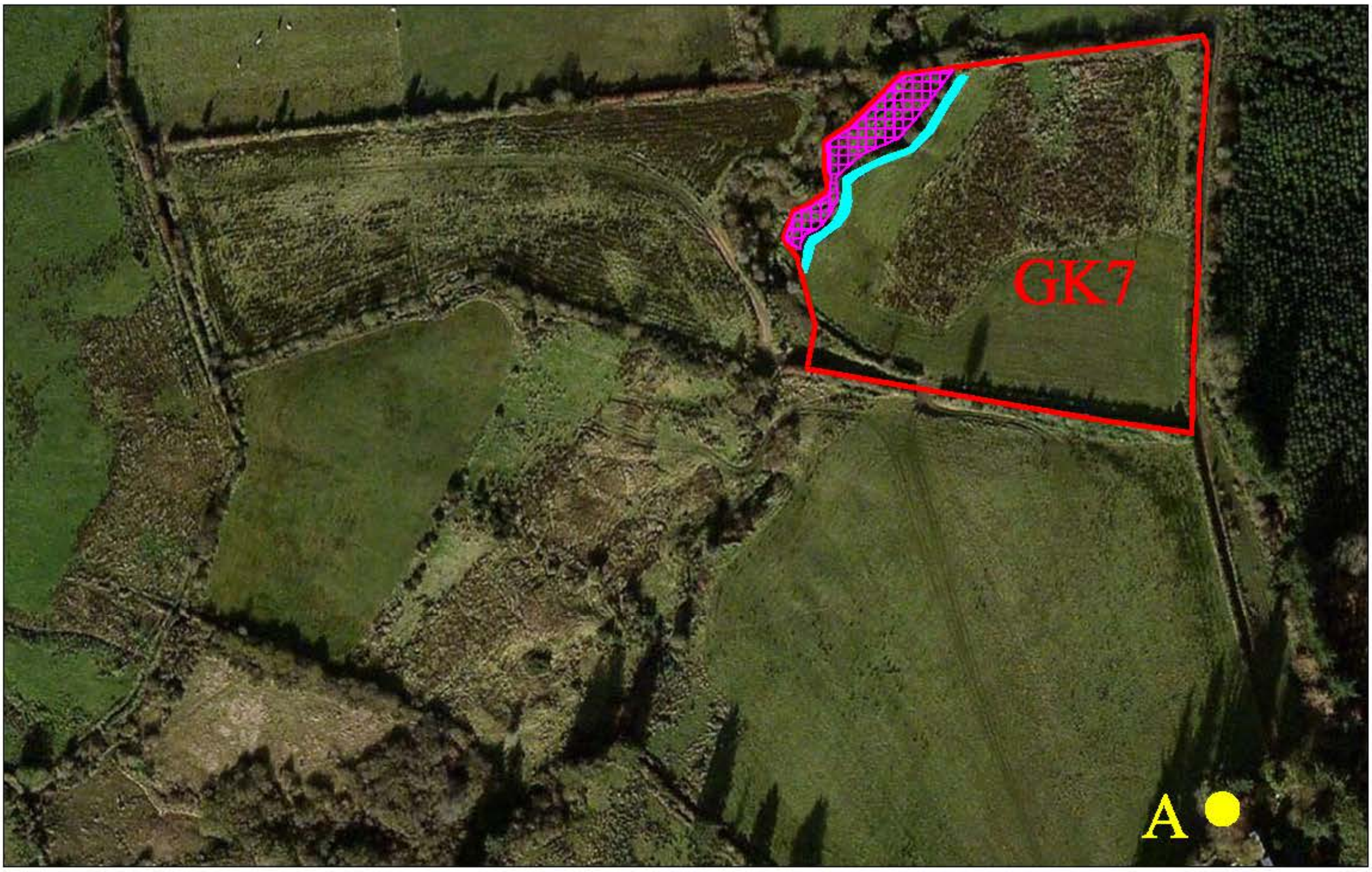
Areas to be planted with woody scrub and suitable trees. Stockproof fencing will be erected to exclude access by livestock.

A Photograph Locations

Photographs of Field GK7

Photograph A looking north-northwest

Field ID: GK7



Field Description: Mix of agricultural grassland and wet grassland with a riparian corridor

Field Size: 1.6 Ha

Measures:
- Centre and northeast of the field will be maintained as wet grassland.
- Achieve 30 - 70% rush coverage.
- Rush coverage is controlled with cutting every second year.
- Rush coverage is controlled with grazing.
- Minimum stocking level of 0.6 LU/Ha and maximum stocking level of 1.6 LU/Ha (to be reviewed by project ecologist in year 3).
- Mark some lines of electric fence with plastic fliers so that they are more visible to the hen harrier.
- Enhance riparian corridor: Plant native broadleaved species.
- Fence off enclosure (0.07Ha) and improve with native broadleaved species.
- Enhance riparian corridor: Erect fencing to make stockproof and exclude access to river by livestock.

Restrictions:
- Limited spreading of fertiliser.
- Limited spreading of lime.
- No burning.
- No excavation of new drains or reclaiming heath or bog.
- No removal of hedgerows.
- No recreational off-roading with vehicles.
- No use of poisons or stupefying baits.
- No new forestry plantation.

Field Map Index:

Field Boundary

New hedgerow planted with suitable shrub and trees such as Willow, Gorse, Birch, Mountain Ash.

Areas to be planted with woody scrub such as Willow, Alder, Birch

Areas to be planted with woody scrub and suitable trees. Stockproof fencing will be erected to exclude access by livestock.

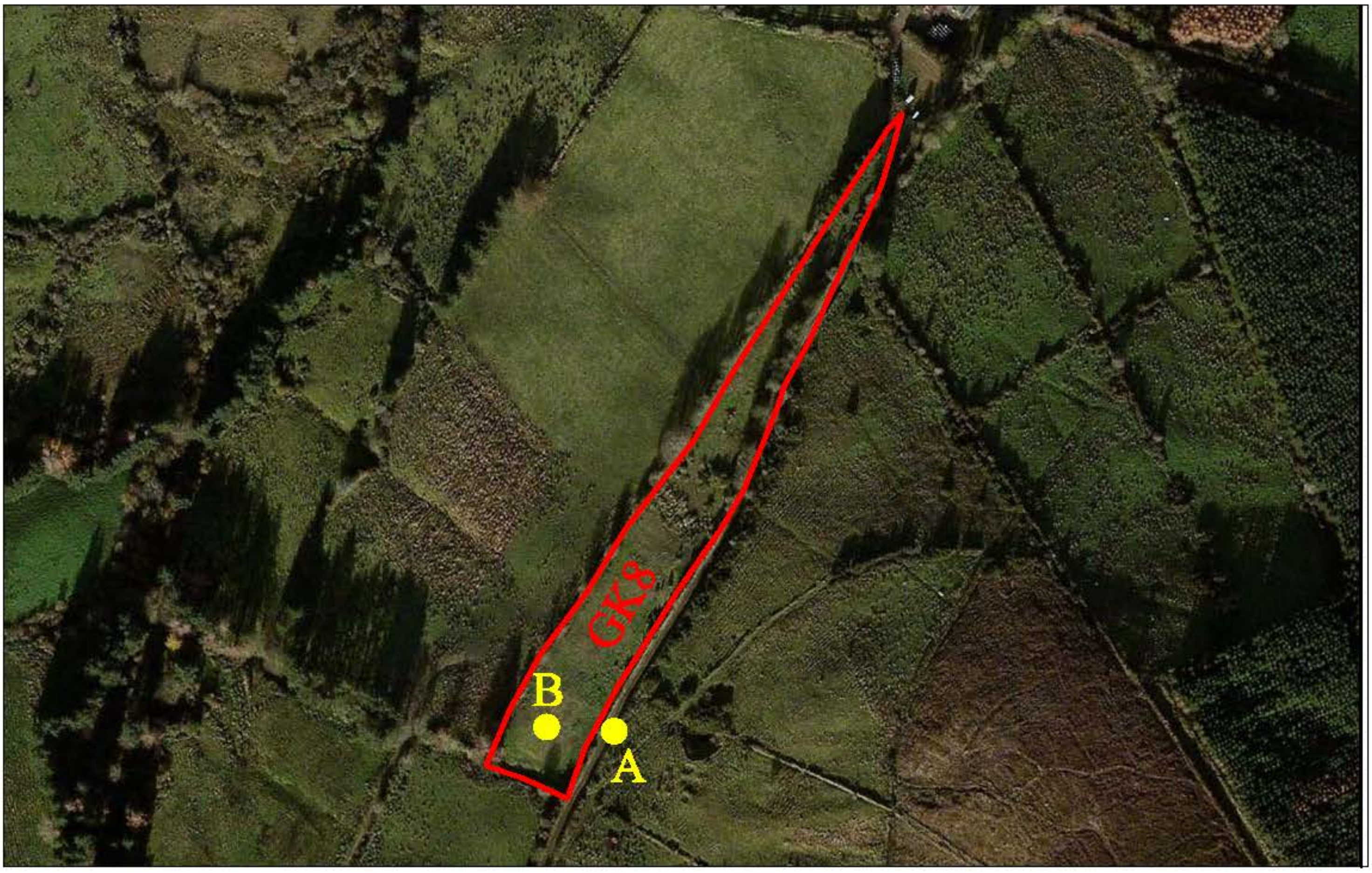
A Photograph Locations

Photographs of Field GK8

Photograph A looking west

Photograph B looking northeast

Field ID: GK8



Field Description: Mix of agricultural grassland and wet grassland.

Field Size: 0.8Ha

Measures:

- Achieve 30 - 70% rush coverage.
- Rush coverage is controlled with cutting every second year.
- Rush coverage is controlled with grazing.
- Minimum stocking level of 0.6 LU/Ha and maximum stocking level of 1.6 LU/Ha (to be reviewed by project ecologist in year 3).
- Mark some lines of electric fence with plastic fliers so that they are more visible to the hen harrier.

Restrictions:

- Limited spreading of fertiliser.
- Limited spreading of lime.
- No burning.
- No excavation of new drains or reclaiming heath or bog.
- No removal of hedgerows.
- No recreational off-roading with vehicles.
- No use of poisons or stupefying baits.
- No new forestry plantation.

Field Map Index:

Field Boundary

New hedgerow planted with suitable shrub and trees such as Willow, Gorse, Birch, Mountain Ash.

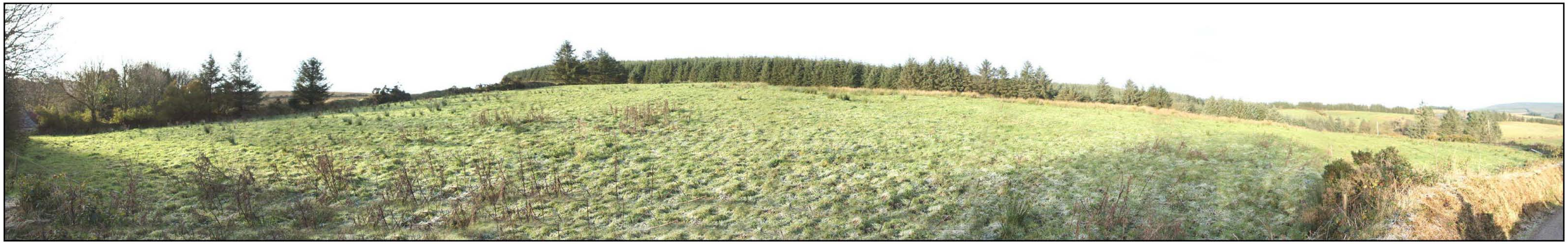
Areas to be planted with woody scrub such as Willow, Alder, Birch

Areas to be planted with woody scrub and suitable trees. Stockproof fencing will be erected to exclude access by livestock.

A Photograph Locations

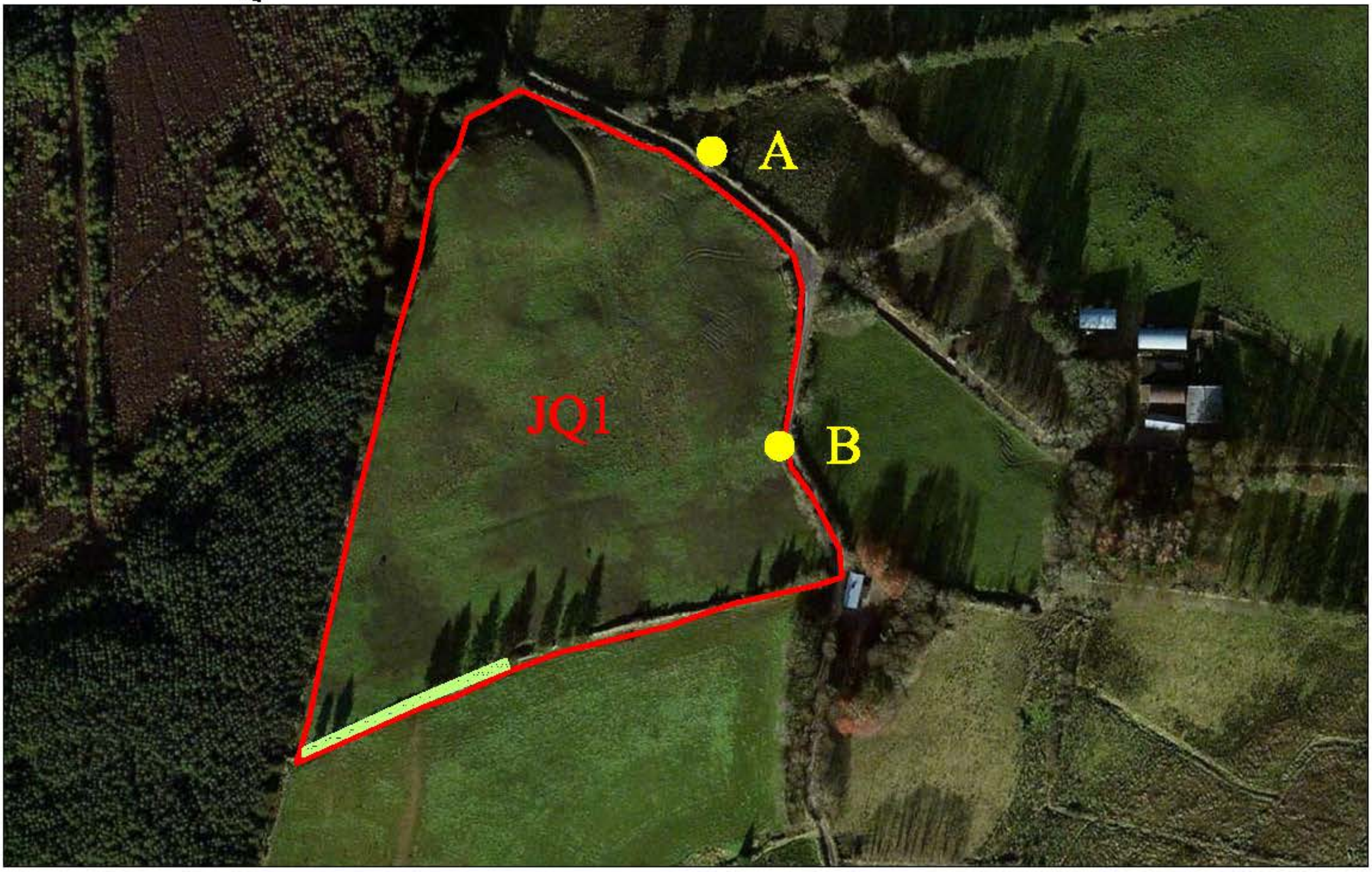
Photographs of Field JQ1

Photograph A looking southwest



Photograph B looking west

Field ID: JQ1



Field Description: Mix of agricultural grassland and wet grassland.

Field Size: 3.5Ha

Measures:
- Field will be allowed to revert back to wet grassland.
- Achieve 30 - 70% rush coverage.
- Rush coverage is controlled with cutting every second year.
- Rush coverage is controlled with grazing.
- Minimum stocking level of 0.6 LU/Ha and maximum stocking level of 1.6 LU/Ha (to be reviewed by project ecologist in year 3).
- Mark some lines of electric fence with plastic fliers so that they are more visible to the hen harrier.
- Plant 88m of hedgerow

Restrictions:
- Limited spreading of fertiliser.
- Limited spreading of lime.
- No burning.
- No excavation of new drains or reclaiming heath or bog.
- No removal of hedgerows.
- No recreational off-roading with vehicles.
- No use of poisons or stupefying baits.
- No new forestry plantation.

Field Map Index:

Field Boundary

New hedgerow planted with suitable shrub and trees such as Willow, Gorse, Birch, Mountain Ash.

Areas to be planted with woody scrub such as Willow, Alder, Birch

Areas to be planted with woody scrub and suitable trees. Stockproof fencing will be erected to exclude access by livestock.

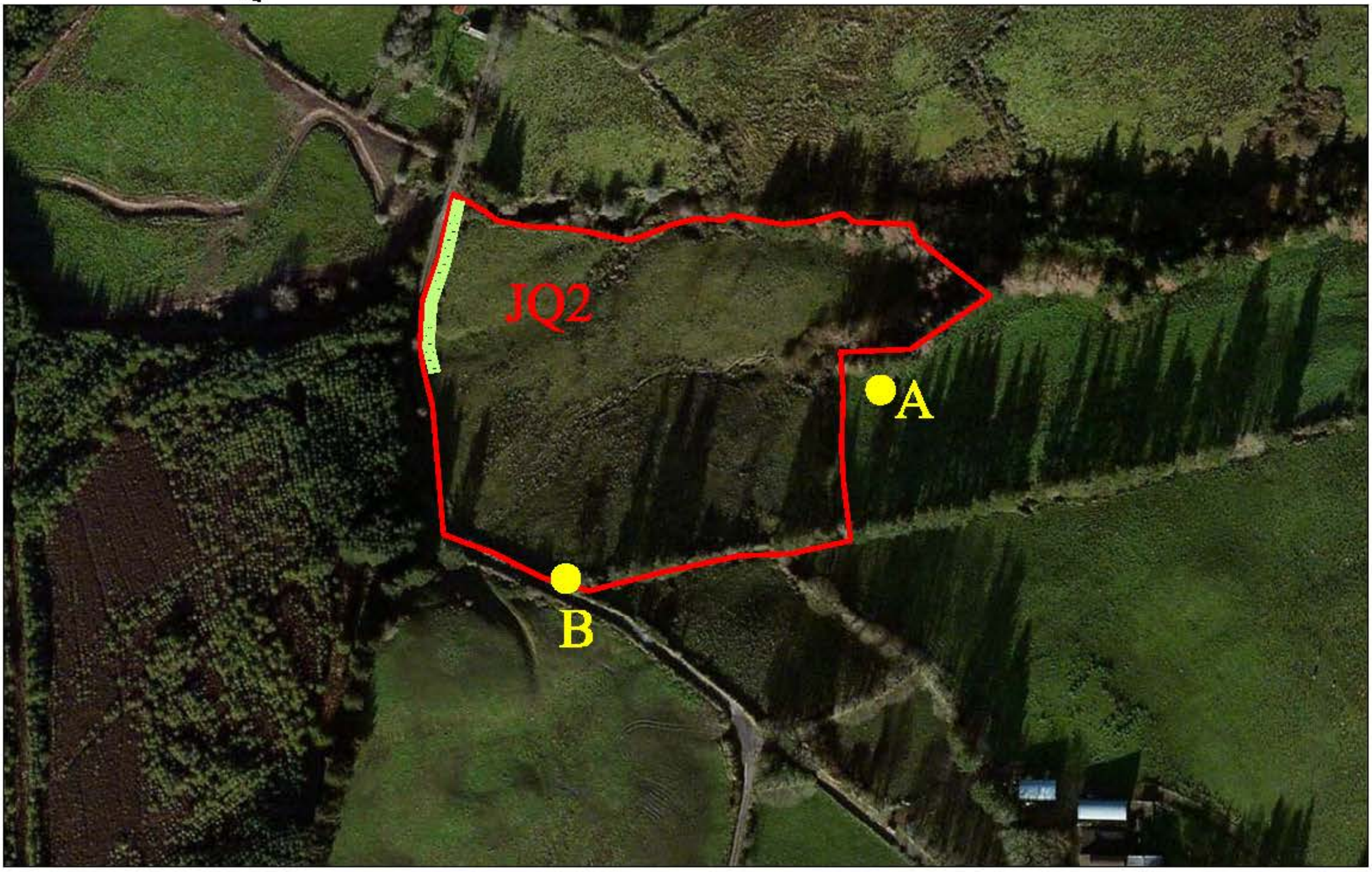
A Photograph Locations

Photographs of Field JQ2

Photograph A looking west

Photograph B looking north

Field ID: JQ2



Field Description: Mix of agricultural grassland and wet grassland with riparian corridor.

Field Size: 2.4Ha

Measures:
- Field will be allowed to revert back to wet grassland.
- Achieve 30 - 70% rush coverage.
- Rush coverage is controlled with cutting every second year.
- Rush coverage is controlled with grazing.
- Minimum stocking level of 0.6 LU/Ha and maximum stocking level of 1.6 LU/Ha (to be reviewed by project ecologist in year 3).
- Mark some lines of electric fence with plastic fliers so that they are more visible to the hen harrier.
- Plant 60m of hedgerow
- Enhance riparian corridor:Erect fencing to make stockproof and exclude access to river by livestock.

Restrictions:
- Limited spreading of fertiliser.
- Limited spreading of lime.
- No burning.
- No excavation of new drains or reclaiming heath or bog.
- No removal of hedgerows.
- No recreational off-roading with vehicles.
- No use of poisons or stupefying baits.
- No new forestry plantation.

Field Map Index:

Field Boundary

New hedgerow planted with suitable shrub and trees such as Willow, Gorse, Birch, Mountain Ash.

Areas to be planted with woody scrub such as Willow, Alder, Birch

Areas to be planted with woody scrub and suitable trees. Stockproof fencing will be erected to exclude access by livestock.

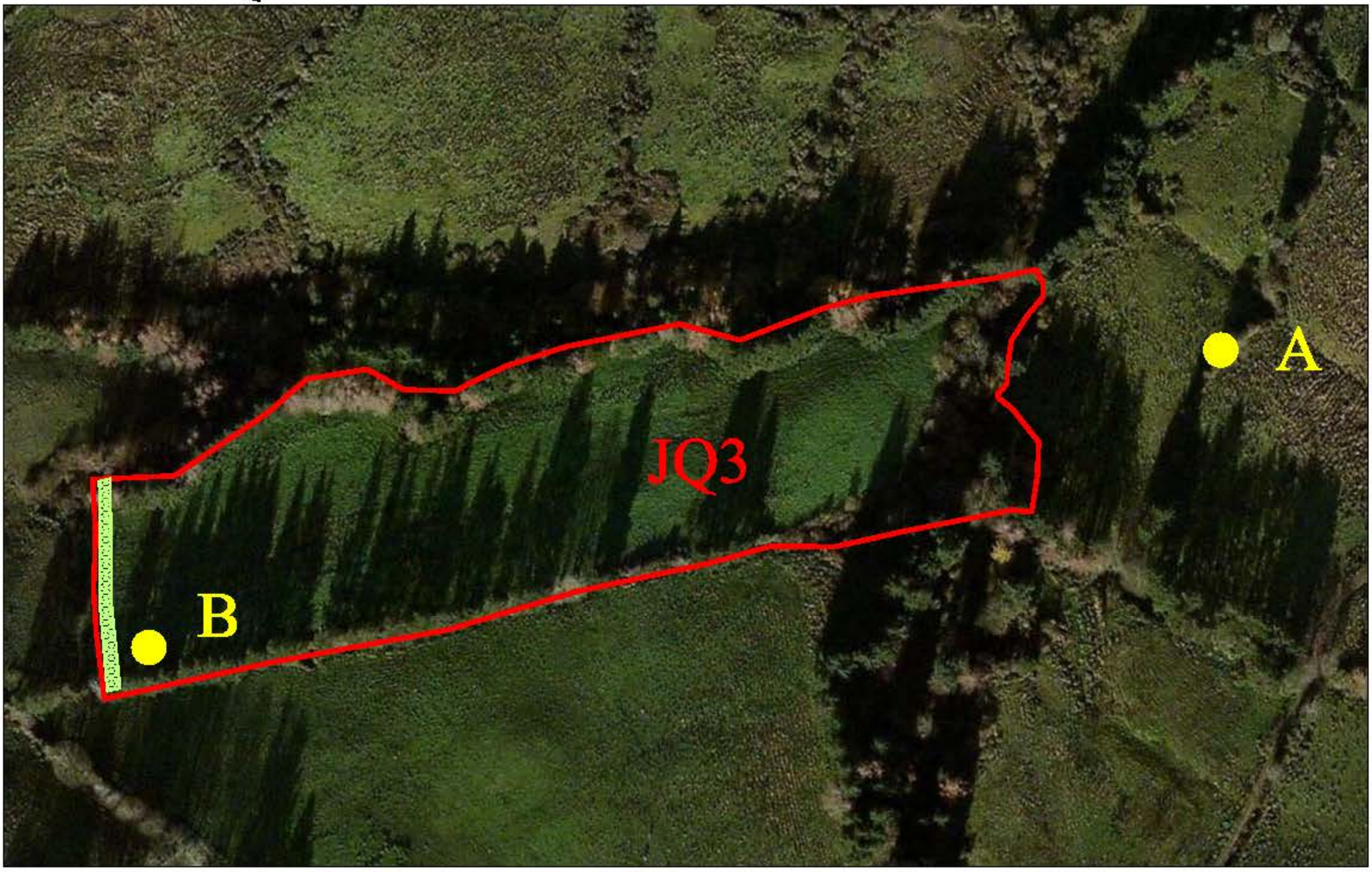
A Photograph Locations

Photographs of Field JQ3

Photograph A looking west

Photograph B looking east

Field ID: JQ3



Field Description: Mix of agricultural grassland and wet grassland with riparian corridor.

Field Size: 2.9Ha

Measures:
- Achieve 30 - 70% rush coverage.
- Rush coverage is controlled with cutting every second year.
- Rush coverage is controlled with grazing.
- Minimum stocking level of 0.6 LU/Ha and maximum stocking level of 1.6 LU/Ha (to be reviewed by project ecologist in year 3).
- Mark some lines of electric fence with plastic fliers so that they are more visible to the hen harrier.
- Plant 73m of hedgerow
- Enhance riparian corridor:Erect fencing to make stockproof and exclude access to river by livestock.

Restrictions:
- Limited spreading of fertiliser.
- Limited spreading of lime.
- No burning.
- No excavation of new drains or reclaiming heath or bog.
- No removal of hedgerows.
- No recreational off-roading with vehicles.
- No use of poisons or stupefying baits.
- No new forestry plantation.

Field Map Index:

Field Boundary

New hedgerow planted with suitable shrub and trees such as Willow, Gorse, Birch, Mountain Ash.

Areas to be planted with woody scrub such as Willow, Alder, Birch

Areas to be planted with woody scrub and suitable trees. Stockproof fencing will be erected to exclude access by livestock.

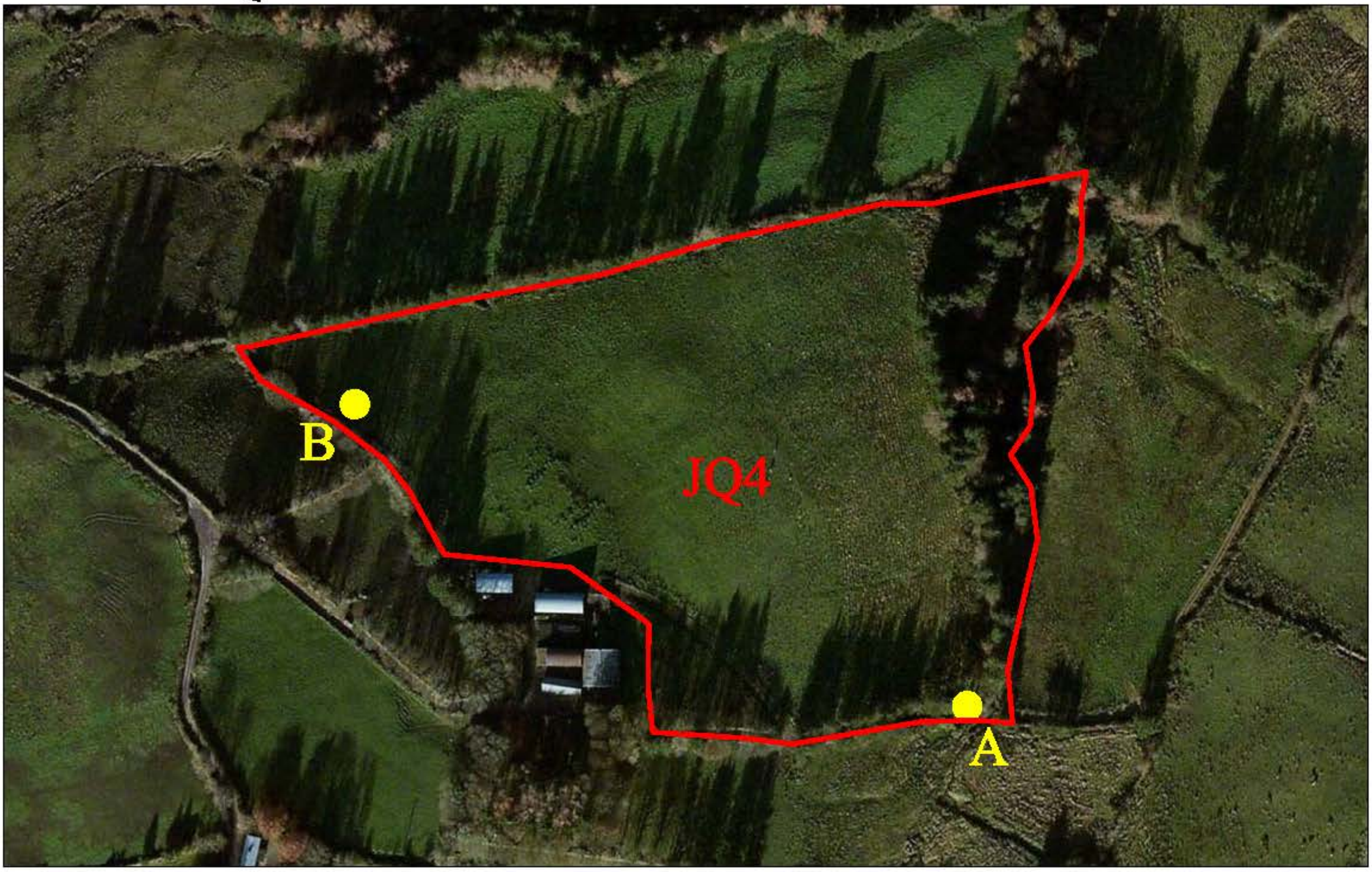
A Photograph Locations

Photographs of Field JQ4

Photograph A looking northwest

Photograph B looking east

Field ID: JQ4



Field Description: Mix of agricultural grassland and wet grassland with riparian corridor.

Field Size: 4.6Ha

Measures:

- Achieve 30 - 70% rush coverage.
- Rush coverage is controlled with cutting every second year.
- Rush coverage is controlled with grazing.
- Minimum stocking level of 0.6 LU/Ha and maximum stocking level of 1.6 LU/Ha (to be reviewed by project ecologist in year 3).
- Mark some lines of electric fence with plastic fliers so that they are more visible to the hen harrier.
- Enhance riparian corridor:Erect fencing to make stockproof and exclude access to river by livestock.

Restrictions:

- Limited spreading of fertiliser.
- Limited spreading of lime.
- No burning.
- No excavation of new drains or reclaiming heath or bog.
- No removal of hedgerows.
- No recreational off-roading with vehicles.
- No use of poisons or stupefying baits.
- No new forestry plantation.

Field Map Index:

Field Boundary

New hedgerow planted with suitable shrub and trees such as Willow, Gorse, Birch, Mountain Ash.

Areas to be planted with woody scrub such as Willow, Alder, Birch

Areas to be planted with woody scrub and suitable trees. Stockproof fencing will be erected to exclude access by livestock.

A Photograph Locations

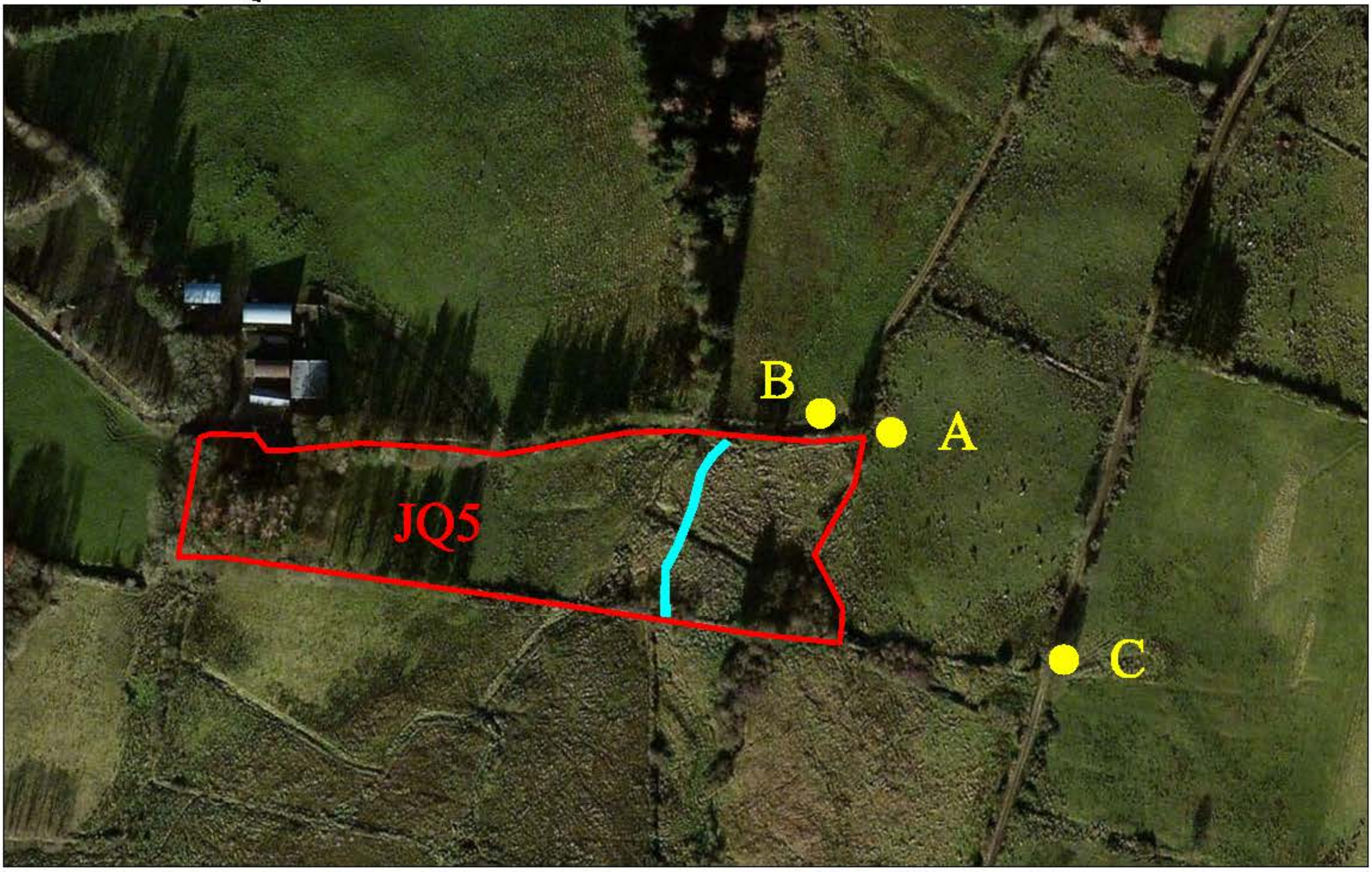
Photographs of Field JQ5

Photograph A looking west-southwest

Photograph B looking south-southwest

Photograph C looking west-northwest

Field ID: JQ5



Field Description: Mix of agricultural grassland and wet grassland with riparian corridor.

Field Size: 1.6Ha

Measures:

- Achieve 30 - 70% rush coverage.
- Rush coverage is controlled with cutting every second year.
- Rush coverage is controlled with grazing.
- Minimum stocking level of 0.6 LU/Ha and maximum stocking level of 1.6 LU/Ha (to be reviewed by project ecologist in year 3)
- Mark some lines of electric fence with plastic fliers so that they are more visible to the hen harrier.
- Enhance riparian corridor: Plant native broadleaved species.
- Enhance riparian corridor: Erect fencing to make stockproof and exclude access to river by livestock.

Restrictions:

- Limited spreading of fertiliser.
- Limited spreading of lime.
- No burning.
- No excavation of new drains or reclaiming heath or bog.
- No removal of hedgerows.
- No recreational off-roading with vehicles.
- No use of poisons or stupefying baits.
- No new forestry plantation.

Field Map Index:

Field Boundary

New hedgerow planted with suitable shrub and trees such as Willow, Gorse, Birch, Mountain Ash.

Areas to be planted with woody scrub such as Willow, Alder, Birch

Areas to be planted with woody scrub and suitable trees. Stockproof fencing will be erected to exclude access by livestock.

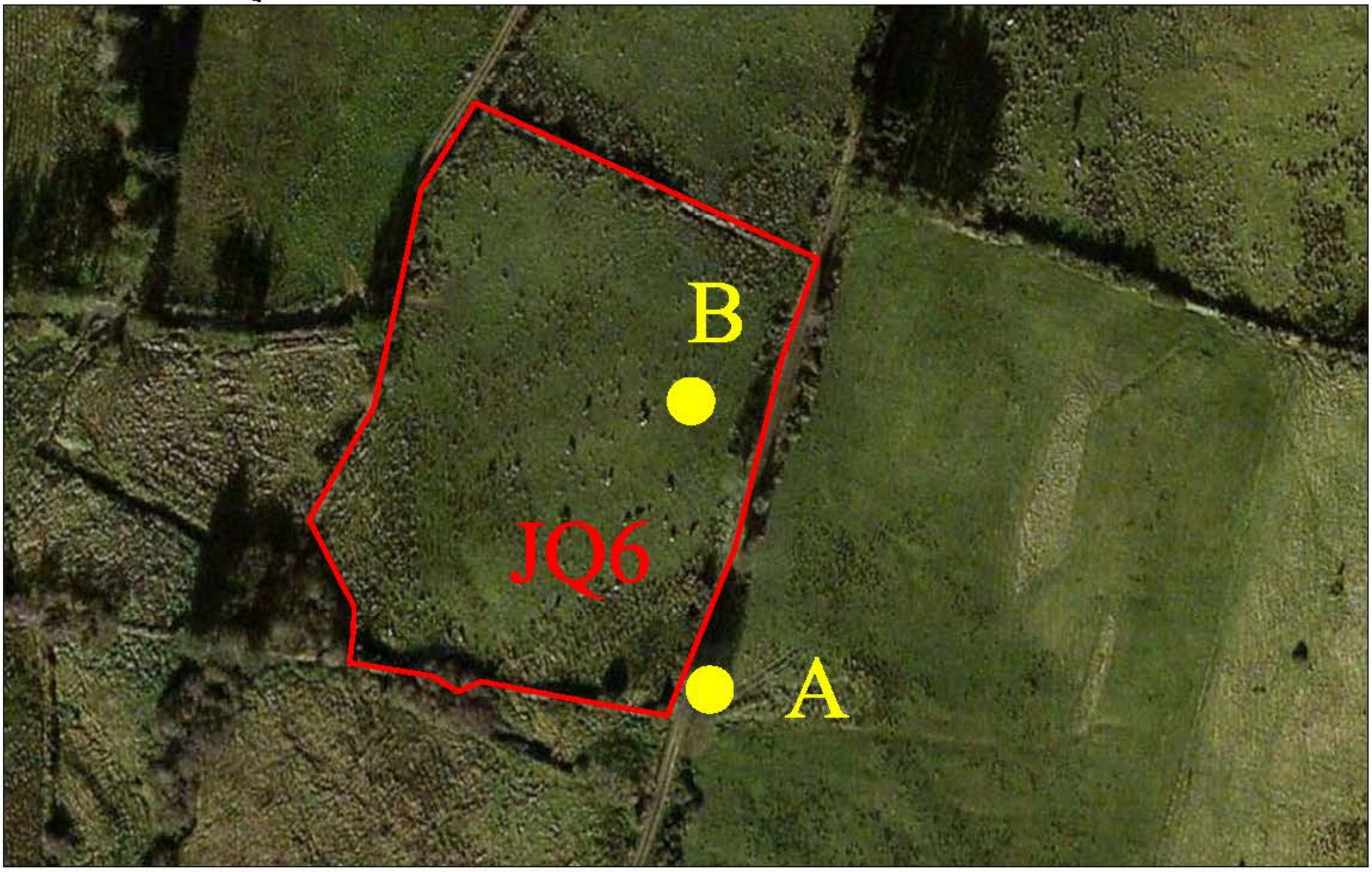
A Photograph Locations

Photographs of Field JQ6

Photograph A looking west

Photograph B looking southwest

Field ID: JQ6



Field Description: Mix of agricultural grassland and wet grassland.

Field Size: 1.3Ha

Measures:
- Achieve 30 - 70% rush coverage.
- Rush coverage is controlled with cutting every second year.
- Rush coverage is controlled with grazing.
- Minimum stocking level of 0.6 LU/Ha and maximum stocking level of 1.6 LU/Ha (to be reviewed by project ecologist in year 3).
- Mark some lines of electric fence with plastic fliers so that they are more visible to the hen harrier.

Restrictions:
- Limited spreading of fertiliser.
- Limited spreading of lime.
- No burning.
- No excavation of new drains or reclaiming heath or bog.
- No removal of hedgerows.
- No recreational off-roading with vehicles.
- No use of poisons or stupefying baits.
- No new forestry plantation.

Field Map Index:

Field Boundary

New hedgerow planted with suitable shrub and trees such as Willow, Gorse, Birch, Mountain Ash.

Areas to be planted with woody scrub such as Willow, Alder, Birch

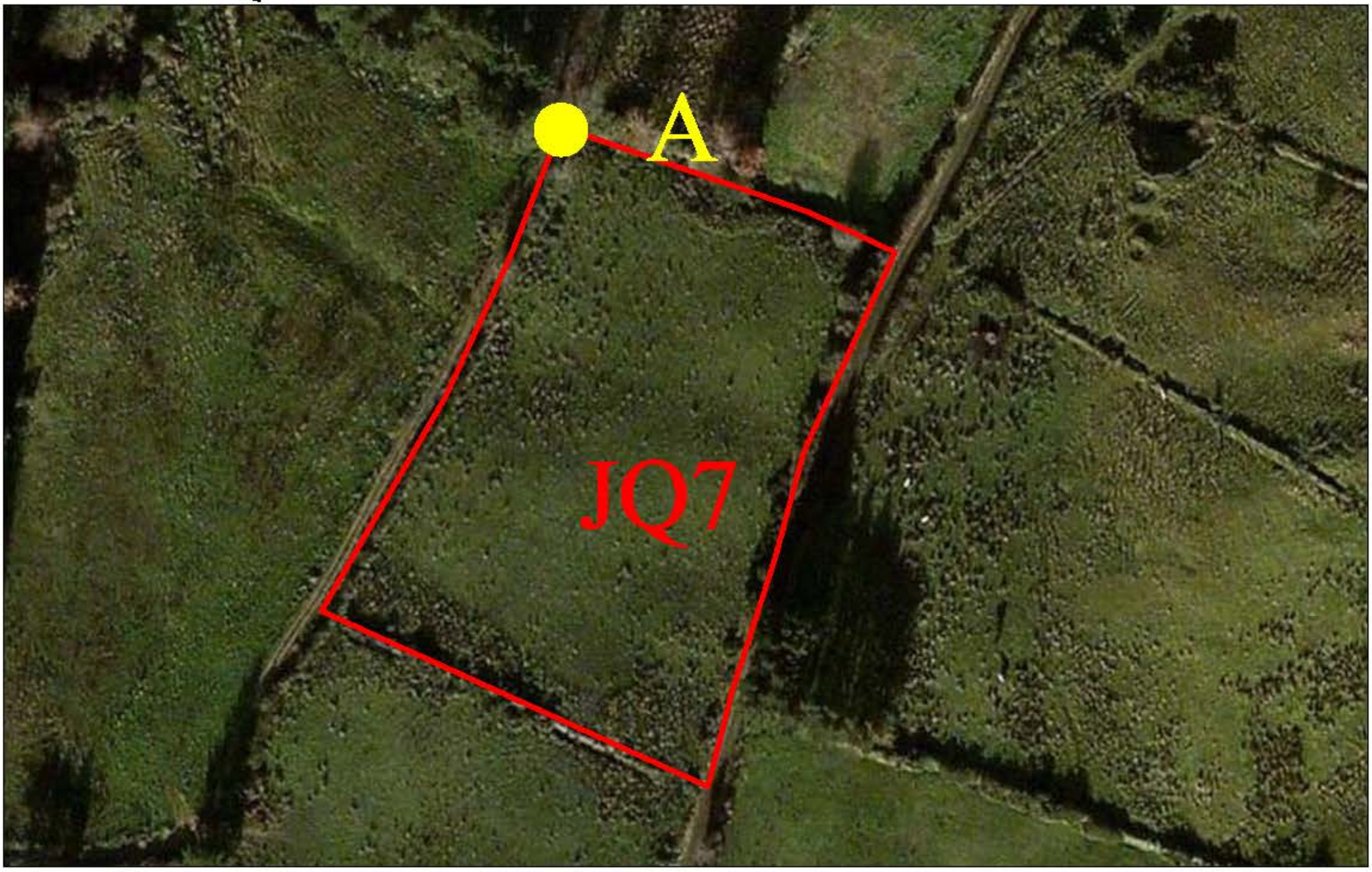
Areas to be planted with woody scrub and suitable trees. Stockproof fencing will be erected to exclude access by livestock.

A Photograph Locations

Photographs of Field JQ7

Photograph A looking southeast

Field ID: JQ7



Field Description: Mix of agricultural grassland and wet grassland.

Field Size: 1.0Ha

Measures:
- Achieve 30 - 70% rush coverage.
- Rush coverage is controlled with cutting every second year.
- Rush coverage is controlled with grazing.
- Minimum stocking level of 0.6 LU/Ha and maximum stocking level of 1.6 LU/Ha (to be reviewed by project ecologist in year 3).
- Mark some lines of electric fence with plastic fliers so that they are more visible to the hen harrier.

Restrictions:
- Limited spreading of fertiliser.
- Limited spreading of lime.
- No burning.
- No excavation of new drains or reclaiming heath or bog.
- No removal of hedgerows.
- No recreational off-roading with vehicles.
- No use of poisons or stupefying baits.
- No new forestry plantation.

Field Map Index:

Field Boundary

New hedgerow planted with suitable shrub and trees such as Willow, Gorse, Birch, Mountain Ash.

Areas to be planted with woody scrub such as Willow, Alder, Birch

Areas to be planted with woody scrub and suitable trees. Stockproof fencing will be erected to exclude access by livestock.

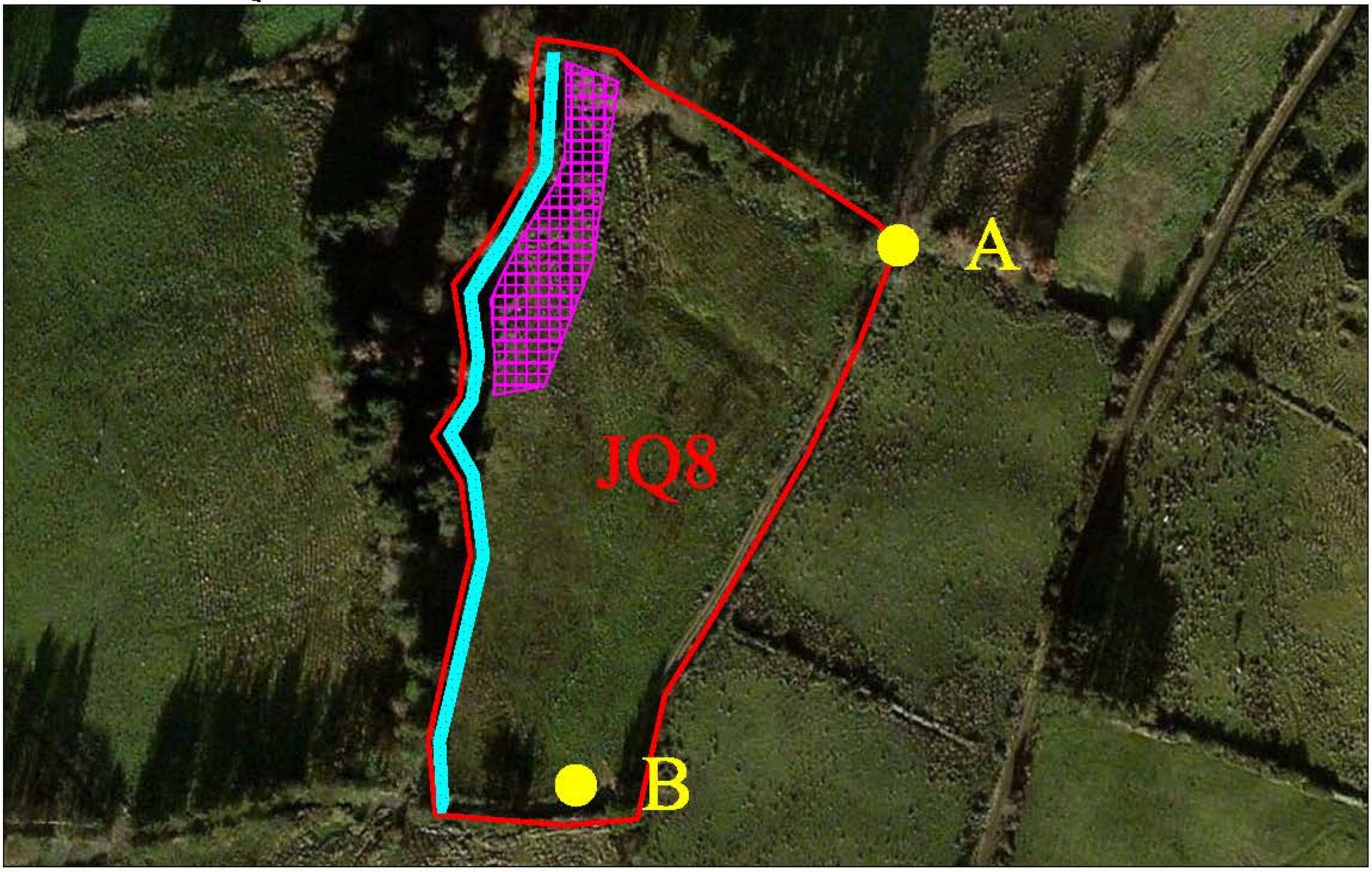
A Photograph Locations

Photographs of Field JQ8


Photograph A looking southwest


Photograph B looking north

Field ID: JQ8



Field Description: Mix of agricultural grassland and wet grassland with riparian corridor.

Field Size: 1.8Ha

Measures:
- Achieve 30 - 70% rush coverage.
- Rush coverage is controlled with cutting every second year.
- Rush coverage is controlled with grazing.
- Minimum stocking level of 0.6 LU/Ha and maximum stocking level of 1.6 LU/Ha (to be reviewed by project ecologist in year 3).
- Mark some lines of electric fence with plastic fliers so that they are more visible to the hen harrier.
- Fence off and maintain 0.15Ha enclosure along the riparian corridor.
- Enhance riparian corridor: Plant native broadleaved species.
- Enhance riparian corridor: Erect fencing to make stockproof and exclude access to river by livestock.

Restrictions:
- Limited spreading of fertiliser.
- Limited spreading of lime.
- No burning.
- No excavation of new drains or reclaiming heath or bog.
- No removal of hedgerows.
- No recreational off-roading with vehicles.
- No use of poisons or stupefying baits.
- No new forestry plantation.

Field Map Index:

Field Boundary

New hedgerow planted with suitable shrub and trees such as Willow, Gorse, Birch, Mountain Ash.

Areas to be planted with woody scrub such as Willow, Alder, Birch

Areas to be planted with woody scrub and suitable trees. Stockproof fencing will be erected to exclude access by livestock.

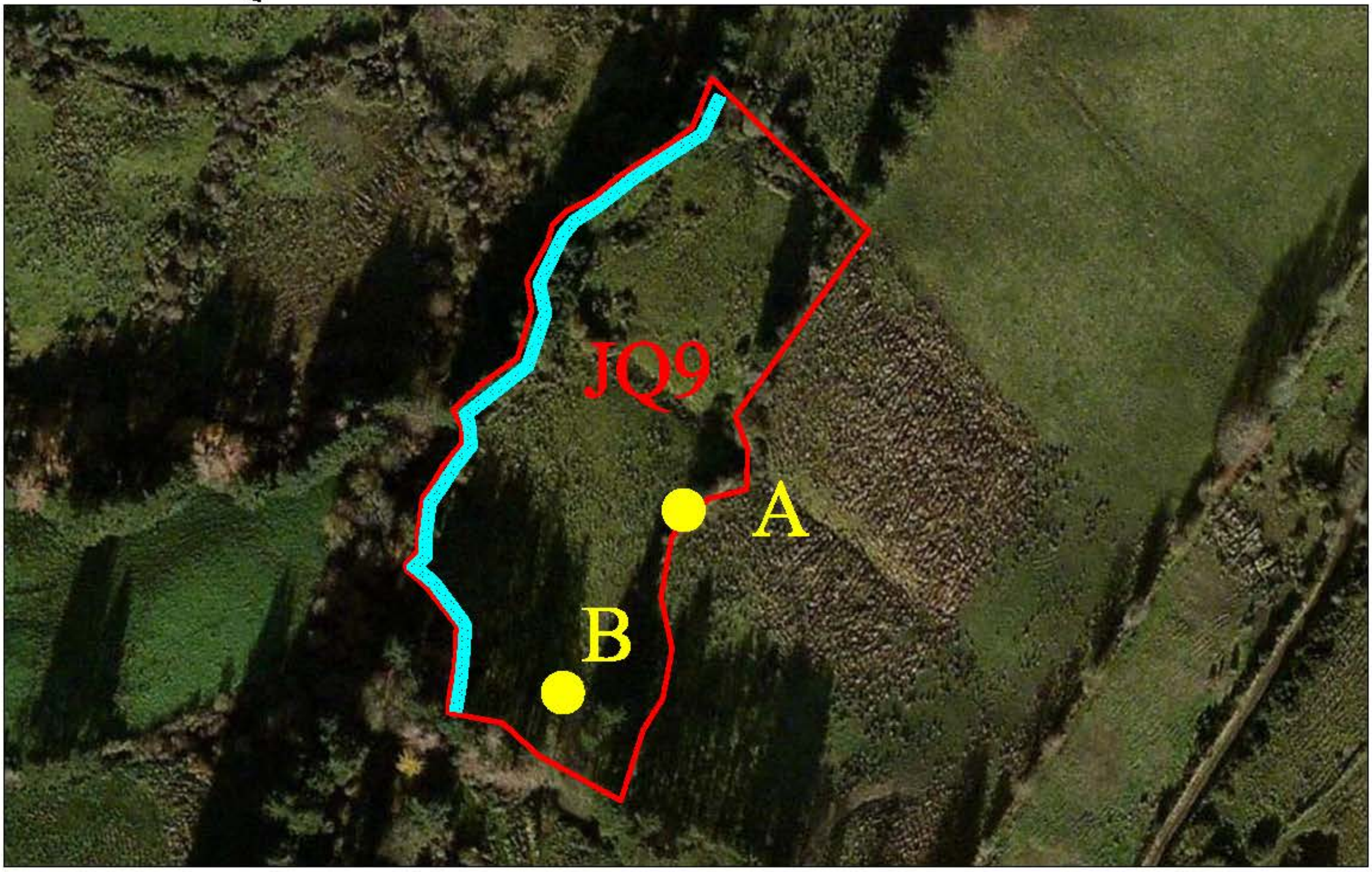
Photograph Locations

Photographs of Field JQ9

Photograph A looking north

Photograph B looking northwest

Field ID: JQ9



Field Description: Mix of agricultural grassland and wet grassland with riparian corridor.

Field Size: 1.2Ha

Measures:

- Field will be allowed to revert back to wet grassland.
- Achieve 30 - 70% rush coverage.
- Rush coverage is controlled with cutting every second year.
- Rush coverage is controlled with grazing.
- Minimum stocking level of 0.6 LU/Ha and maximum stocking level of 1.6 LU/Ha (to be reviewed by project ecologist in year 3).
- Mark some lines of electric fence with plastic fliers so that they are more visible to the hen harrier.
- Enhance riparian corridor: Plant native broadleaved species.
- Enhance riparian corridor:Erect fencing to make stockproof and exclude access to river by livestock.

Restrictions:

- Limited spreading of fertiliser.
- Limited spreading of lime.
- No burning.
- No excavation of new drains or reclaiming heath or bog.
- No removal of hedgerows.
- No recreational off-roading with vehicles.
- No use of poisons or stupefying baits.
- No new forestry plantation.

Field Map Index:

Field Boundary

New hedgerow planted with suitable shrub and trees such as Willow, Gorse, Birch, Mountain Ash.

Areas to be planted with woody scrub such as Willow, Alder, Birch

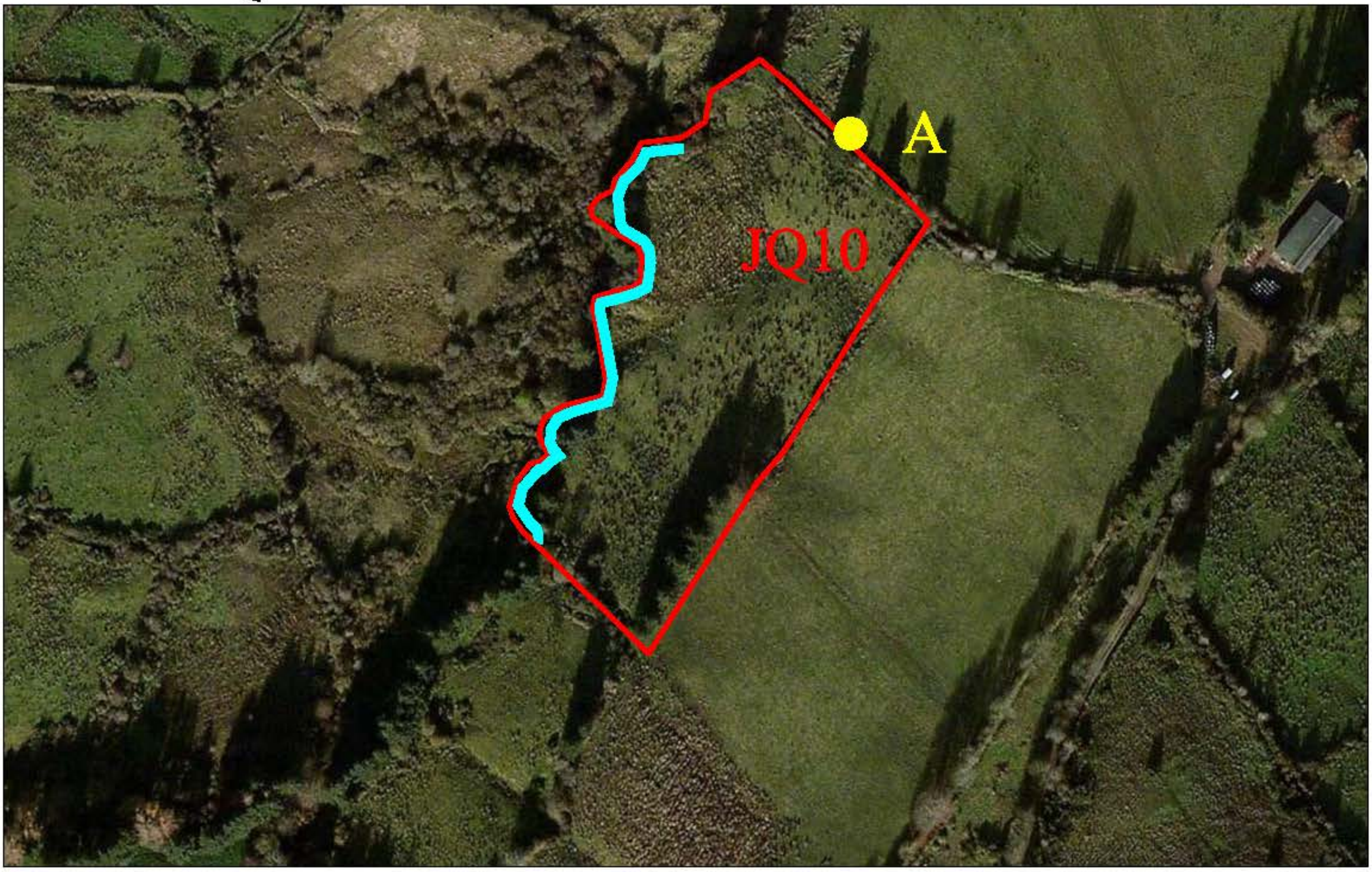
Areas to be planted with woody scrub and suitable trees. Stockproof fencing will be erected to exclude access by livestock.

A Photograph Locations

Photographs of Field JQ10

Photograph A looking southwest

Field ID: JQ10



Field Description: Mix of agricultural grassland and wet grassland with riparian corridor.

Field Size: 1.7Ha

Measures:
- Field will be allowed to revert back to wet grassland.
- Achieve 30 - 70% rush coverage.
- Rush coverage is controlled with cutting every second year.
- Rush coverage is controlled with grazing.
- Minimum stocking level of 0.6 LU/Ha and maximum stocking level of 1.6 LU/Ha (to be reviewed by project ecologist in year 3).
- Mark some lines of electric fence with plastic fliers so that they are more visible to the hen harrier.
- Enhance riparian corridor: Plant native broadleaved species.
- Enhance riparian corridor:Erect fencing to make stockproof and exclude access to river by livestock.

Restrictions:
- Limited spreading of fertiliser.
- Limited spreading of lime.
- No burning.
- No excavation of new drains or reclaiming heath or bog.
- No removal of hedgerows.
- No recreational off-roading with vehicles.
- No use of poisons or stupefying baits.
- No new forestry plantation.

Field Map Index:

Field Boundary

New hedgerow planted with suitable shrub and trees such as Willow, Gorse, Birch, Mountain Ash.

Areas to be planted with woody scrub such as Willow, Alder, Birch

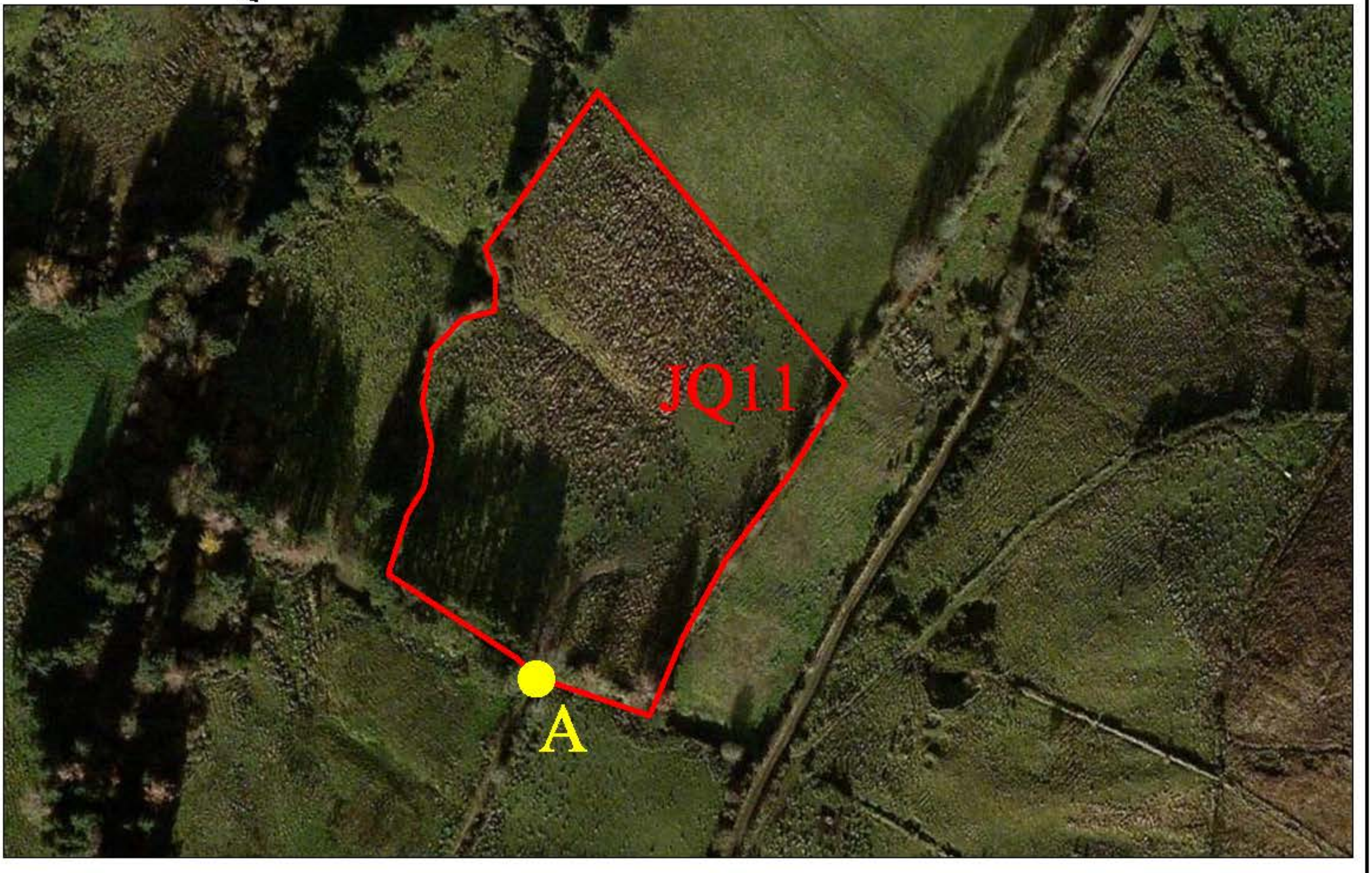
Areas to be planted with woody scrub and suitable trees. Stockproof fencing will be erected to exclude access by livestock.

A Photograph Locations

Photographs of Field JQ11

Photograph A looking north

Field ID: JQ11



Field Description: Mix of agricultural grassland and wet grassland.

Field Size: 1.7Ha

Measures:
- Achieve 30 - 70% rush coverage.
- Rush coverage is controlled with cutting every second year.
- Rush coverage is controlled with grazing.
- Minimum stocking level of 0.6 LU/Ha and maximum stocking level of 1.6 LU/Ha (to be reviewed by project ecologist in year 3).
- Mark some lines of electric fence with plastic fliers so that they are more visible to the hen harrier.

Restrictions:
- Limited spreading of fertiliser.
- Limited spreading of lime.
- No burning.
- No excavation of new drains or reclaiming heath or bog.
- No removal of hedgerows.
- No recreational off-roading with vehicles.
- No use of poisons or stupefying baits.
- No new forestry plantation.

Field Map Index:

Field Boundary

New hedgerow planted with suitable shrub and trees such as Willow, Gorse, Birch, Mountain Ash.

Areas to be planted with woody scrub such as Willow, Alder, Birch

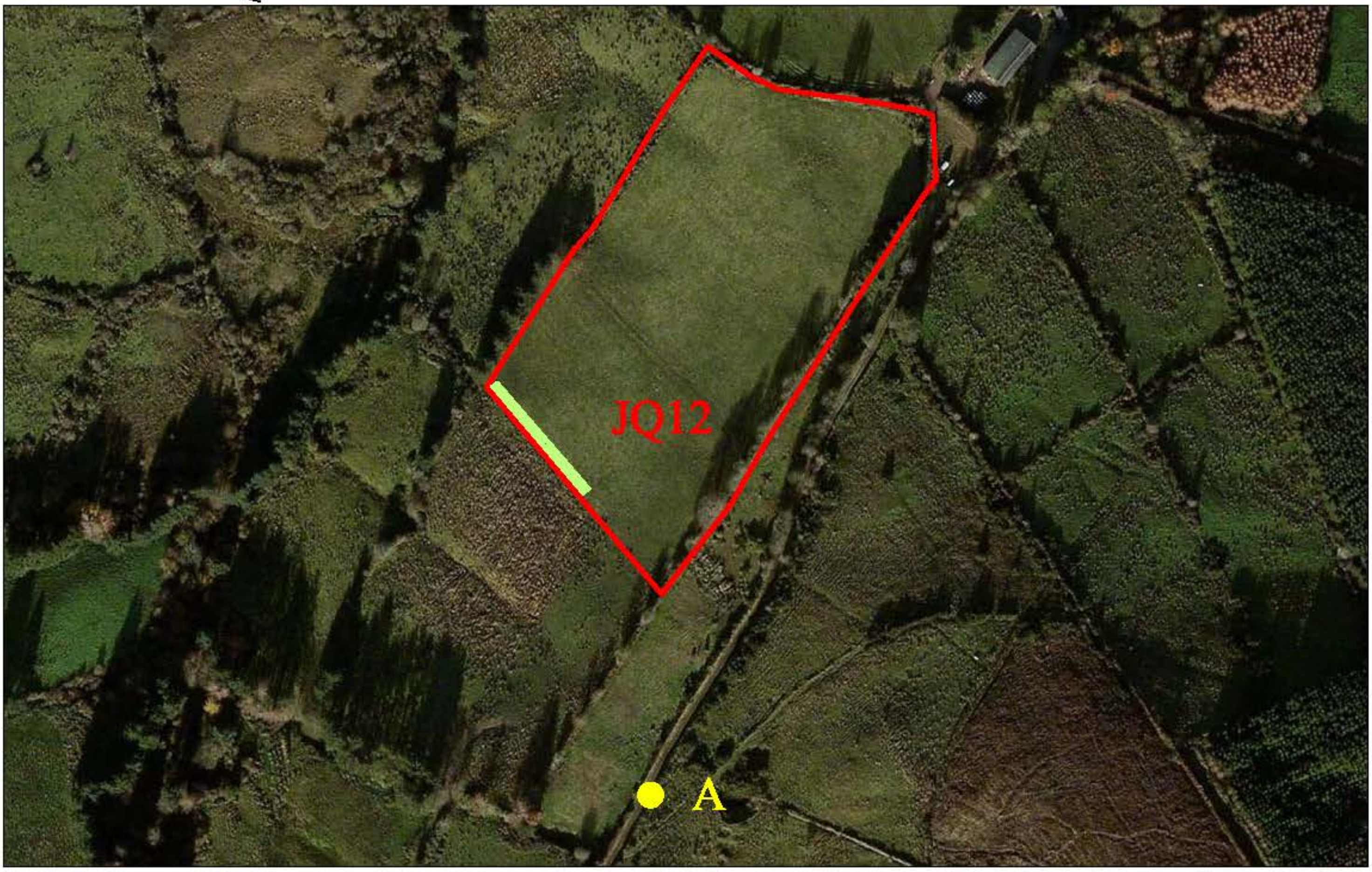
Areas to be planted with woody scrub and suitable trees. Stockproof fencing will be erected to exclude access by livestock.

A Photograph Locations

Photographs of Field JQ12

Photograph A looking west

Field ID: JQ12



Field Description: Mix of agricultural grassland and wet grassland.

Field Size: 2.6Ha

Measures:

- Achieve 30 - 70% rush coverage.
- Rush coverage is controlled with cutting every second year.
- Rush coverage is controlled with grazing.
- Minimum stocking level of 0.6 LU/Ha and maximum stocking level of 1.6 LU/Ha (to be reviewed by project ecologist in year 3).
- Mark some lines of electric fence with plastic fliers so that they are more visible to the hen harrier.
- Plant 65m of hedgerow

Restrictions:

- Limited spreading of fertiliser.
- Limited spreading of lime.
- No burning.
- No excavation of new drains or reclaiming heath or bog.
- No removal of hedgerows.
- No recreational off-roading with vehicles.
- No use of poisons or stupefying baits.
- No new forestry plantation.

Field Map Index:

Field Boundary

New hedgerow planted with suitable shrub and trees such as Willow, Gorse, Birch, Mountain Ash.

Areas to be planted with woody scrub such as Willow, Alder, Birch

Areas to be planted with woody scrub and suitable trees. Stockproof fencing will be erected to exclude access by livestock.

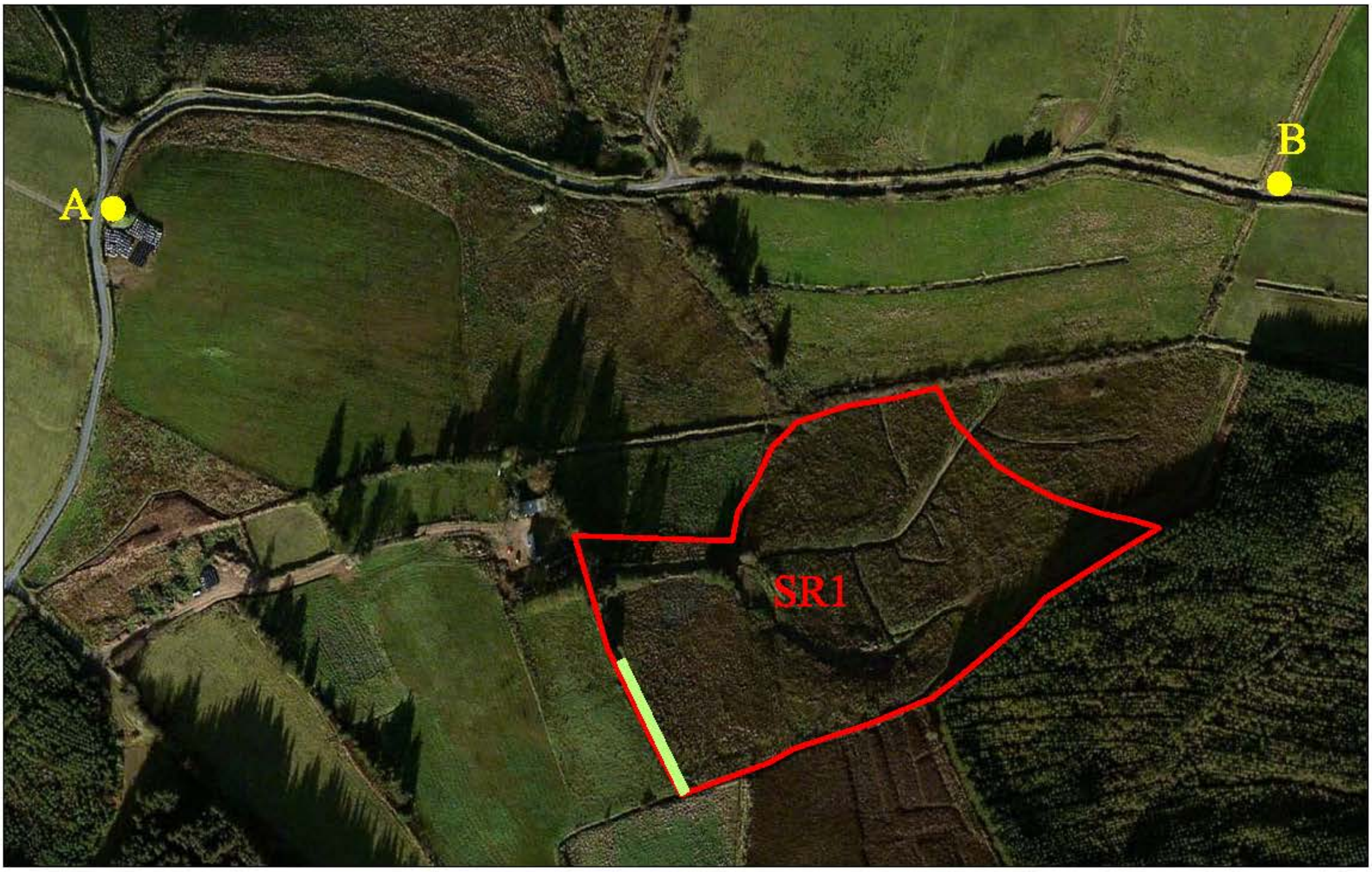
A Photograph Locations

Photographs of Field SR1

Photograph A looking southeast

Photograph B looking southwest

Field ID: SR1



Field Description: Wet grassland

Field Size: 2.8Ha

Measures:

- Field will be maintained as wet grassland.
- Achieve 30 - 70% rush coverage.
- Rush coverage is controlled with cutting every second year.
- Rush coverage is controlled with grazing.
- Minimum stocking level of 0.6 LU/Ha and maximum stocking level of 1.6 LU/Ha (to be reviewed by project ecologist in year 3).
- Mark some lines of electric fence with plastic fliers so that they are more visible to the hen harrier.
- Plant 70m of hedgerow

Restrictions:

- No speading of fertilizer
- No spreading of lime.
- No burning.
- No excavation of new drains or reclaiming heath or bog.
- No removal of hedgerows.
- No recreational off-roading with vehicles.
- No use of poisons or stupefying baits.
- No new forestry plantation.

Field Map Index:

Field Boundary

New hedgerow planted with suitable shrub and trees such as Willow, Gorse, Birch, Mountain Ash.

Areas to be planted with woody scrub such as Willow, Alder, Birch

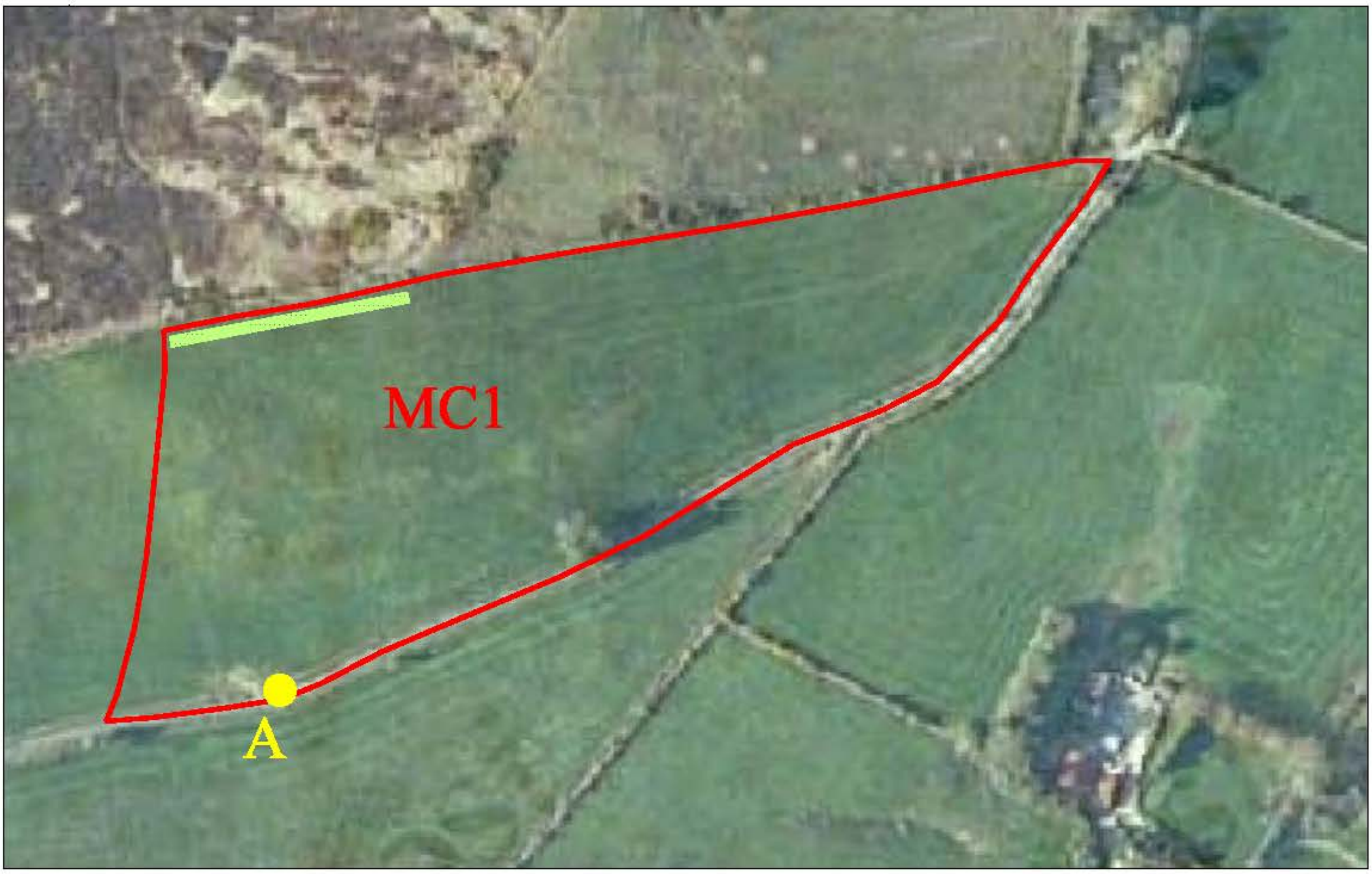
Areas to be planted with woody scrub and suitable trees. Stockproof fencing will be erected to exclude access by livestock.

A Photograph Locations

Photographs of Field MC1

Photograph A looking north

Field ID: MC1



Field Description: Mix of agricultural grassland and wet grassland

Field Size: 3.5Ha

Measures:

- Field will be allowed to revert back to wet grassland.
- Achieve 30 - 70% rush coverage.
- Rush coverage is controlled with cutting every second year.
- Rush coverage is controlled with grazing.
- Minimum stocking level of 0.6 LU/Ha and maximum stocking level of 1.6 LU/Ha (to be reviewed by project ecologist in year 3).
- Mark some lines of electric fence with plastic fliers so that they are more visible to the hen harrier.
- Plant 88m of hedgerow

Restrictions:

- Limited spreading of lime.
- No burning.
- No excavation of new drains or reclaiming heath or bog.
- No removal of hedgerows.
- No recreational off-roading with vehicles.
- No use of poisons or stupefying baits.
- No new forestry plantation.

Field Map Index:

Field Boundary

New hedgerow planted with suitable shrub and trees such as Willow, Gorse, Birch, Mountain Ash.

Areas to be planted with woody scrub such as Willow, Alder, Birch

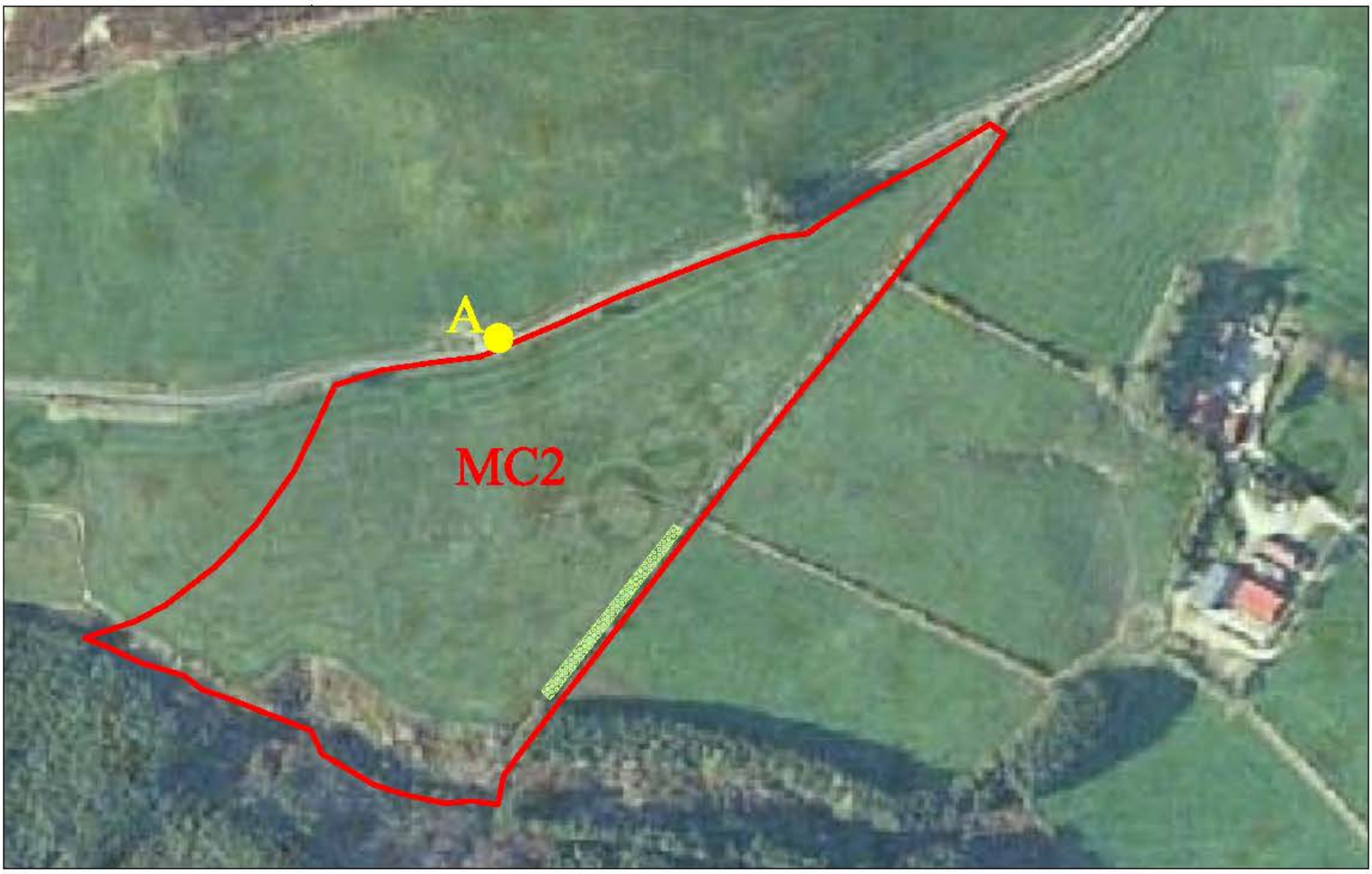
Areas to be planted with woody scrub and suitable trees. Stockproof fencing will be erected to exclude access by livestock.

A Photograph Locations

Photographs of Field MC2

Photograph A looking southwest

Field ID: MC2



Field Description: Mix of agricultural grassland and wet grassland

Field Size: 3.5Ha

Measures:

- Field will be allowed to revert back to wet grassland.
- Achieve 30 - 70% rush coverage.
- Rush coverage is controlled with cutting every second year.
- Rush coverage is controlled with grazing.
- Minimum stocking level of 0.6 LU/Ha and maximum stocking level of 1.6 LU/Ha (to be reviewed by project ecologist in year 3).
- Mark some lines of electric fence with plastic fliers so that they are more visible to the hen harrier.
- Plant 88m of hedgerow

Restrictions:

- Limited spreading of lime.
- No burning.
- No excavation of new drains or reclaiming heath or bog.
- No removal of hedgerows.
- No recreational off-roading with vehicles.
- No use of poisons or stupefying baits.
- No new forestry plantation.

Field Map Index:

Field Boundary

New hedgerow planted with suitable shrub and trees such as Willow, Gorse, Birch, Mountain Ash.

Areas to be planted with woody scrub such as Willow, Alder, Birch

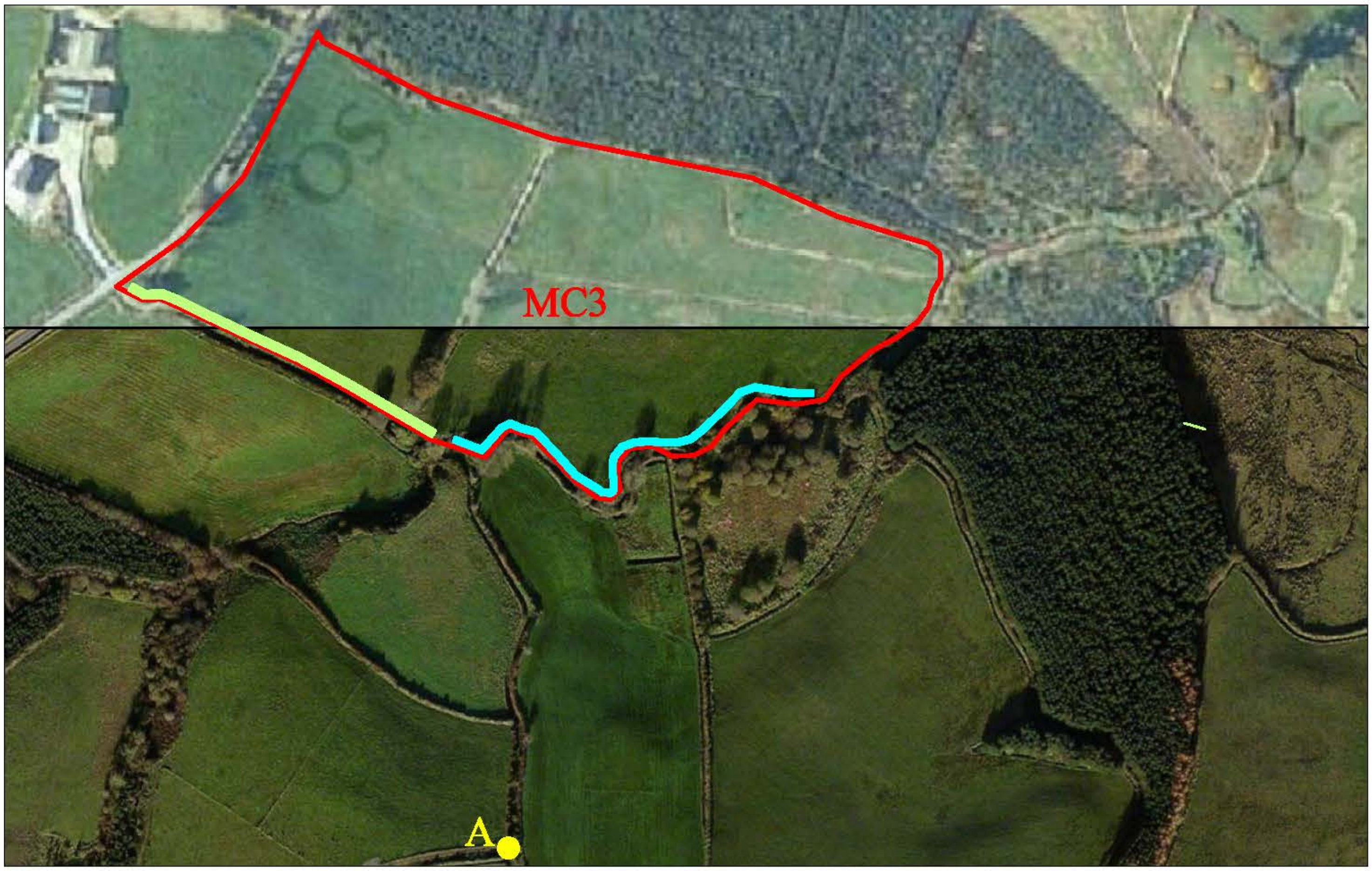
Areas to be planted with woody scrub and suitable trees. Stockproof fencing will be erected to exclude access by livestock.

A Photograph Locations

Photographs of Field MC3

Photograph A looking northt

Field ID: MC3



Field Description: Mix of agricultural grassland and wet grassland

Field Size: 5.4Ha

Measures:
- Field will be allowed to revert back to wet grassland.
- Achieve 30 - 70% rush coverage.
- Rush coverage is controlled with cutting every second year.
- Rush coverage is controlled with grazing.
- Minimum stocking level of 0.6 LU/Ha and maximum stocking level of 1.6 LU/Ha (to be reviewed by project ecologist in year 3).
- Mark some lines of electric fence with plastic fliers so that they are more visible to the hen harrier.
- Enhance riparian corridor: Plant native broadleaved species.
- Plant 180m of hedgerow

Restrictions:
- Limited spreading of lime.
- No burning.
- No excavation of new drains or reclaiming heath or bog.
- No removal of hedgerows.
- No recreational off-roading with vehicles.
- No use of poisons or stupefying baits.
- No new forestry plantation.

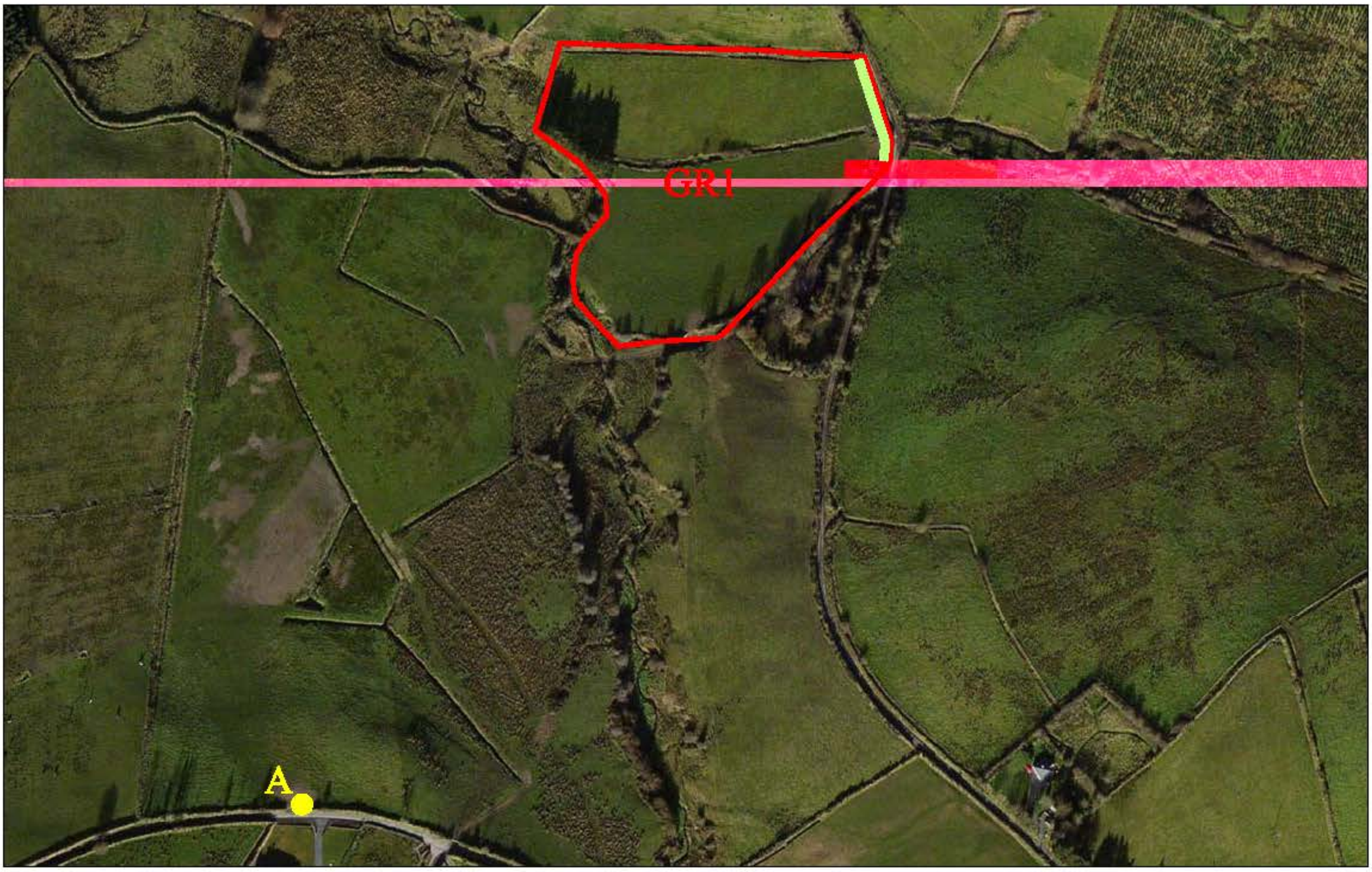
Field Map Index:

(red line)	Field Boundary
(light green line)	New hedgerow planted with suitable shrub and trees such as Willow, Gorse, Birch, Mountain Ash.
(cyan line)	Areas to be planted with woody scrub such as Willow, Alder, Birch
(magenta line)	Areas to be planted with woody scrub and suitable trees. Stockproof fencing will be erected to exclude access by livestock.
A	Photograph Locations

Photograph of Field GR1

Photograph A looking northeast

Field ID: GR1



Field Description: Agricultural grassland

Field Size: 2.4Ha

Measures:
- Achieve 30 - 70% rush coverage.
- Rush coverage is controlled with cutting every second year.
- Rush coverage is controlled with grazing.
- Minimum stocking level of 0.6 LU/Ha and maximum stocking level of 1.6 LU/Ha (to be reviewed by project ecologist in year 3).
- Mark some lines of electric fence with plastic fliers so that they are more visible to the hen harrier.
- Plant 60m of hedgerow

Restrictions:
- Limited spreading of fertiliser.
- No spreading of lime.
- No burning.
- No excavation of new drains or reclaiming heath or bog.
- No removal of hedgerows.
- No recreational off-roading with vehicles.
- No use of poisons or stupefying baits.
- No new forestry plantation.

Field Map Index:

Field Boundary

New hedgerow planted with suitable shrub and trees such as Willow, Gorse, Birch, Mountain Ash.

Areas to be planted with woody scrub such as Willow, Alder, Birch

Areas to be planted with woody scrub and suitable trees. Stockproof fencing will be erected to exclude access by livestock.

A Photograph Locations

Photograph of Field GR2

Photograph A looking northeast

Field ID: GR2

Field Description: Willow scrub and wet grassland

Field Size: 0.4Ha

Measures:
- Enhance with tree planting.

Restrictions:
- No spreading of fertiliser.
- No spreading of lime.
- No burning.
- No excavation of new drains or reclaiming heath or bog.
- No removal of hedgerows or trees.
- No recreational off-roading with vehicles.
- No use of poisons or stupefying baits.
- No new forestry plantation.

Field Map Index:

Field Boundary

New hedgerow planted with suitable shrub and trees such as Willow, Gorse, Birch, Mountain Ash.

Areas to be planted with woody scrub such as Willow, Alder, Birch

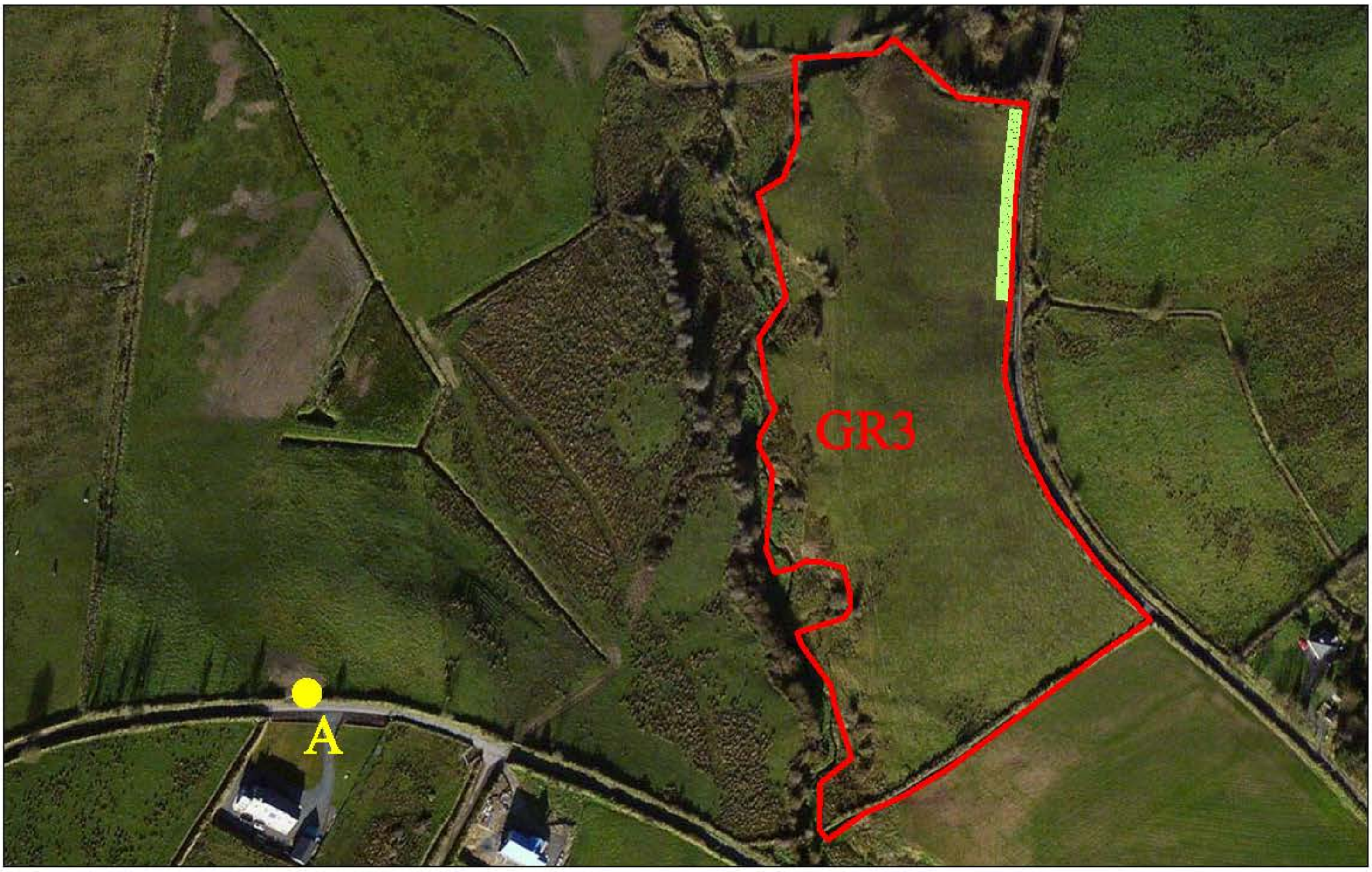
Areas to be planted with woody scrub and suitable trees. Stockproof fencing will be erected to exclude access by livestock.

A Photograph Locations

Photograph of Field GR3

Photograph A looking east-northeast

Field ID: GR3



Field Description: Mix of agricultural grassland and wet grassland with a riparian corridor

Field Size: 3.0 Ha

Measures:
- Field will be allowed to revert back to wet grassland.
- Achieve 30 - 70% rush coverage.
- Rush coverage is controlled with cutting every second year.
- Rush coverage is controlled with grazing.
- Minimum stocking level of 0.6 LU/Ha and maximum stocking level of 1.6 LU/Ha (to be reviewed by project ecologist in year 3).
- Mark some lines of electric fence with plastic fliers so that they are more visible to the hen harrier.
- Plant 75m of hedgerow.
- Enhance riparian corridor: Improve with woody scrub.

Restrictions:
- Limited spreading of fertiliser.
- No spreading of lime.
- No burning.
- No excavation of new drains or reclaiming heath or bog.
- No removal of hedgerows.
- No recreational off-roading with vehicles.
- No use of poisons or stupefying baits.
- No new forestry plantation.

Field Map Index:

Field Boundary

New hedgerow planted with suitable shrub and trees such as Willow, Gorse, Birch, Mountain Ash.

Areas to be planted with woody scrub such as Willow, Alder, Birch

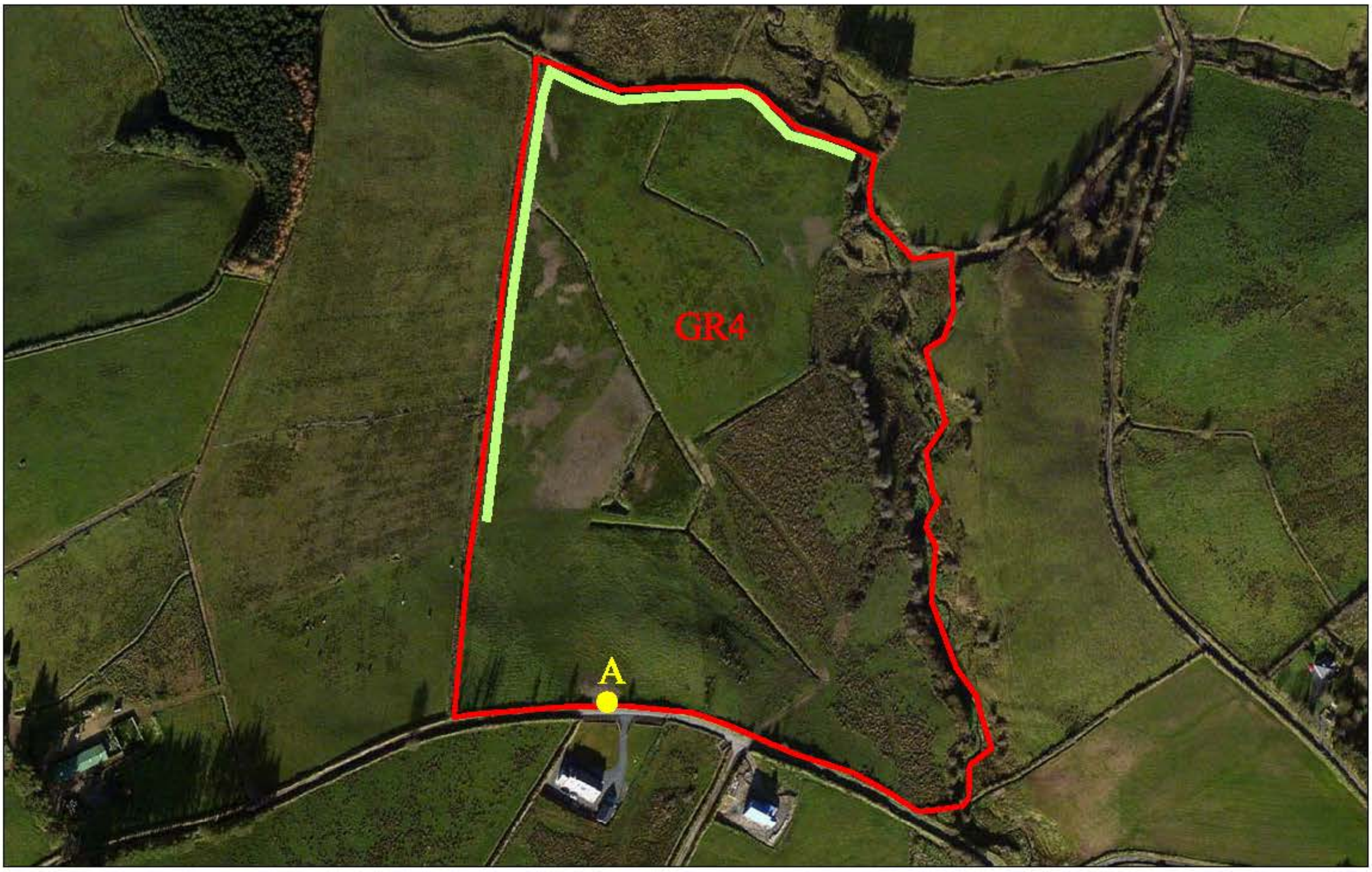
Areas to be planted with woody scrub and suitable trees. Stockproof fencing will be erected to exclude access by livestock.

A Photograph Locations

Photograph of Field GR4

Photograph A looking north

Field ID: GR4



Field Description: Mix of agricultural grassland and wet grassland with a riparian corridor

Field Size: 9.1Ha

Measures:
- Field will be allowed to revert back to wet grassland.
- Achieve 30 - 70% rush coverage.
- Rush coverage is controlled with cutting every second year.
- Rush coverage is controlled with grazing.
- Minimum stocking level of 0.6 LU/Ha and maximum stocking level of 1.6 LU/Ha (to be reviewed by project ecologist in year 3).
- Mark some lines of electric fence with plastic fliers so that they are more visible to the hen harrier.
- Plant 410m of hedgerow.
- Enhance riparian corridor: Improve with woody scrub.

Restrictions:
- Limited spreading of fertiliser.
- No spreading of lime.
- No burning.
- No excavation of new drains or reclaiming heath or bog.
- No removal of hedgerows.
- No recreational off-roading with vehicles.
- No use of poisons or stupefying baits.
- No new forestry plantation.

Field Map Index:

Field Boundary

New hedgerow planted with suitable shrub and trees such as Willow, Gorse, Birch, Mountain Ash.

Areas to be planted with woody scrub such as Willow, Alder, Birch

Areas to be planted with woody scrub and suitable trees. Stockproof fencing will be erected to exclude access by livestock.

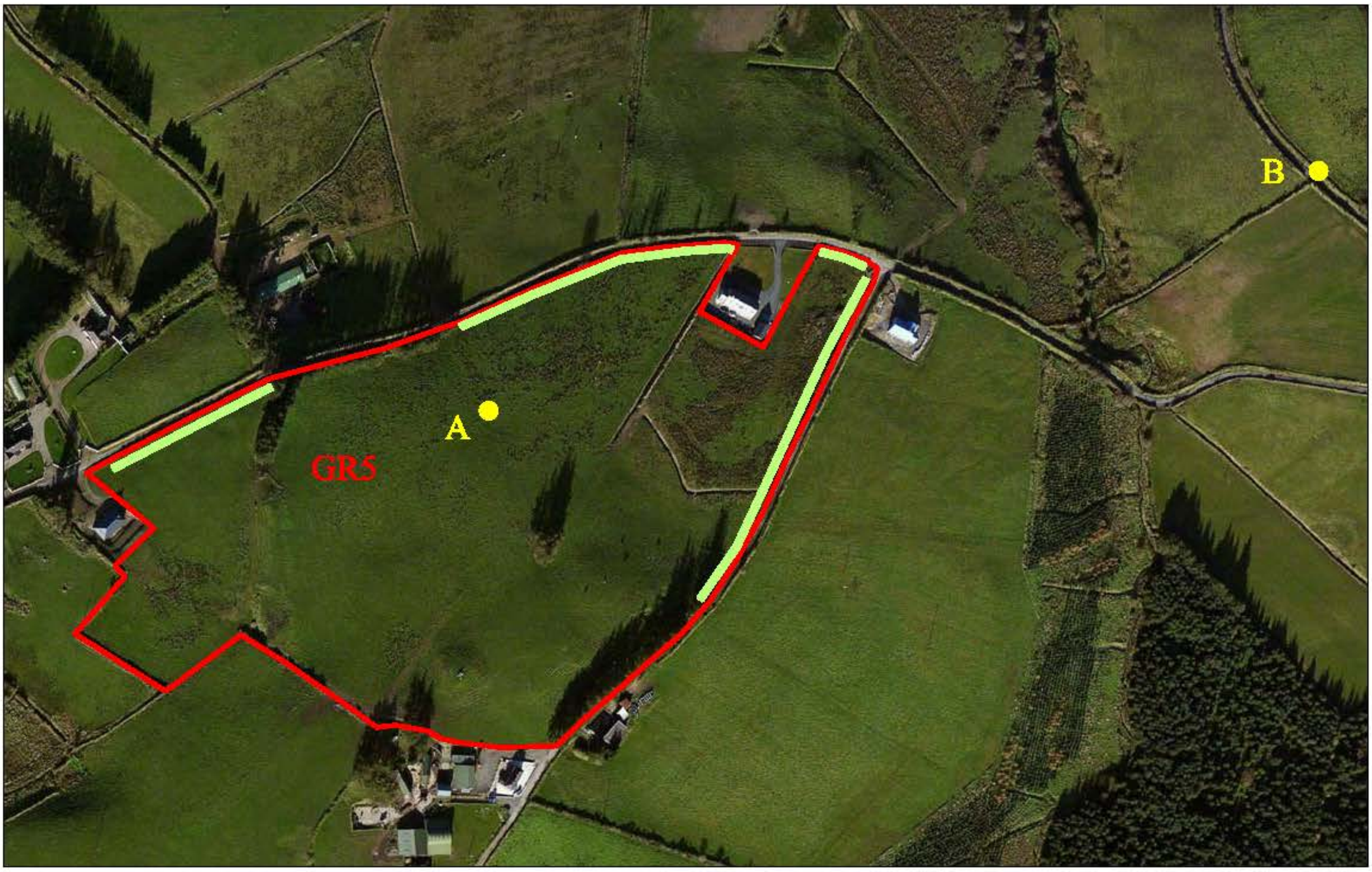
A Photograph Locations

Photographs of Field GR5

Photograph A looking southeast

Photograph B looking southwest

Field ID: GR5



Field Description: Mix of agricultural grassland and wet grassland.

Field Size: 9.4Ha

Measures:
- Field will be allowed to revert back to wet grassland.
- Achieve 30 - 70% rush coverage.
- Rush coverage is controlled with cutting every second year.
- Rush coverage is controlled with grazing.
- Minimum stocking level of 0.6 LU/Ha and maximum stocking level of 1.6 LU/Ha (to be reviewed by project ecologist in year 3).
- Mark some lines of electric fence with plastic fliers so that they are more visible to the hen harrier.
- Plant 540m of hedgerow.

Restrictions:
- Limited spreading of fertiliser.
- No spreading of lime.
- No burning.
- No excavation of new drains or reclaiming heath or bog.
- No removal of hedgerows.
- No recreational off-roading with vehicles.
- No use of poisons or stupefying baits.
- No new forestry plantation.

Field Map Index:

Field Boundary

New hedgerow planted with suitable shrub and trees such as Willow, Gorse, Birch, Mountain Ash.

Areas to be planted with woody scrub such as Willow, Alder, Birch

Areas to be planted with woody scrub and suitable trees. Stockproof fencing will be erected to exclude access by livestock.

A Photograph Locations

Photographs of Field PQ1

Photograph A looking southeast

Field ID: PQ1

Field Description: Mix of agricultural grassland and wet grassland.

Field Size: 2.1Ha

Measures:
- Achieve 30 - 70% rush coverage.
- Rush coverage is controlled with cutting every second year.
- Rush coverage is controlled with grazing.
- Minimum stocking level of 0.6 LU/Ha and maximum stocking level of 1.6 LU/Ha (to be reviewed by project ecologist in year 3).
- Mark some lines of electric fence with plastic fliers so that they are more visible to the hen harrier.
- Plant 53m of hedgerow

Restrictions:
- Limited spreading of fertiliser.
- Limited spreading of lime.
- No burning.
- No excavation of new drains or reclaiming heath or bog.
- No removal of hedgerows.
- No recreational off-roading with vehicles.
- No use of poisons or stupefying baits.
- No new forestry plantation.

Field Map Index:

Field Boundary

New hedgerow planted with suitable shrub and trees such as Willow, Gorse, Birch, Mountain Ash.

Areas to be planted with woody scrub such as Willow, Alder, Birch

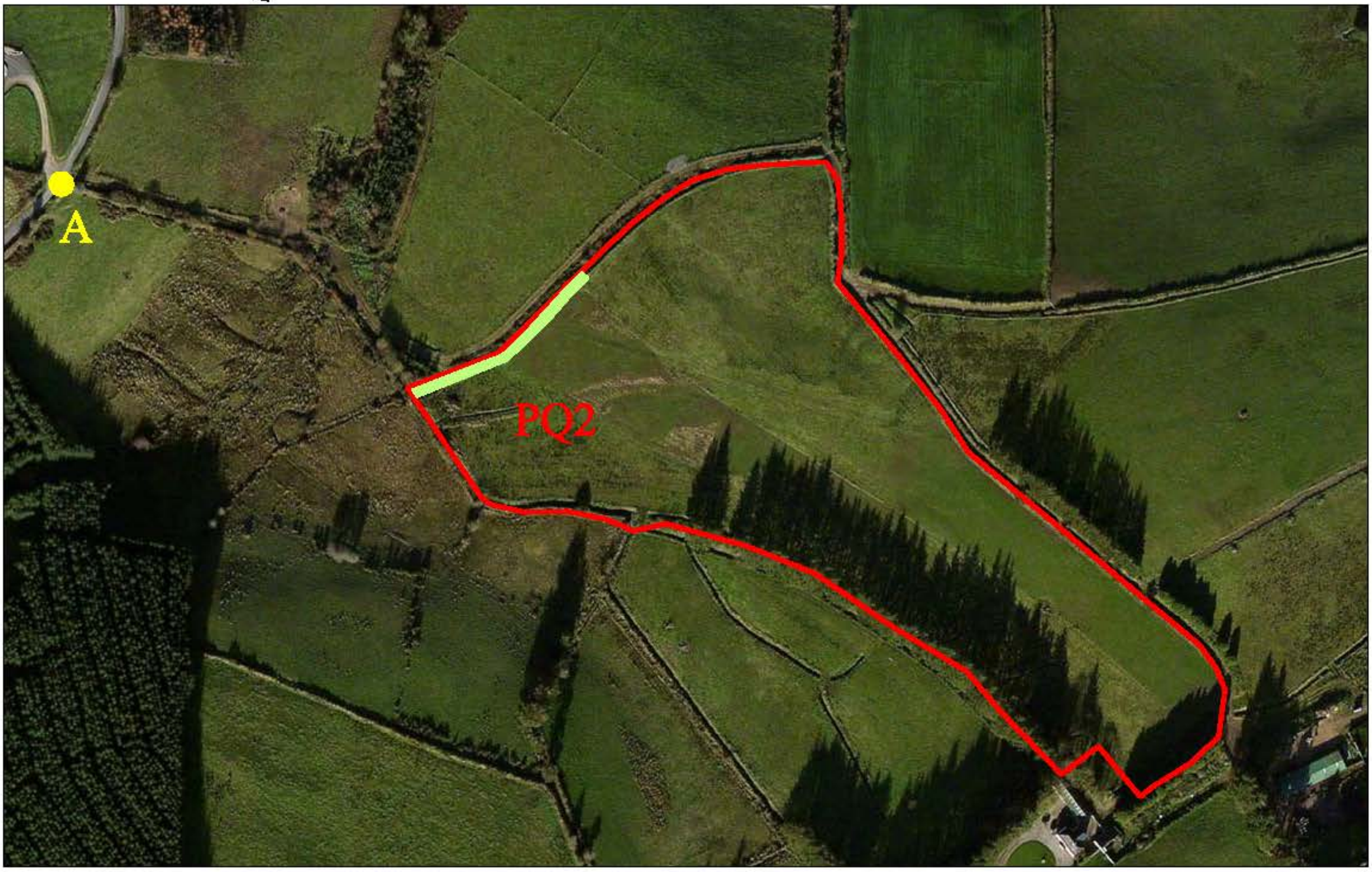
Areas to be planted with woody scrub and suitable trees. Stockproof fencing will be erected to exclude access by livestock.

A Photograph Locations

Photographs of Field PQ2

Photograph A looking southeast

Field ID: PQ2



Field Description: Mix of agricultural grassland and wet grassland.

Field Size: 4.5Ha

Measures:
- Achieve 30 - 70% rush coverage.
- Rush coverage is controlled with cutting every second year.
- Rush coverage is controlled with grazing.
- Minimum stocking level of 0.6 LU/Ha and maximum stocking level of 1.6 LU/Ha (to be reviewed by project ecologist in year 3). Mark some lines of electric fence with plastic fliers so that they are more visible to the hen harrier.
- Plant 100m of hedgerow

Restrictions:
- Limited spreading of fertiliser.
- Limited spreading of lime.
- No burning.
- No excavation of new drains or reclaiming heath or bog.
- No removal of hedgerows.
- No recreational off-roading with vehicles.
- No use of poisons or stupefying baits.
- No new forestry plantation.

Field Map Index:

Field Boundary

New hedgerow planted with suitable shrub and trees such as Willow, Gorse, Birch, Mountain Ash.

Areas to be planted with woody scrub such as Willow, Alder, Birch

Areas to be planted with woody scrub and suitable trees. Stockproof fencing will be erected to exclude access by livestock.

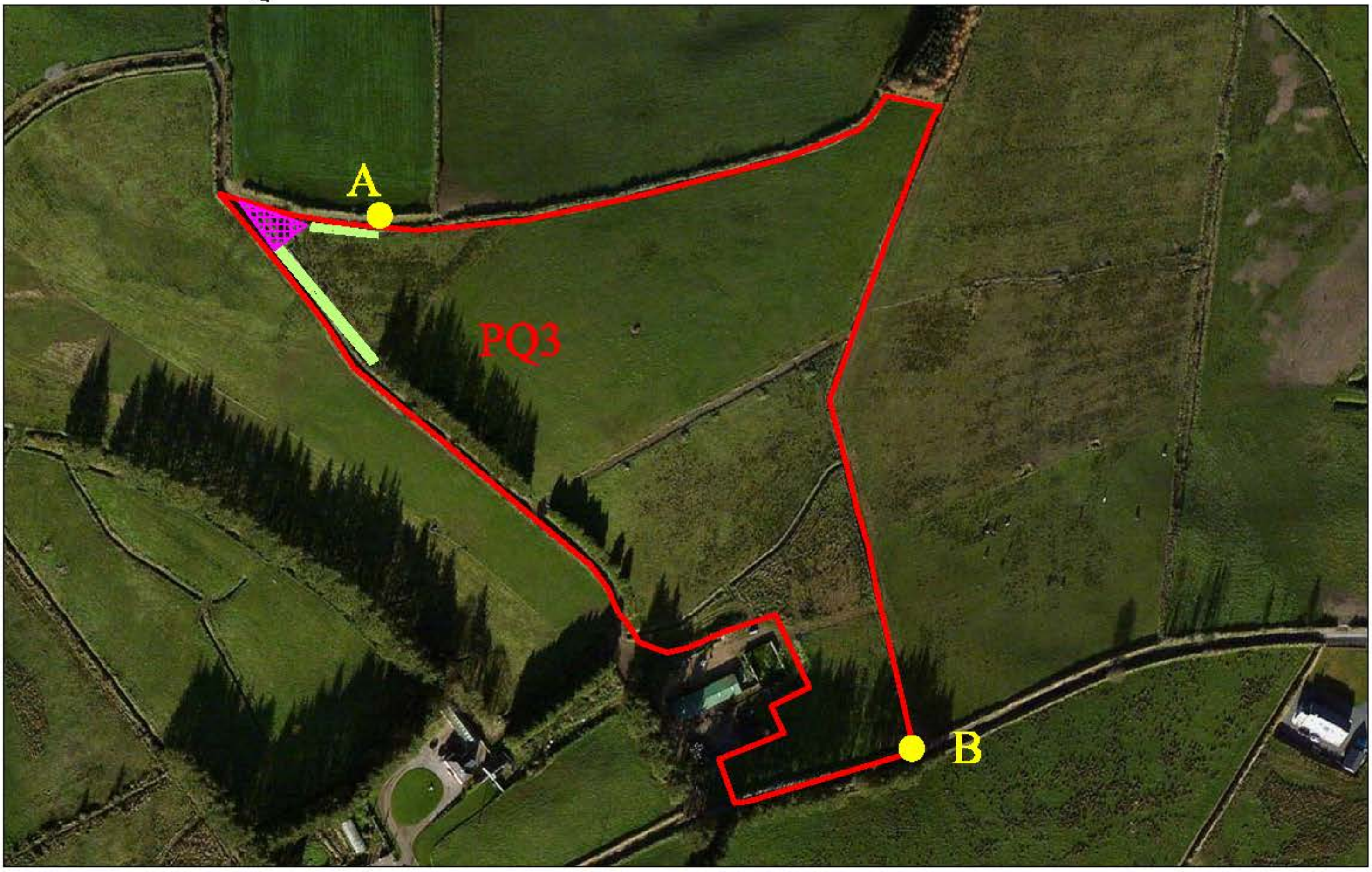
A Photograph Locations

Photographs of Field PQ3

Photograph A looking south-southeast

Photograph B looking northwest

Field ID: PQ3



Field Description: Mix of agricultural grassland and wet grassland.

Field Size: 4.7Ha

Measures:

- Achieve 30 - 70% rush coverage.
- Rush coverage is controlled with cutting every second year.
- Rush coverage is controlled with grazing.
- Minimum stocking level of 0.6 LU/Ha and maximum stocking level of 1.6 LU/Ha (to be reviewed by project ecologist in year 3).
- Mark some lines of electric fence with plastic fliers so that they are more visible to the hen harrier.
- Plant 100m of hedgerow
- Fence off enclosure (0.03Ha) improve with native broadleaved species.

Restrictions:

- Limited spreading of fertiliser.
- Limited spreading of lime.
- No burning.
- No excavation of new drains or reclaiming heath or bog.
- No removal of hedgerows.
- No recreational off-roading with vehicles.
- No use of poisons or stupefying baits.
- No new forestry plantation.

Field Map Index:

Field Boundary

New hedgerow planted with suitable shrub and trees such as Willow, Gorse, Birch, Mountain Ash.

Areas to be planted with woody scrub such as Willow, Alder, Birch

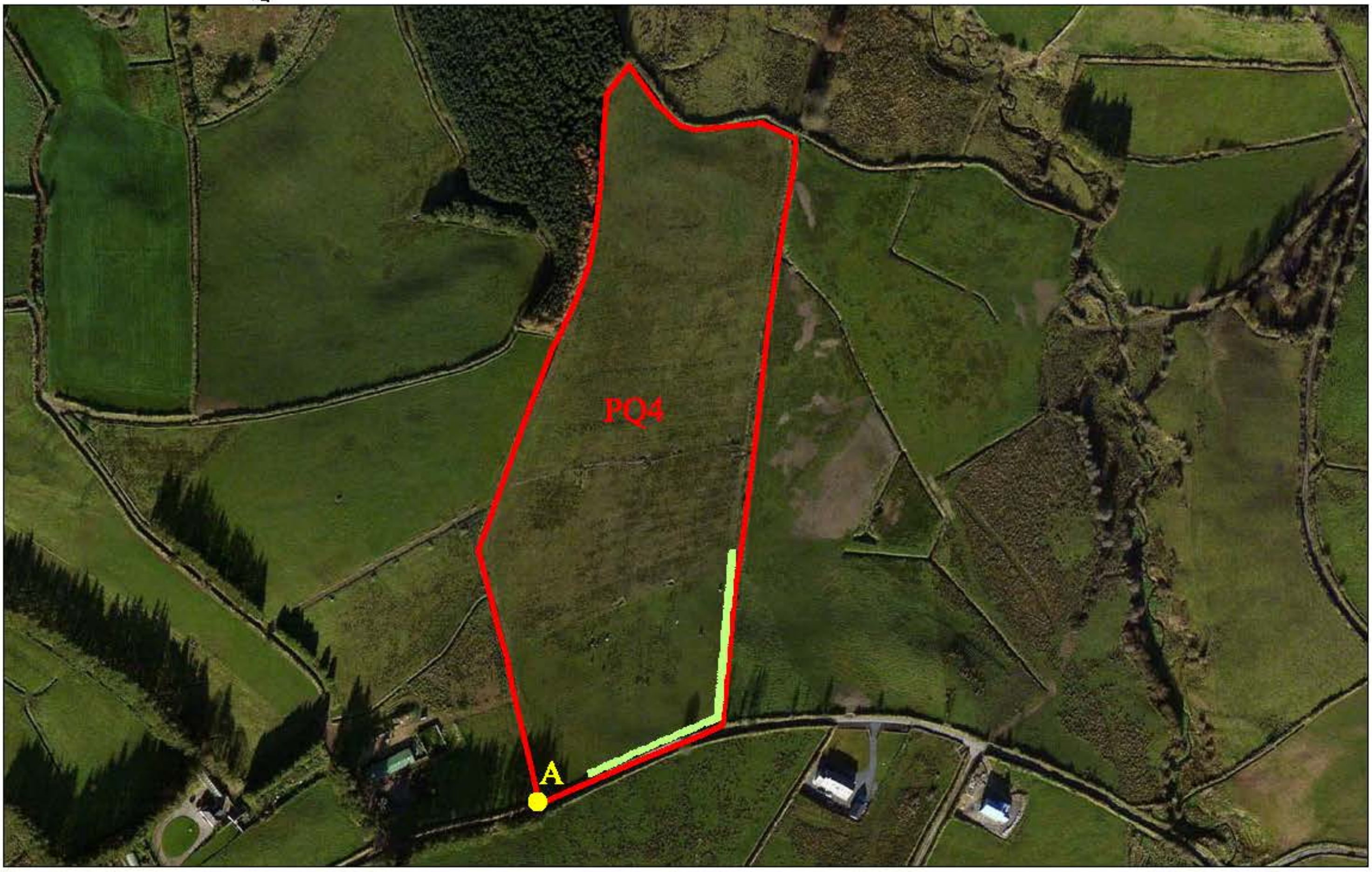
Areas to be planted with woody scrub and suitable trees. Stockproof fencing will be erected to exclude access by livestock.

A Photograph Locations

Photographs of Field PQ4

Photograph A looking northeast

Field ID: PQ4



Field Description: Mix of agricultural grassland and wet grassland.

Field Size: 5.9Ha

Measures:
- Achieve 30 - 70% rush coverage.
- Rush coverage is controlled with cutting every second year.
- Rush coverage is controlled with grazing.
- Minimum stocking level of 0.6 LU/Ha and maximum stocking level of 1.6 LU/Ha (to be reviewed by project ecologist in year 3).
- Mark some lines of electric fence with plastic fliers so that they are more visible to the hen harrier.
- Plant 200m of hedgerow

Restrictions:
- Limited spreading of fertiliser.
- Limited spreading of lime.
- No burning.
- No excavation of new drains or reclaiming heath or bog.
- No removal of hedgerows.
- No recreational off-roading with vehicles.
- No use of poisons or stupefying baits.
- No new forestry plantation.

Field Map Index:

Field Boundary

New hedgerow planted with suitable shrub and trees such as Willow, Gorse, Birch, Mountain Ash.

Areas to be planted with woody scrub such as Willow, Alder, Birch

Areas to be planted with woody scrub and suitable trees. Stockproof fencing will be erected to exclude access by livestock.

A Photograph Locations

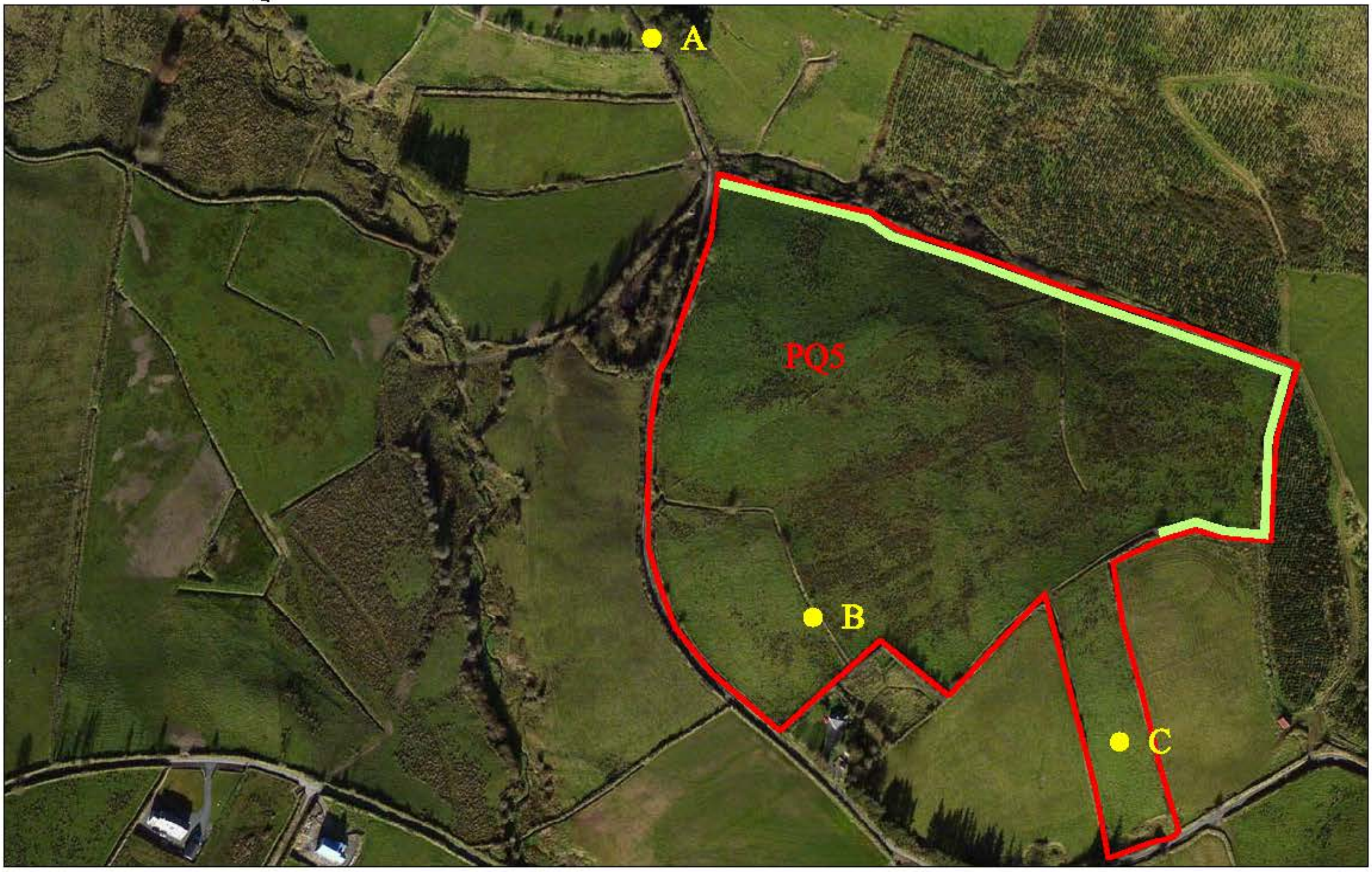
Photographs of Field PQ5

Photograph A looking southeast

Photograph B looking west

Photograph C looking north

Field ID: PQ5



Field Description: Mix of agricultural grassland and wet grassland.

Field Size: 9.8Ha

Measures:
- Achieve 30 - 70% rush coverage.
- Rush coverage is controlled with cutting every second year.
- Rush coverage is controlled with grazing.
- Minimum stocking level of 0.6 LU/Ha and maximum stocking level of 1.6 LU/Ha (to be reviewed by project ecologist in year 3).
- Mark some lines of electric fence with plastic fliers so that they are more visible to the hen harrier.
- Plant 560m of hedgerow

Restrictions:
- Limited spreading of fertiliser.
- Limited spreading of lime.
- No burning.
- No excavation of new drains or reclaiming heath or bog.
- No removal of hedgerows.
- No recreational off-roading with vehicles.
- No use of poisons or stupefying baits.
- No new forestry plantation.

Field Map Index:

Field Boundary

New hedgerow planted with suitable shrub and trees such as Willow, Gorse, Birch, Mountain Ash.

Areas to be planted with woody scrub such as Willow, Alder, Birch

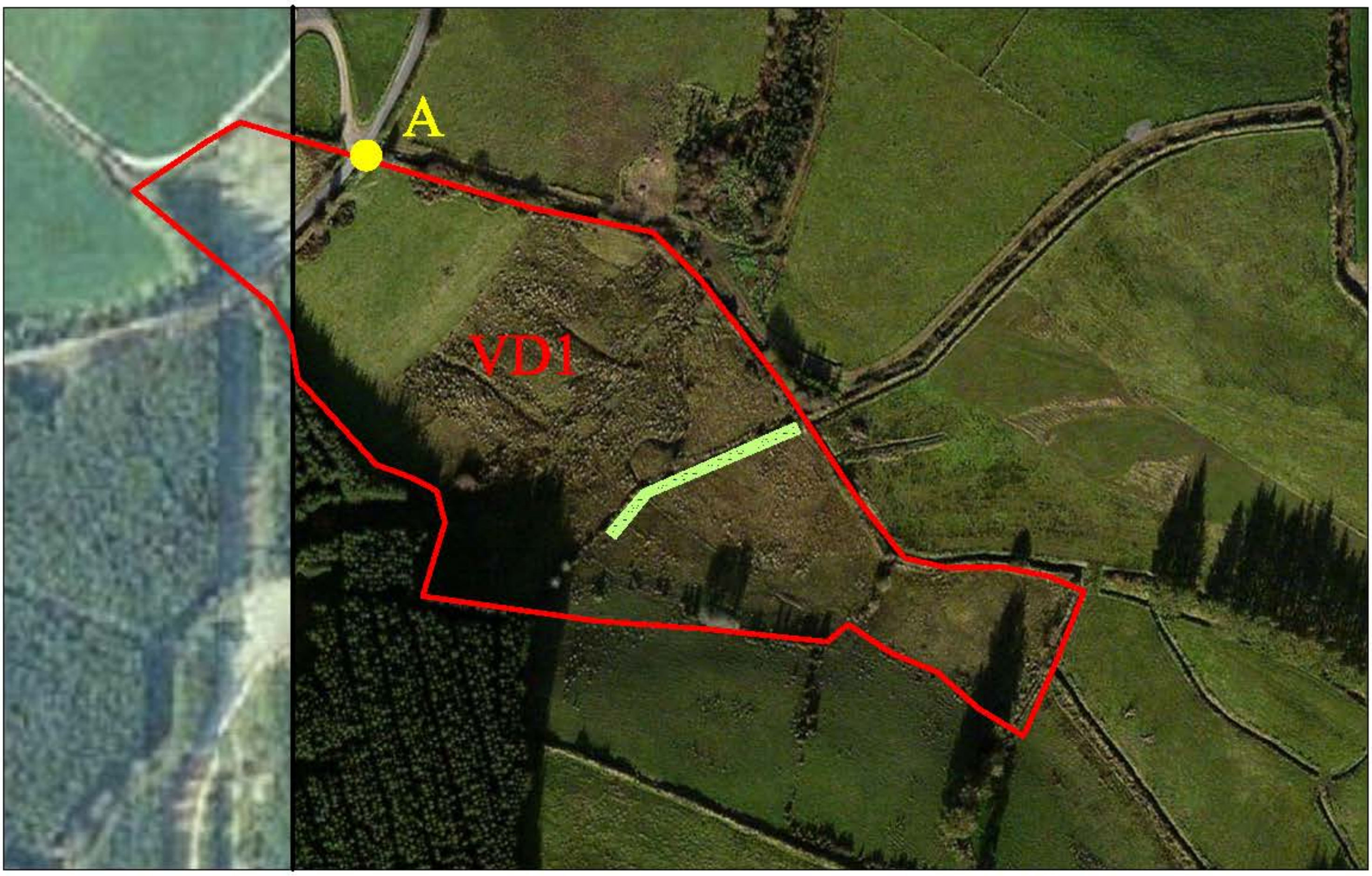
Areas to be planted with woody scrub and suitable trees. Stockproof fencing will be erected to exclude access by livestock.

A Photograph Locations

Photographs of Field VD1

Photograph A looking southeast

Field ID: VD1



Field Description: Mix of agricultural grassland and wet grassland.

Field Size: 3.3Ha

Measures:
- Field will be allowed to revert back to wet grassland.
- Achieve 30 - 70% rush coverage.
- Rush coverage is controlled with cutting every second year.
- Rush coverage is controlled with grazing.
- Minimum stocking level of 0.6 LU/Ha and maximum stocking level of 1.6 LU/Ha (to be reviewed by project ecologist in year 3).
- Mark some lines of electric fence with plastic fliers so that they are more visible to the hen harrier.
- Plant 82m of hedgerow

Restrictions:
- Limited spreading of fertiliser.
- Limited spreading of lime.
- No burning.
- No excavation of new drains or reclaiming heath or bog.
- No removal of hedgerows.
- No recreational off-roading with vehicles.
- No use of poisons or stupefying baits.
- No new forestry plantation.

Field Map Index:

Field Boundary

New hedgerow planted with suitable shrub and trees such as Willow, Gorse, Birch, Mountain Ash.

Areas to be planted with woody scrub such as Willow, Alder, Birch

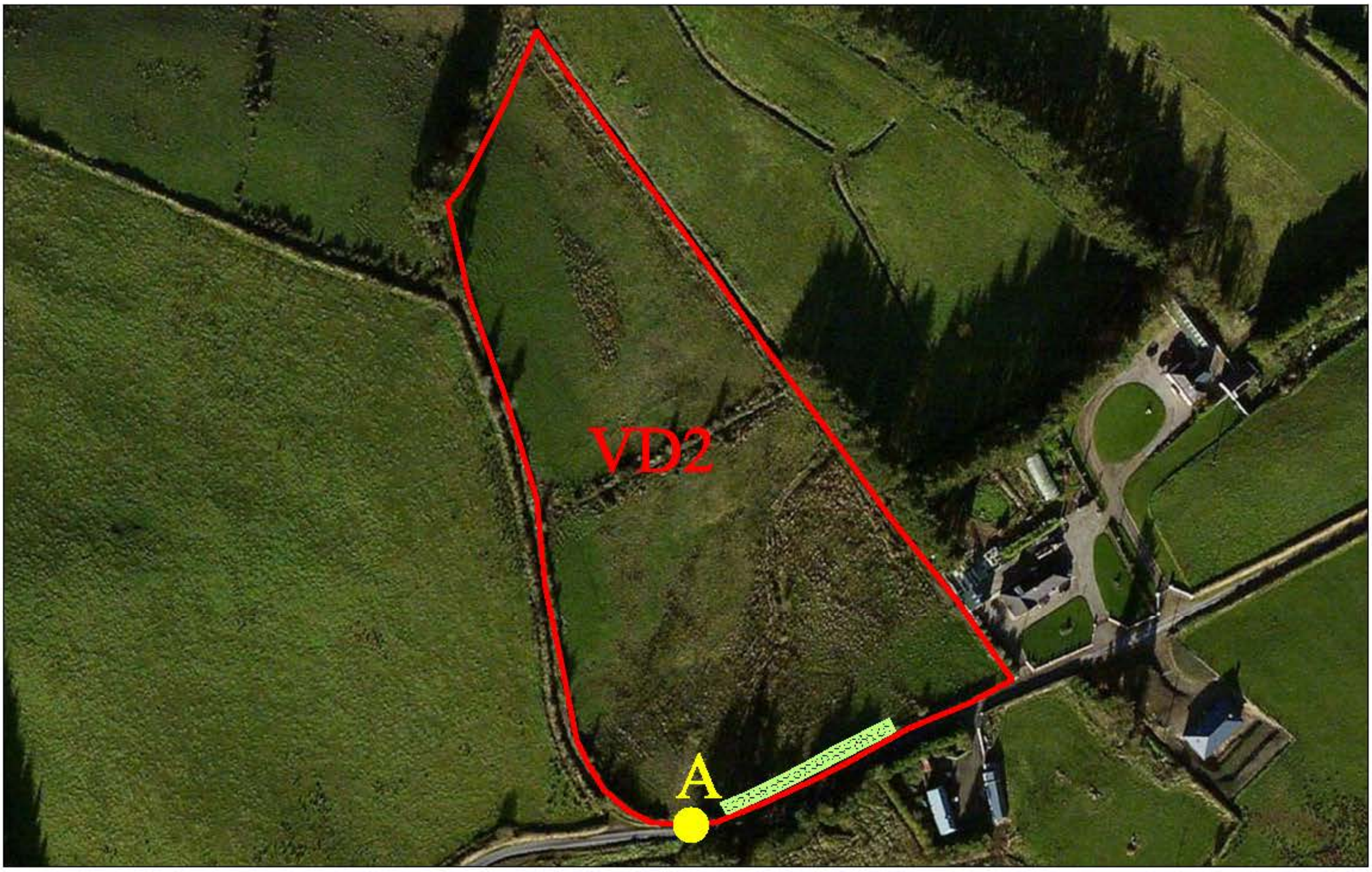
Areas to be planted with woody scrub and suitable trees. Stockproof fencing will be erected to exclude access by livestock.

A Photograph Locations

Photographs of Field VD2

Photograph A looking north

Field ID: VD2



Field Description: Mix of agricultural grassland and wet grassland

Field Size: 2.4Ha

Measures:
- Field will be allowed to revert back to wet grassland.
- Achieve 30 - 70% rush coverage.
- Rush coverage is controlled with cutting every second year.
- Rush coverage is controlled with grazing.
- Minimum stocking level of 0.6 LU/Ha and maximum stocking level of 1.6 LU/Ha (to be reviewed by project ecologist in year 3).
- Mark some lines of electric fence with plastic fliers so that they are more visible to the hen harrier.
- Plant 63m of hedgerow

Restrictions:
- Limited spreading of fertiliser.
- Limited spreading of lime.
- No burning.
- No excavation of new drains or reclaiming heath or bog.
- No removal of hedgerows.
- No recreational off-roading with vehicles.
- No use of poisons or stupefying baits.
- No new forestry plantation.

Field Map Index:

Field Boundary

New hedgerow planted with suitable shrub and trees such as Willow, Gorse, Birch, Mountain Ash.

Areas to be planted with woody scrub such as Willow, Alder, Birch

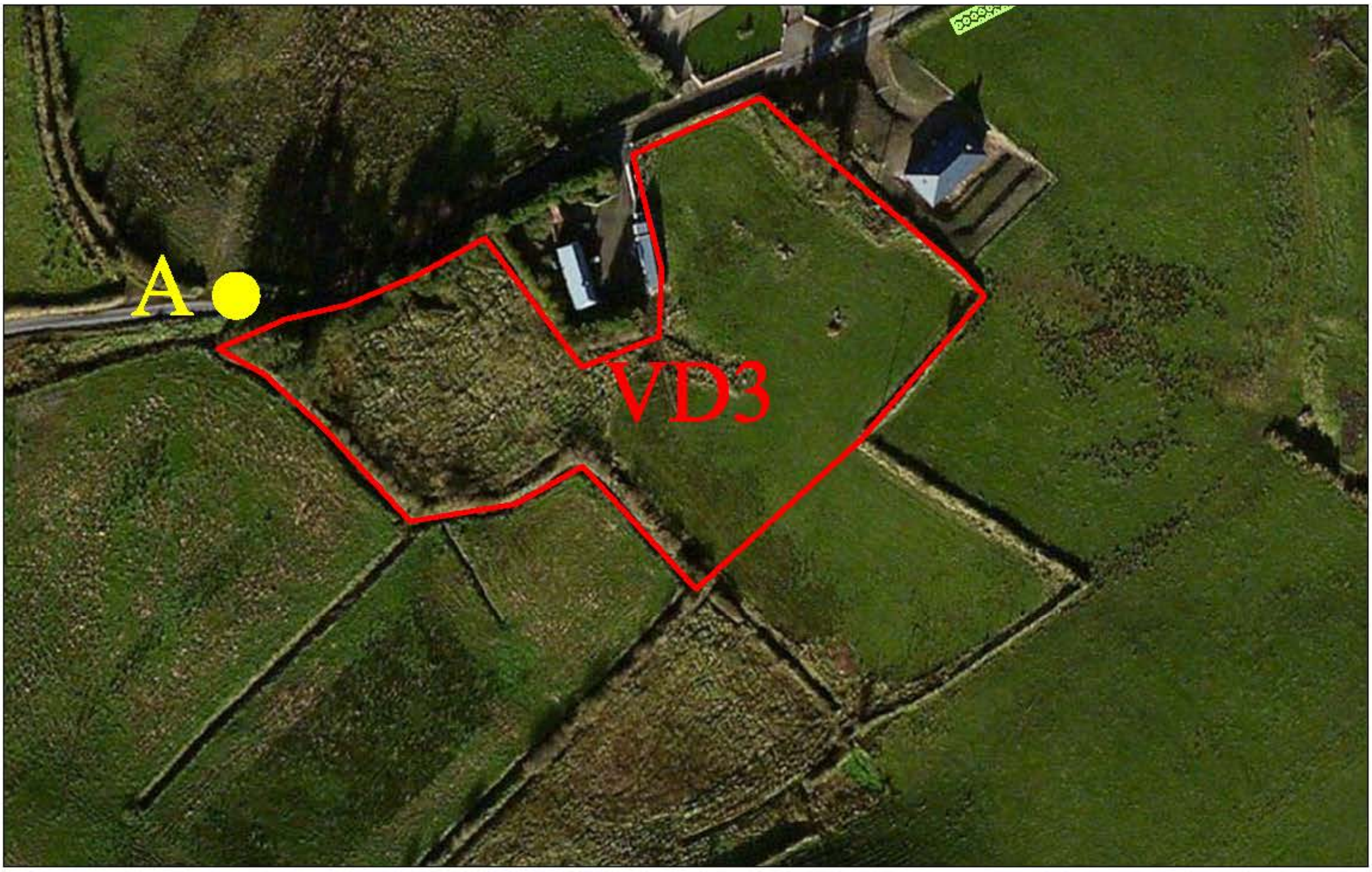
Areas to be planted with woody scrub and suitable trees. Stockproof fencing will be erected to exclude access by livestock.

A Photograph Locations

Photographs of Field VD3

Photograph A looking southeast

Field ID: VD3



Field Description: Mix of agricultural grassland and wet grassland.

Field Size: 1.1Ha

Measures:
- Western half of the field will be allowed to revert back to wet grassland.
- Achieve 30 - 70% rush coverage.
- Rush coverage is controlled with cutting every second year.
- Rush coverage is controlled with grazing.
- Minimum stocking level of 0.6 LU/Ha and maximum stocking level of 1.6 LU/Ha (to be reviewed by project ecologist in year 3).
- Mark some lines of electric fence with plastic fliers so that they are more visible to the hen harrier.

Restrictions:
- Limited spreading of fertiliser.
- Limited spreading of lime.
- No burning.
- No excavation of new drains or reclaiming heath or bog.
- No removal of hedgerows.
- No recreational off-roading with vehicles.
- No use of poisons or stupefying baits.
- No new forestry plantation.

Field Map Index:

Field Boundary

New hedgerow planted with suitable shrub and trees such as Willow, Gorse, Birch, Mountain Ash.

Areas to be planted with woody scrub such as Willow, Alder, Birch

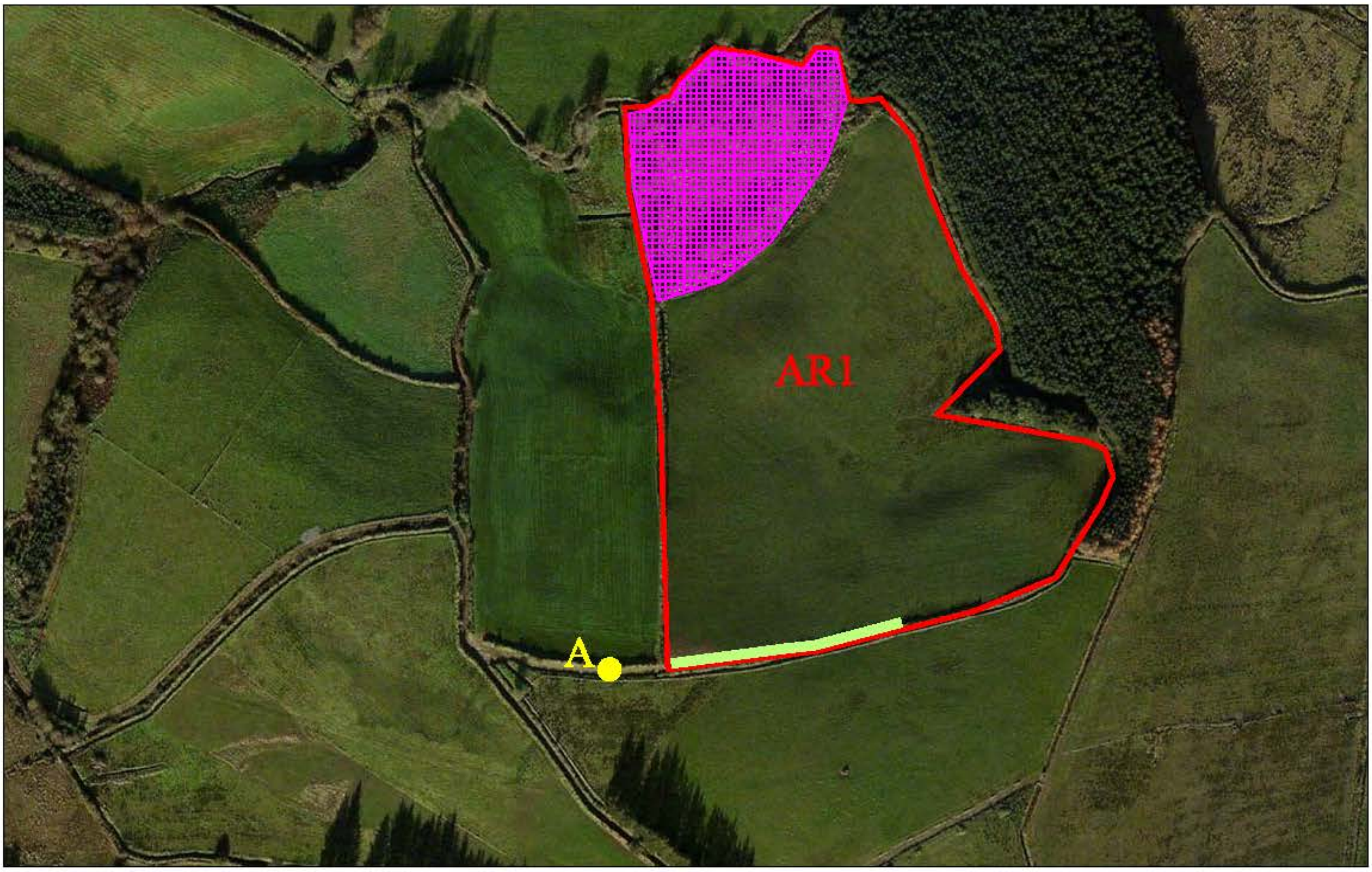
Areas to be planted with woody scrub and suitable trees. Stockproof fencing will be erected to exclude access by livestock.

A Photograph Locations

Photographs of Field AR1

Photograph A looking northeast

Field ID: AR1



Field Description: Mix of agricultural grassland, wet grassland and enclosure with riparian corridor

Field Size: 5.0Ha

Measures:
- Achieve 30 - 70% rush coverage.
- Rush coverage is controlled with cutting every second year.
- Rush coverage is controlled with grazing.
- Minimum stocking level of 0.6 LU/Ha and maximum stocking level of 1.6 LU/Ha (to be reviewed by project ecologist in year 3).
- Mark some lines of electric fence with plastic fliers so that they are more visible to the hen harrier.
- Plant 120m of hedgerow
- Fence off and maintain enclosure (0.93) and improve with native broadleaved species.

Restrictions:
- Limited speading of fertilizer
- Limited spreading of lime.
- No burning.
- No excavation of new drains or reclaiming heath or bog.
- No removal of hedgerows.
- No recreational off-roading with vehicles.
- No use of poisons or stupefying baits.
- No new forestry plantation.

Field Map Index:

Field Boundary

New hedgerow planted with suitable shrub and trees such as Willow, Gorse, Birch, Mountain Ash.

Areas to be planted with woody scrub such as Willow, Alder, Birch

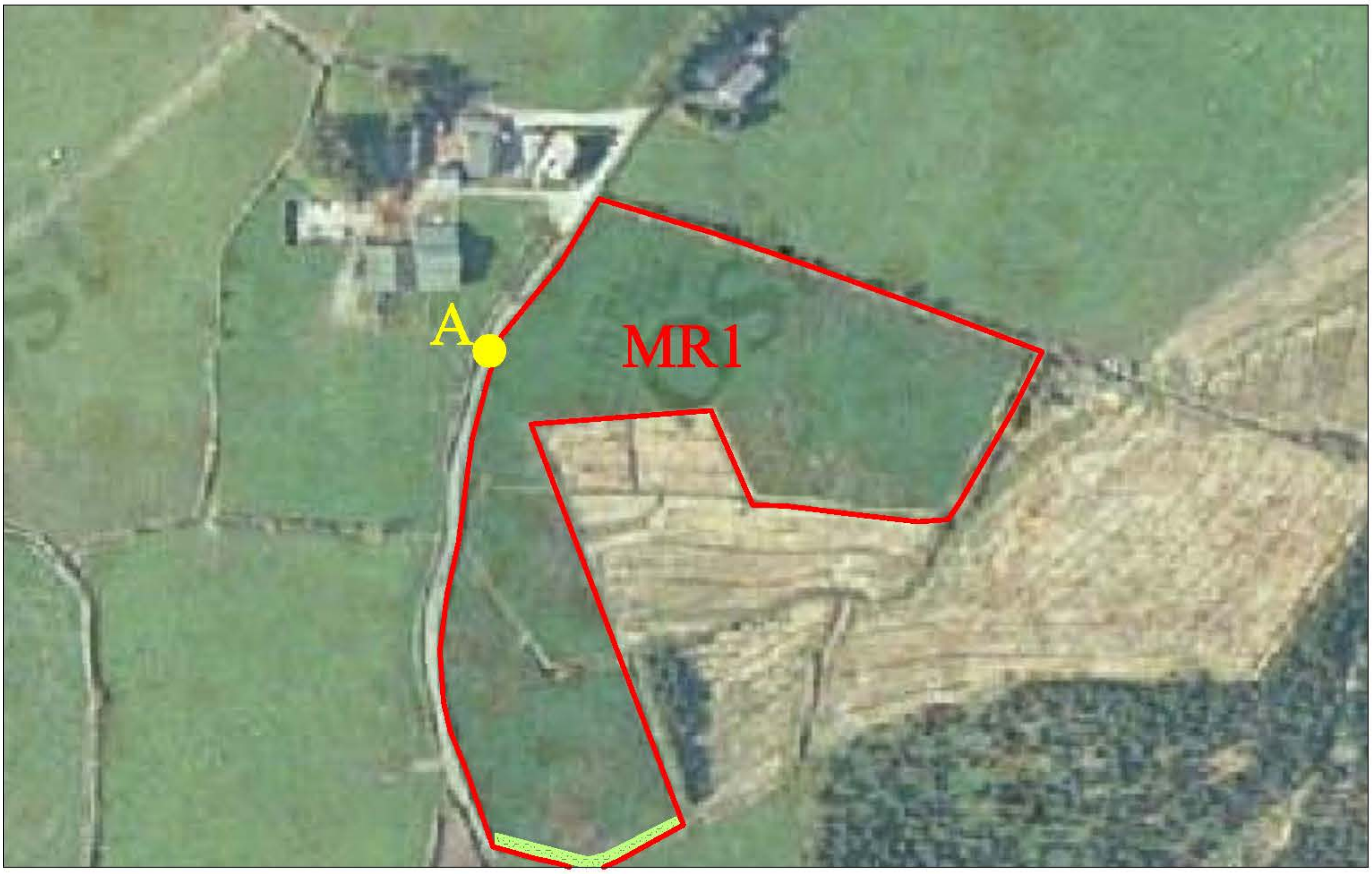
Areas to be planted with woody scrub and suitable trees. Stockproof fencing will be erected to exclude access by livestock.

A Photograph Locations

Photographs of Field MR1

Photograph A looking east

Field ID: MR1



Field Description: Mix of agricultural grassland and wet grassland

Field Size: 2.2Ha

Measures:
- Field will be allowed to revert back to wet grassland.
- Achieve 30 - 70% rush coverage.
- Rush coverage is controlled with cutting every second year.
- Rush coverage is controlled with grazing.
- Minimum stocking level of 0.6 LU/Ha and maximum stocking level of 1.6 LU/Ha (to be reviewed by project ecologist in year 3).
- Mark some lines of electric fence with plastic fliers so that they are more visible to the hen harrier.
- Plant 70m of hedgerow.

Restrictions:
- Limited speading of fertilizer
- Limited spreading of lime.
- No burning.
- No excavation of new drains or reclaiming heath or bog.
- No removal of hedgerows.
- No recreational off-roading with vehicles.
- No use of poisons or stupefying baits.
- No new forestry plantation.

Field Map Index:

Field Boundary

New hedgerow planted with suitable shrub and trees such as Willow, Gorse, Birch, Mountain Ash.

Areas to be planted with woody scrub such as Willow, Alder, Birch

Areas to be planted with woody scrub and suitable trees. Stockproof fencing will be erected to exclude access by livestock.

A Photograph Locations

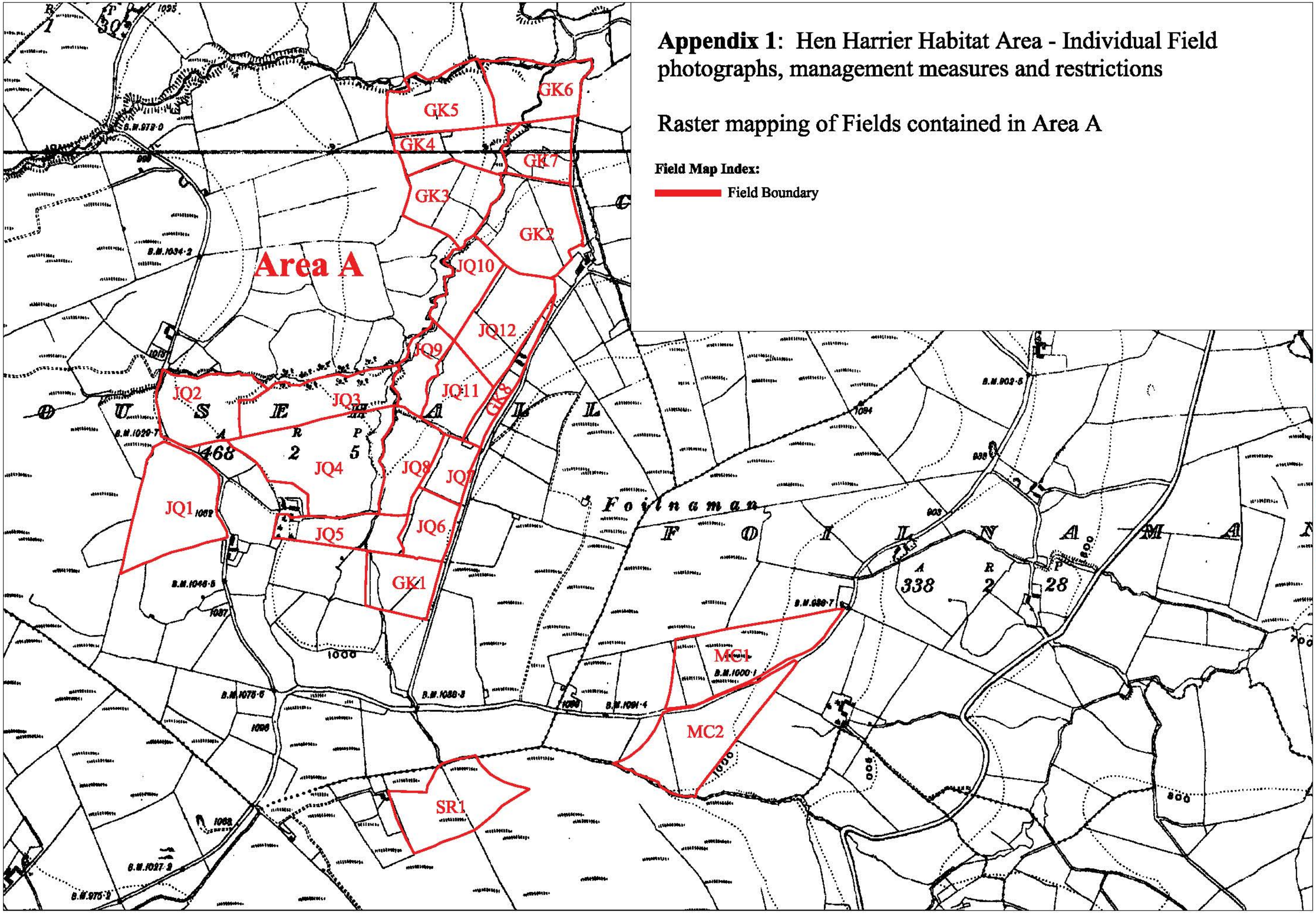
REFERENCE DOCUMENTS

Appendix 1: Hen Harrier Habitat Area - Individual Field photographs, management measures and restrictions

Raster mapping of Fields contained in Area A

Field Map Index:

Field Boundary

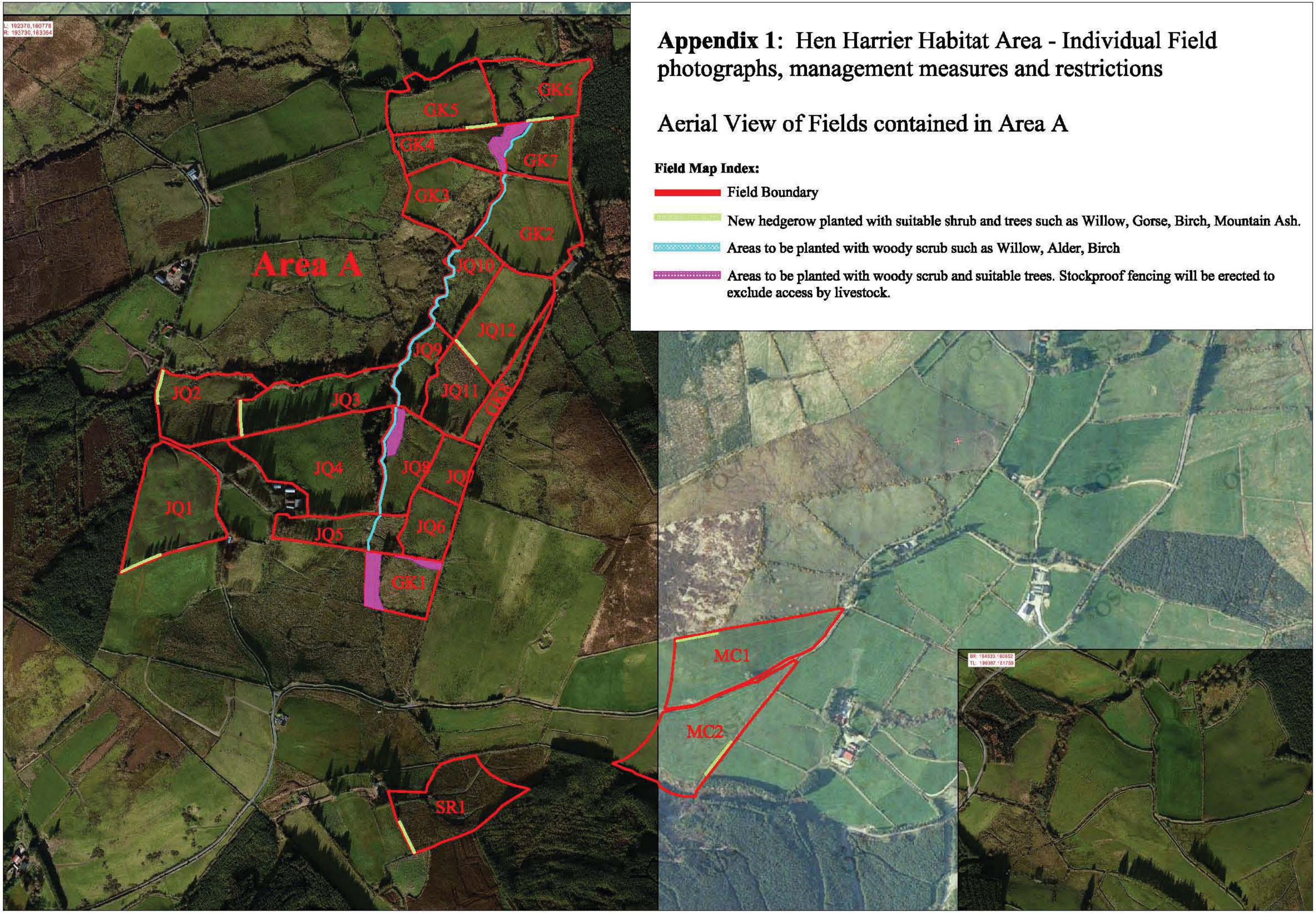


Appendix 1: Hen Harrier Habitat Area - Individual Field photographs, management measures and restrictions

Aerial View of Fields contained in Area A

Field Map Index:

- Field Boundary
- New hedgerow planted with suitable shrub and trees such as Willow, Gorse, Birch, Mountain Ash.
- Areas to be planted with woody scrub such as Willow, Alder, Birch
- Areas to be planted with woody scrub and suitable trees. Stockproof fencing will be erected to exclude access by livestock.

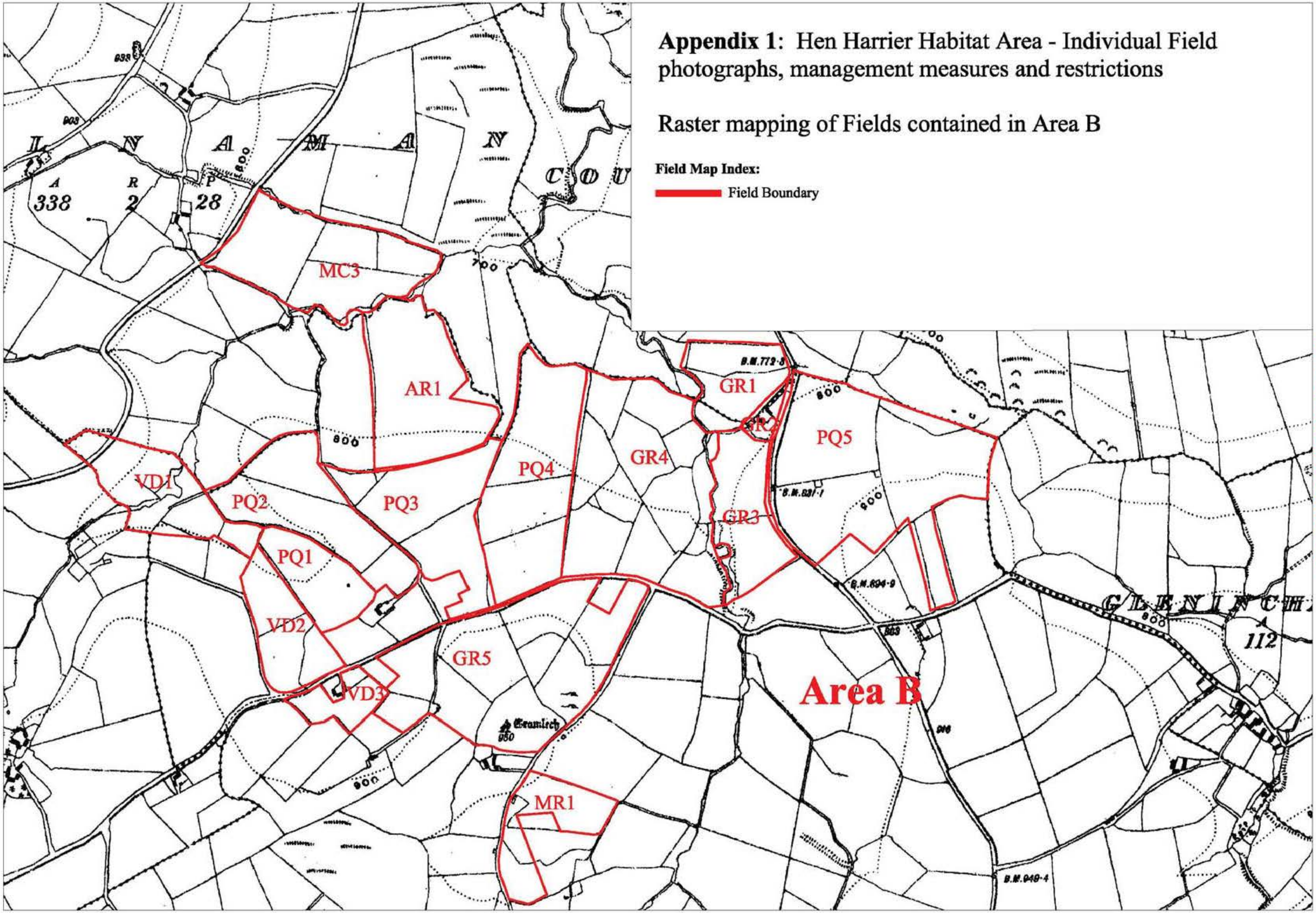


Appendix 1: Hen Harrier Habitat Area - Individual Field photographs, management measures and restrictions

Raster mapping of Fields contained in Area B

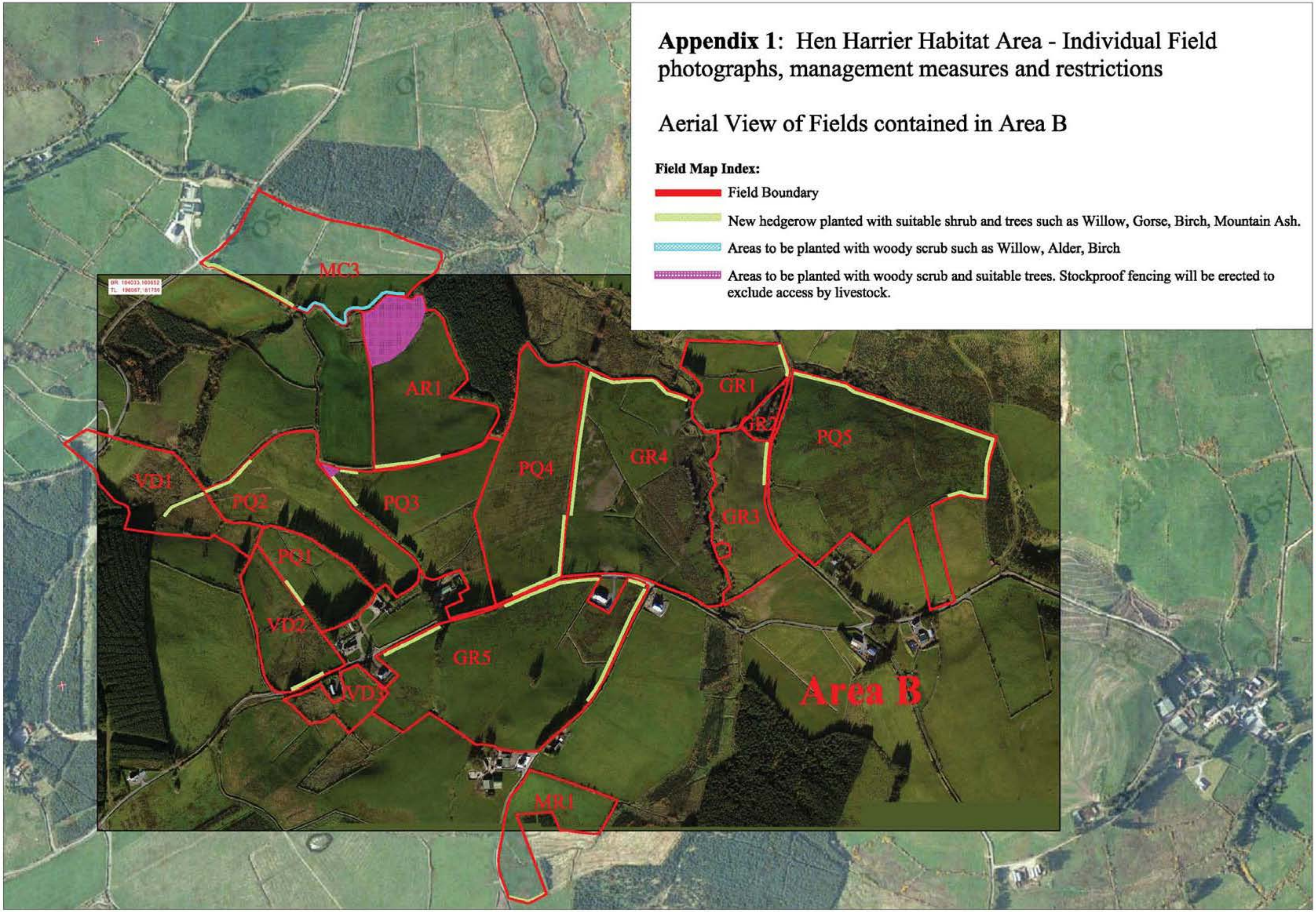
Field Map Index:

Field Boundary



Appendix 1: Hen Harrier Habitat Area - Individual Field photographs, management measures and restrictions

Aerial View of Fields contained in Area B



REFERENCE DOCUMENTS

Appendix 2

National Parks and Wildlife Service Farm Plan Scheme

Part 1

NPWS FARM PLAN SCHEME FOR PRO-ACTIVE HEN HARRIER HABITAT MANAGEMENT

1. **Biology and Ecology.**

The Hen Harrier is a rare and threatened bird of prey, with a small breeding population (130-150 pairs). In Ireland, breeding habitat is found on low hills, particularly in the south and mid-west.

Hen Harriers nest on the ground in deep cover. Heather, scrub and early stages of new and replanted (second-rotation) conifer plantations are important nesting habitats. The breeding season is from mid-March to mid-August. The females lay a single clutch of 4-6 eggs and the number of young reared depends on habitat quality and availability of suitable prey. Birds generally move off the hills to lowland areas in winter, but many remain and occupy the same grounds they use for breeding, right throughout the year.

One of the major issues facing the Hen Harrier's future is habitat loss, and this is the reason why Hen Harriers are so rare in Ireland today. Hen Harriers require extensive areas of quality habitat to forage over, namely moorland, rough grassland, hill farmland, hedgerows, scrub and young conifer plantations. Forest plantations are useful while there is still open ground between the trees, but are of no use after canopy closure, and thus represent a loss of habitat from age 10-15 years onwards. Harriers depend on open areas, particularly farmed hill pastures. Without suitable grazing, vegetation becomes too rank for Hen Harriers to hunt over effectively.

2. **Designation.**

Since the Hen Harrier is listed on Annex 1 of the Birds Directive, Ireland is required to designate a suite of SPAs for its protection. In total six sites have been designated;

- Slieve Bloom Mountains SPA, Co's Laois & Offaly.
- Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA, Co's Cork, Kerry & Limerick.
- Mullaghanish to Musheramore Mountains SPA, Co. Cork.
- Slievefelim to Silvermines Mountains SPA, Co's Limerick & Tipperary.
- Slieve Beagh SPA, Co. Monaghan.
- Slieve Aughty Mountains SPA, Co's Clare & Galway.

The SPAs include conifer plantations, heath/ bog, scrub and rough grassland. Intensively managed agricultural land, houses and farm buildings have generally been excluded. Together the six sites total 169,000 hectares of land. Conifer plantation makes up 80,950 hectares (48%), rough grassland 39,630 hectares (23%) and heath/ bogs 47,760 hectares (28%). Certain SAC sites are included within the Hen Harrier SPA areas. In these cases the planner must refer to the conservation management plan and conservation objectives for the SAC and consult with the local Conservation Ranger.

2.1 Hen Harrier ARCS

NOTIFIABLE ACTIONS – ACTIVITIES REQUIRING CONSENT (OPERATIONS LIKELY TO ALTER, DAMAGE, DESTROY OR INTERFERE WITH THE INTEGRITY OF THE SITE).

- Burning areas of vegetation.
- Improving or reclaiming heath or bog.
- Removal of hedgerows.
- Organising, allowing or engaging in recreational activities involving off-road or racing vehicles, other than on a public road or by a landowner.
- Any other activity of which notice may be given by the Minister from time to time.

2.2 Hen Harrier conservation objectives.

- **Proposed Special Conservation Interest for Slieve Bloom Mountains SPA (4160)**
  Site is selected for: Hen Harrier
  Main conservation objective:
  To maintain the special conservation interest for this SPA at favourable conservation status: Hen Harrier.
- **Proposed Special Conservation Interest for Stacks to Mullaghereirk Mountains, West Limerick Hills and Mount Eagle SPA (4161)**
  Site is selected for: Hen Harrier
  Main conservation objective:
  To maintain the special conservation interest for this SPA at favourable conservation status: Hen Harrier.
- **Proposed Special Conservation Interest for Mullaghanish to Musheramore Mountains SPA (4162)**
  Site is selected for: Hen Harrier
  Main conservation objective:
  To maintain the special conservation interest for this SPA at favourable conservation status: Hen Harrier.
- **Proposed Special Conservation Interest for Slievefelim to Silvermines Mountains SPA (4165)**
  Site is selected for: Hen Harrier
  Main conservation objective:
  To maintain the special conservation interest for this SPA at favourable conservation status: Hen Harrier.
- **Proposed Special Conservation Interest for Slieve Beagh SPA (4167)**
  Site is selected for: Hen Harrier
  Main conservation objective**:**
  To maintain the special conservation interest for this SPA at favourable conservation status: Hen Harrier.
- **Proposed Special Conservation Interests for Slieve Aughty Mountains SPA (4168)**
  Site is selected for: Hen Harrier, Merlin
  Main conservation objective:
  To maintain the special conservation interests for this SPA at favourable conservation status: Hen Harrier; Merlin.

3. Management Prescriptions for Hen Harrier.

Hen Harrier SPAs include heath/ bog, rough grassland and conifer plantations and generally exclude areas of intensive farmland. The prescription involves maintaining or improving habitats to suit the Hen Harrier, delivering a required level of grazing, introduction or improvement of hedgerows, conifer, bracken and briar control, as well as ensuring rush or scrub do not grow to levels which are excessive or impenetrable for foraging harriers. It is important to understand beneficial and acceptable thresholds of scrub and rush. At either end of the spectrum, abandonment or intensification will reduce favourable hunting habitat for the Hen Harrier. It is also important to realise which ground is suitable for nesting and which is suitable for foraging.

The following prescription is a guidance document, which will be interpreted at farm level by NPWS approved farm planners and NPWS staff and will apply only to SPA lands that are currently suitable habitat (or will be maintained in a suitable condition) for Hen Harrier over the period of the plan. The intention is to ensure that extensive grazing continues and that appropriate management of grassland, scrub and bog creates a favourable habitat mosaic for Hen Harrier. It is important to appreciate that effective habitat management for Hen Harriers will benefit a wide range of other species. It is only by creating and maintaining habitat for prey species that populations of predatory species like the Hen Harriers can be protected.

The management prescription for the Hen Harrier has two objectives;

- **The provision of suitable nest sites.** Where known or suspected Hen Harrier nest sites occur on the farm the preservation of these sites takes precedence over other parts of the prescription. If there are no suitable nesting areas on the farm or within 1km of the farm then the provision of suitable nesting habitat is a priority for that farm.
- **Improving the value of the farm as a foraging area for Hen Harriers.** In general terms, anything that benefits potential prey species is of benefit to the Hen Harrier. Every plan must make provision for habitat enhancement. A key objective of the plan is to diversify the range and extent of habitats on the farm with a particular focus on habitats that support prey species e.g. scrub and habitats that facilitate foraging Hen Harriers, e.g. Rushy grassland.

It is imperative that important habitats present on entry into the scheme are retained over the period of the plan.

All a landowner's designated land must be entered into the scheme, with the option of up to 20% being managed as permanently improved grassland. Such permanently improved grasslands will not be eligible for payment in the scheme, as they are of limited use to Hen Harriers.

The small scale reseeding of fields of rough grassland (unless there are overriding conservation concerns by NPWS), is permitted where reseeding and reversion to rush pasture is a necessary part of the management dynamic in these areas. Any area to be reseeded can only be reseeded once over the five years of the plan.

The prescription (and payment) does not apply to;

- Commercial forestry.
- Commonages.
- Water bodies & Lakes.
- Areas of active turf cutting (within the last 5 years) or spread lands.
- Active quarries etc. A buffer ring around the foot of a wind turbine (250 metres radius). The increase in the buffer zone around wind turbines in respect of eligibility for payment shall apply to new plans approved after the approval of the terms and conditions document.
- Public roads and tarmac or concrete farm roads.
- Farmyards or dwelling houses.
- Recreational areas (e.g. clay-pigeon shooting, regular or intensive game shooting, car or ATV racing etc.)
- Intensively managed improved grassland. This includes wet grassland where silage is cut. Species rich Hay Meadows may be eligible for payment if no fertiliser is applied and cutting is delayed until July 15th.
- Payment on Bog/ Heath will be capped at 10 hectares. The requirement to manage bog or heath plots in an appropriate manner will however apply to all of the bog or heath on target area plots on the farm.
- Any other ground not deemed suitable by habitat or existing activities.

4. <u>Required Management in different Habitat Types.</u>

4.1 Grassland.

- **Improved grassland** is not eligible for payment under the scheme. Likewise wet grassland which is cut annually for silage is ineligible for payment. In general existing practices can continue on improved grassland. The plan must incorporate a planned stocking rate and a nutrient management plan for improved grassland plots. Any areas of existing improved grassland within the SPA can be retained on the farm. In addition the farmer is permitted to improve wet grassland plots to bring the area of improved grassland up to 20% of the designated area on the farm. If the farmer takes up this option it must be included in the plan. No payment will be made on plots planned for improvement.

  Where it is proposed to allow improved grassland to revert to a more natural state, a reversion program is required. This will involve;

  — Analysis of soil samples so that a baseline record of soil P & K exists.
  — Cease applying chemical and organic fertilisers.
  — No application of lime.
  — Habitat enhancement works. In most cases this will be satisfied by extra hedgerow planting. If there is already 400 metres of hedgerow per hectare on or adjoining the land planned for reversion then no further planting is required. If the amount of Hedgerow is less than 400 metres per hectare, the applicant will be required to plant sufficient hedgerow to bring the length of hedgerow up to 400 metres per hectare, subject to a maximum planting requirement of 50 metres per hectare. All hedgerow planting must be completed in year 1 of the plan – *see specifications for New Hedgerow Planting and Establishment* in

Part 3 of this Appendix. In most cases the new hedgerow should be located on or adjacent to the plots planned for reversion. If this is not possible they can be planted on other designated plots. A full explanation for this course of action must be given in the plan.

— If planting of new hedgerows is not feasible, alternative habitat enhancement works may be considered. Any such proposals must be agreed with NPWS before an application is submitted.

- **Wet grassland** is eligible for payment**. The objective is** to have rough grassland as rank as possible while not overgrown with dead grasses/ rushes. To achieve this, management must focus on three principal points;

  — **Appropriate grazing pressure.** Grazing of areas of wet/ rough grassland by cattle or horses/ ponies or by mixed grazing is essential. Grazing by sheep can continue where this has been the traditional practice. Introduce light grazing, rather than cutting or topping, to areas with no stock. Guideline target stocking level on rough grazing is a minimum of 0.6 LU/ hectare. There is no formal upper limit to planned stocking density but it must not be at a level that would constitute management as improved grassland. Any deviation below the 0.6 LU/ hectare planned stocking rate for grasslands must be fully explained in the plan. In cases where the land is wet, consideration should be given to concentrating grazing pressure in the summer months.

  The planners will decide the appropriate stocking for each farm, relating the stocking level requirement to the condition of the site. The planners will also consider the effects on the value of the farm for Hen Harriers by the current stocking density/ grazing regime and to maintain, decrease or increase this rate as is deemed necessary. Where the current stocking density is too high, stock may have to be sold or extra non-designated lands leased. Where stocking density is too low, new stock may have to be bought in for all or part of the year. How changes in stocking densities are to be achieved should be clearly described in paragraph 4.1 of the plan. A date must be given by which time such changes will have been achieved.

  — **Rush management.** The objective is to maintain rough grassland in the optimal condition for Hen Harrier. Optimal condition constitutes as dense a covering of rushes as feasible, but not to the point where rushes are falling over, or matting the ground. Rush cover in the 30 – 70% range is ideal. While appropriate grazing pressure is essential, in most cases managing rush cover will require some degree of active management. In the majority of cases rush management will be achieved by cutting every second year. However there will be considerable variation from site to site and alternative cutting regimes may be more appropriate in certain cases. Table A below defines the most common situations encountered and the most appropriate management rush management regimes.

  At the outset of the plan, the planner should specify what management regime is to be applied to achieve and maintain optimal rush cover.

The plan should also explain why the proposed course of action has been selected.

Advice on appropriate rush management is given in the *Rush* Management Table below. In general, rushes should be cut on a 2 year cycle unless there are specific reasons for a longer cycle, e.g. weak rush growth. In most cases, active rush management should commence in year 1 of the plan and should only be delayed until year 2 or 3 where improved grassland is in reversion, where rush growth is very weak or where the rushes were cut or treated with herbicide in the year prior to joining the scheme. On farms with a large area of rushy grassland (> 10 hectares) it is permitted to delay active rush management on a portion of the area until year 2. The area where active rush management is to be delayed for this reason should not normally exceed 50% of the wet grassland component of the farm. The plots selected for a delayed commencement of active rush management should if possible be in classes II or III as described below.

The use of a herbicide applied using a weed lick is permitted but not encouraged. This should only be considered in cases where rush growth is very dense and cutting is impractical. In certain situation where difficulty of access prevents the use of mowing equipment the use of a weed lick mounted on a quad bike may be considered. The application of herbicides for the management of rushes should normally be restricted to years 1 or 2 of the plan. In no circumstances should a weed lick be used more than once on the same plot over the course of the plan.

If a planner feels that the most appropriate management regime differs from that given in these guidelines they should give a full explanation for their planned course of action. The location of a station in the area involved may be beneficial. The planned rush management should be reviewed on an annual basis to determine if it is having the desired effect. If difficulty of access prevents the active management of rushes this should be fully explained in the farm plan and any possible alternatives described.

Planners are reminded that if during an annual inspection they assess that rush recovery has been stronger or weaker than had been originally anticipated then they should update the plan to change the cutting sequence for future years.

Table A

Code	**Rush Management Table**
I	Habitats where rush cover of 30-70% is considered unlikely to be achievable, irrespective of management and perhaps in some cases undesirable, e.g. Shallow Limestone soils. No cutting required.
II	Swards where reversion of Improved Grassland is planned or where Rush cover is less than 10%. One or two cycles of cutting commencing in year 3 may be appropriate may be appropriate to allow further rush development in the early years of the plan.
III	Swards where rush cover is 10-30 % or where rushes have been topped in the past year. One or two cycles of cutting commencing in year 3 may be appropriate.
IV	Swards where the rush cover is already in the 30-70% range. In these cases cutting / topping in years 1, 3 & 5 could maintain the sward in the desired state.
V	Swards where rush cover is dominant (>70%) and where weed-licking with a suitable herbicide in year 1 followed by cutting/ topping in years 3 & 5 could be considered. In most of these cases there would be no recent history of rush control management. Weed licking with a suitable herbicide may give the applicant the chance to create a suitable sward within 2 or 3 years. The use of herbicides must always be subject to consideration of the possible effects on Watercourses. No herbicide use is permitted within 5 metres of a watercourse or existing hedgerow without the consent of the NPWS. A greater distance may be required in sites which are also designated as an SAC.

The actions suggested above are for example only, and do not constitute set prescriptions. The planners will have to use their own judgement in drawing up a rush management plan. However if the planners intend to deviate from the guidelines given above a full explanation for their chosen course of action is required. This should be given on the relevant Implementation Page of the plan. The ultimate goal is to achieve a covering of 30-70% rushes.

— **Nutrient management.** In most cases the application of chemical or organic fertiliser should be avoided. Where this has been traditionally carried out it may continue – *see Appendix 5 Soil Analysis, Lime and Plant Nutrient Applications.*

- **Other grasslands.** The management of other grassland types, e.g. long established hay meadows or upland grassland should be based on the following;
  - — Maintain traditional grazing patterns.
  - — Control Bracken if necessary (by weed licking, spot spraying, cutting, rolling or controlled trampling with stock. Mechanical control or trampling is most effective in May/ early June. Mechanical control will need to be repeated several times during this period to have a beneficial impact.
  - — Cut species rich meadows after July 15th, preferably later.
  - — Do not plough, cultivate, drain or otherwise reclaim.
  - — Do not plant conifers.
  - — Do not plant trees unless such action is provided for in the plan.

— Do not apply lime.
— Do not fertilise above the stipulated levels.
— Do not fertilise on slopes greater than 25°.
— Do not exceed the recommended stocking limits.
— Do not provide supplementary feed stock on the grassland except where this has been traditionally practised.
— Do not dump waste material.

- **Mosaic of wet grassland and heath.**

There are many cases where the vegetation in a plot is best described as a mosaic of wet grassland and heath. Such plots may have a high cover of rushes along with heather species, Purple Moor Grass (*Molinia caerula*) and occasionally Bog Myrtle (*Myrica gale*). These are amongst the most important hunting habitats, as they are home to the Meadow Pipit (*Anthus pratensis*), the main prey item of Hen Harriers. Where cover is deep enough, e.g. ≥40 cm, they can also make attractive nesting or roosting sites. In many cases these plots will be very wet and difficult to access with machinery. Management should focus primarily on maintaining grazing at a sustainable level and the establishment of small patches of scrub. Appropriate grazing levels will vary from site to site but should be between 0.25 LU/ hectare and 0.6 LU/ hectare. Cutting of Rushes should be considered where it is feasible but the use of herbicides other than as a spot treatment for difficult weeds should not be carried out.

- **Requirement for habitat enhancement in certain large grassland plots.**

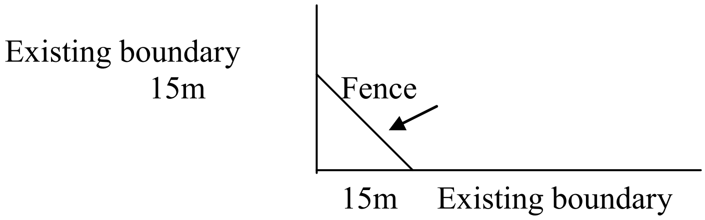
In large grassland plots there is a risk that lack of cover may be a limiting factor on the value of the site for potential prey species. The same issue applies in plots with little or no hedgerows. To address this, additional measures to diversify the habitat are required. These apply in all designated SPA grassland plots where payment is being claimed. They are not required in areas designated as part of an SAC.

Grassland fields over 2 hectares in size or with less than 100 metres of hedgerow per hectare.

In fields of this type the plan must incorporate the establishment of scrub in field corners or the planting of 25 metres of hedgerow per hectare. The planting of Hedgerows must be in accordance with the Specifications for Hedgerow Planting and Establishment *(See- Appendix 6*). Planting must be completed in year 1 and established by the end of year 4. If the field corners option is chosen then stock must be excluded from at least 2 field corners. A permanent fence is required for this purpose. The fence is to be set back at least 15 metres from the corners - *see Figure 1* below. At least 10 native trees must be planted in the field corner; the trees must be staked and protected with a tree guard. The choice of species is to be based on those native species known to do well on similar sites in the area. Willows are very useful for supporting Hen Harrier prey and increasing hunting potential, and grow well in most cases. Native tree species such as Oak (*Quercus robur & Q petraea*), Mountain Ash (*Sorbus aucuparia*) and Hawthorn (*Crataegus monogyna*) are also preferred. Achieving a diverse blend of species is encouraged. The field corner must be left ungrazed for the duration of the farm plan contract. Fencing and tree planting must be completed before the end of year 1. Briars and Blackthorn are to be controlled on an annual basis through the contract period. Spot treatments with a suitable herbicide or mechanical control, e.g. using a strimmer are acceptable control methods. If using a strimmer care should be taken to avoid damaging the young trees. The tree guards referred to above will be of some value in this regard. In situations where soil types permit and where adequate shelter exists an acceptable alternative is to plant a cover crop e.g. Kale in the field corner. If this option is chosen, Kale must be planted in the first spring in the scheme and left undisturbed for 2 years. The Kale should be removed in the second autumn after planting and the site left fallow in year 3. The Kale must be replanted in the spring of year 4 and left undisturbed for the rest of the contract period. Club root resistant varieties like Caledonian should be used. The use of small quantities of fertiliser is permitted but not required. A margin of 2 metres is to be left undisturbed along the existing field boundaries. The use of herbicides in site preparation is permitted provided;

- —The plot is not also designated as an SAC.
- —They are not used within 3 metres of the existing field boundaries (5m in the case of watercourses and existing hedgerows).
- —That care is taken to ensure that no drift occurs.

Figure 1.



Grassland fields over 4 hectares in size.

In grassland fields over 4 hectares in size the establishment of new hedges and/ or exclosures is required. In grassland fields over 4 hectares in size, at least one exclosure or 100 metres of new hedgerow are required for each hectare or part thereof over 4 hectares. For example in a 6 hectare grassland plot, 2 exclosures or 200 metres of new Hedgerow are required. If the plot in question is improved grassland in reversion, then these requirements are in addition to any additional hedgerow planting required as part of the reversion process.

Exclosures should be 0.1-0.3 hectares in size, stock are to be excluded from these exclosures by means of a permanent fence before the end of year 1. The fence must be maintained in a stockproof condition for the duration of the scheme. Where possible, exclosures should incorporate any existing patches of scrub. Exclosures are to be planted with native tree/ shrub species at a density of 1000 plants per hectare (Whips 40-80 cm in size are the preferred planting material. Planting must be completed before the end of year 1 in the scheme. The choice of species should be based on those known to do well on similar sites on the farm. The planting density may be reduced if some scrub already exists on the site.

Hedgerow planting and establishment must be in accordance with the Hedgerow planting specifications in the Terms and Conditions document.

General issues relating to grassland management.

- Reseeding of rough grassland fields will be allowed, or may be required, where this is shown to be necessary and part of an existing management regime. (There will be very few instances where this is necessary, but there are always caveats and every farm has its own intricacies).
- Broadcast spraying of rushes is not permitted but spot treatments or wipe-on treatments are allowed. Herbicides applied using a weed lick can be applied where necessary, particularly in situations where rush growth is very dense or where cutting is impractical due to steep slopes. Applications should not be at a rate which will denude fields completely of rushes. Under normal circumstances chemical treatment of rushes will only be permitted once in a 5 year plan. Wipe on treatments can only be applied in either year 1 or year 2 of the plan.

4.2 Scrub/ hedgerows.

Woody Scrub (e.g. Gorse, Willow, Alder, Birch etc.) is one of the most beneficial habitats on the landscape for Hen Harriers, as it provides prey (e.g. passerines, small mammals) and an ideal hunting scenario for the harrier (i.e. irregular/ thick/ 'bushy'). Scrub and hedgerow clearance has been held accountable for the loss of much Hen Harrier habitat in Ireland, and subsequent decline in population. Where there is evidence of scrub or hedgerow removal (since 2007) these habitats must be re-instated before application to the scheme.

In general existing areas of scrub and hedgerow should be retained. In open areas or areas where the extent of scrub/ hedgerow is limited, there will be a need to either create habitat or to facilitate some expansion of gorse and native hardwood scrub. Small areas of established gorse or willow scrub, or gorse, willow can be trimmed to prevent further encroachment onto grassland or access paths, but they must not be removed, burnt or killed.

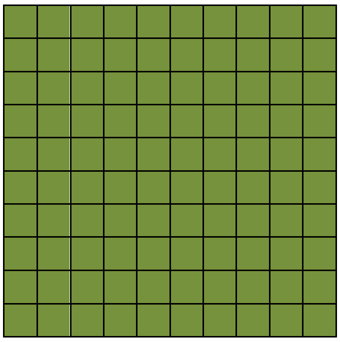
The cutting of roadside hedgerows for safety reasons and cutting necessary for the protection of overhead lines is permitted on an annual basis. In the case of other hedgerows, cutting is not normally required. It is permitted to cut a hedge, once over the period of the plan to prevent the hedge "escaping". Hedgerow trees, e.g. Ash and Oak should be left uncut in such cases. If a hedgerow requires cutting it should be cut to an "A" shape, i.e. wider at the base then at the top. The further encroachment of scrub onto grassland can be controlled by cutting on annual basis if required. Cutting in this case should not come closer than 1m from the base of the hedge. However a buffer zone of 1.5m on each side of the hedge must be left uncut. Fertilisers should not be applied within this buffer zone. In addition herbicides and pesticides should not be used within 5m of an existing hedgerow. The only exception to this is the spot treatment of difficult invasive weeds such as Japanese Knotweed (*Fallopia japonica*). Hedge cuttings should be piled into heaps and left to decay naturally. In all cases, the cutting of hedgerows must not be carried out between March 1st and August 31st.

Large continuous blocks (>1 hectare) of established briar, scrub or gorse must be opened up (outside the bird breeding season, March 1st –August 31st) unless the area is known, or deemed suitable as nesting habitat. Contact the local Conservation Ranger if clarification is sought on this matter. Often, areas of bramble, dwarf gorse, and willow will be used for nesting. As a general rule, the planner should assess the ground flora in this respect. If the area of scrub has patches of grasses, sedges, bramble or heather etc, there is a chance of Hen Harriers (or other birds such as Merlin) nesting there. If the area of scrub has little or no ground vegetation under the scrub canopy, then the scrub will be of limited nesting value, and thus management should focus on increasing its foraging value by increasing surface area. The Hen Harriers world is one of surface area and habitat structure as much as habitat/ species composition. Increased surface area equals increased foraging ability. A 1 hectare area of scrub, which is completely closed in, resembles the surface area of a cube. A 1 hectare area of scrub, which has open patches, particularly linear open patches („rides'), has a much higher surface area. Proposed rides or paths must be marked on the farm plan map. Rides should be c 10 metres in width; the preferred method to cut out rides is cutting with hand tools (including chainsaws). Any proposal for mechanical control must be agreed with NPWS prior to plan submission. The brash should be stacked in heaps along the length of the ride and allowed to decay naturally. The ride can be grazed by stock after clearance works are completed. Sufficient rides to ensure that the remaining blocks of scrub do not exceed 1 hectare in size are required. Work on cutting out rides must commence in year 1, At least 80% of the required works must be completed before the end of year 3 and 100% before the end of year 4.

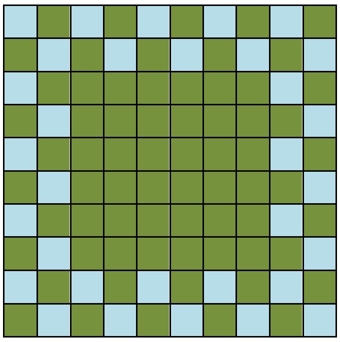
Retain at least 50% of the area covered by scrub and hedges in scattered lines or patches rather than in a single block. A suggested clearance of scrub (*where necessary*) is given in Figure 2. In situations where the terrain makes access difficult and cutting out rides or paths impossible an alternative strategy is to cut out 10 x 10 m blocks. One block must be cut out per hectare per year in blocks of scrub exceeding 1 hectare in size. The brash is to be piled within the clearing and left to decay naturally. Control of scrub regeneration is not required (except in the case of Rhododendron). Dates for the completion of planned scrub control must be given in the plan. In all cases the cutting off scrub is not permitted between March 1st and August 31st each year.

FIGURE 2. SUGGESTED SCRUB MANAGEMENT FOR
NON-NESTING AREAS CLOSED IN BY UNSUITABLE SCRUB

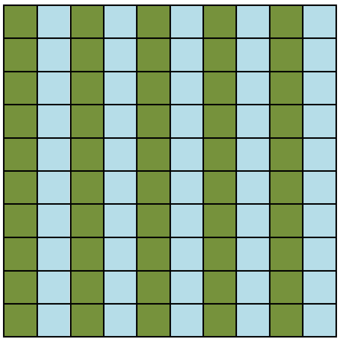
Scrub
Open Space



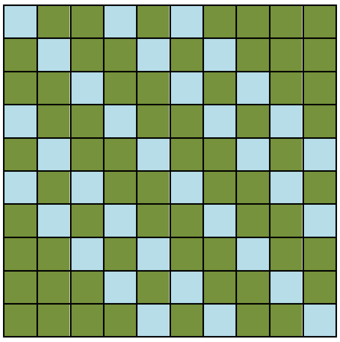
(a)
1 hectare of closed-in,
Non-nesting scrub (0% O.S.)



(b)
Staggered Edge
(40% O.S.)



(c)
Linear Rides (50% O.S.)



(d)
Diagonal Rides (34% O.S.)

Each diagram = 1hectare. Each cell = $100m^2$
Plots of >1hectare to be designed hectare by hectare
Optimum ride width = 10 metres
Design Open Space (O.S.) lengthwise (i.e. 5 rides of 100 metres long rather than 100 rides of 5 metres long)
Creation of designs by cutting/ removal, not burning
Diagrams for illustrative purposes only.

4.3 Woodland.

No active management of woodlands is normally required. Supplementary feeding should not be carried out in deciduous woodlands.

4.4 Forestry.

Commercial forestry plantations are not eligible for payment. However thinning, fertilising, disease control and clear felling should be in accordance with current Forest Service guidelines. The planting of areas on which payment has been claimed without the approval of the NPWS is a serious matter which will result in penalties up to and including termination of farm plan contracts.

4.5 Heath and blanket bog.

Maintain a low stocking intensity on heath/ bog. Guideline stocking levels are a maximum 0.25 LU/ hectare on heath and a maximum of 0.10 LU/ hectare on blanket bog. All self-seeded conifers outside of forestry plantations and Rhododendron or other invasive species must be removed in year 1 of the plan. Ongoing control will be required in each subsequent year of the contract period. Acceptable control methods are cutting/ pulling or spot treatment with a suitable herbicide. This is of particular importance in Blanket Bog/ Heath Habitats.

Consideration should be given to the creation of shallow pools 30- 50 cm deep to provide spawning sites for amphibians.

4.6 Other habitats.

The planner should refer to the NPWS publication *"Nature on the Farm"* for guidelines on the appropriate management of habitats other than those described above.

5. Management Issues Common to all Habitat Types.

5.1 Protection of known nest sites.

If a nest is present, grazing should be excluded from an area within 50 metres of the nest site between March 1st and July 31st. A temporary electric fence is adequate for this purpose. If there is an existing stockproof boundary closer than 50 metres from the nest site it can be utilised as part of the boundary.

If nesting is suspected the participant should notify the NPWS or their planner at the earliest possible opportunity

5.2 Supplementary feeding.

Supplementary feeding can continue provided excessive poaching is avoided. Sacrificial paddocks are not permitted at any time. Supplementary feeding of round bales or from fixed feeding points is not permitted within 30 metres of a watercourse. On land sloping towards a watercourse a greater distance may be required.

5.3 **Burning.**

The burning of vegetation or other materials on SPA designated lands is not permitted at any time during the contract period.

5.4 **Use of herbicides.**

Spraying or broadcast application of herbicide is not permitted. Use spot application and wipe-on treatments to eradicate docks, thistles, ragwort and similar noxious weeds. Rhododendron and conifers may be removed by cutting and herbicide treatment (round-up applied to incision made into the cambium (just inside bark) works best. Bracken control may be by rolling, cutting and/ or by controlled cattle/ equine trampling in early summer. In exceptional circumstances, control of bracken by herbicides may be permitted. The use of herbicides is not permitted within 5 metres of a watercourse or existing hedgerows; the only exception is spot treatment for the control of difficult invasive species such as Japanese Knotweed (*F japonica*). If watercourses are located in an SAC and a conservation management plan or ARCs specify a greater distance then this greater distance shall apply. Any exceptions to the above must be agreed with NPWS before the plan is approved.

5.5 **Use of poisons or stupefying baits**

The use of poisons or stupefying baits is not permitted. Hen Harriers and other birds of prey can fall victim to secondary and direct poisoning.

5.6 **Fence marking.**

Hen Harriers can fly into electric and barbed wire. Light coloured plastic fliers on wire are an effective counter measure.

5.7 **Drainage maintenance**.

The maintenance of existing drains is permitted but new drains should not be opened. In blanket bog or heath drain maintenance should cease unless there is evidence that to do so would adversely affect neighbouring properties. Maintenance of drains is only permitted in the month of September unless derogation has been granted by the relevant Fisheries Board for the period October –April.

Creation of ponds which will benefit biodiversity (e.g. amphibians, other wildlife) are to be encouraged, where no annexed habitat (e.g. heather/ bog) is being sacrificed and the land is not also an SAC.

6 **Supplementary Notes, Hen Harrier**

6.1 The area of blanket bog and heath payable to individual applicants shall be capped at an area of 10 hectares.

6.2 The improved grassland existing at the time of SPA designation can remain in the farm. However it is not permitted to increase this area beyond 20% of the SPA area on the farm.

If the area of improved grassland already exceeds 20% of the SPA area on the farm then no further increase is permitted.

6.3 If it is known that Hen Harriers are nesting or winter roosting on the farm, the farm plan must provide protection for the nest site. Where it is discovered that Hen Harriers are nesting or winter roosting on the farm after a plan has been approved an amendment to the farm plan will be required. Participants must report any suspected nest sites to their planner or to the NPWS.

6.4 Landowners should be requested to report any Hen Harrier sightings to their planner and/or NPWS (via harriers@environ.ie).

6.5 Participants should refrain from publicising the exact location of nest sites. They should in so far as is practical avoid approaching the nest during the period March 1st – July 31st.

6.6 Managing the farm for Hen Harriers fits the concept of focal species modelling. In managing habitats to benefit Hen Harriers, a range of other beneficial outcomes will be achieved. Successful management for Hen Harriers will be of benefit for other species most notably Merlin, Kestrels, Sparrowhawks, Owls, Red Grouse, Irish Hare, Curlew, Golden Plover and a range of small mammal and bird species. Habitats such as blanket bog, upland heath, rivers and streams, hedgerows and trees will also benefit. Hen Harriers can be seen as indicator species, indicating the health of the overall ecosystem and landscape.

REFERENCE DOCUMENTS

Appendix 3

Landowner consent letters

To:
Ecopower Development s Limited
Sion Road
Kilkenny

I, Gerard Ryan, Knockeravoola, Upperchurch, Thurles, Co. Tipperary confirm that I am the owner of the lands outlined on the attached map containing 24.6Ha in area.

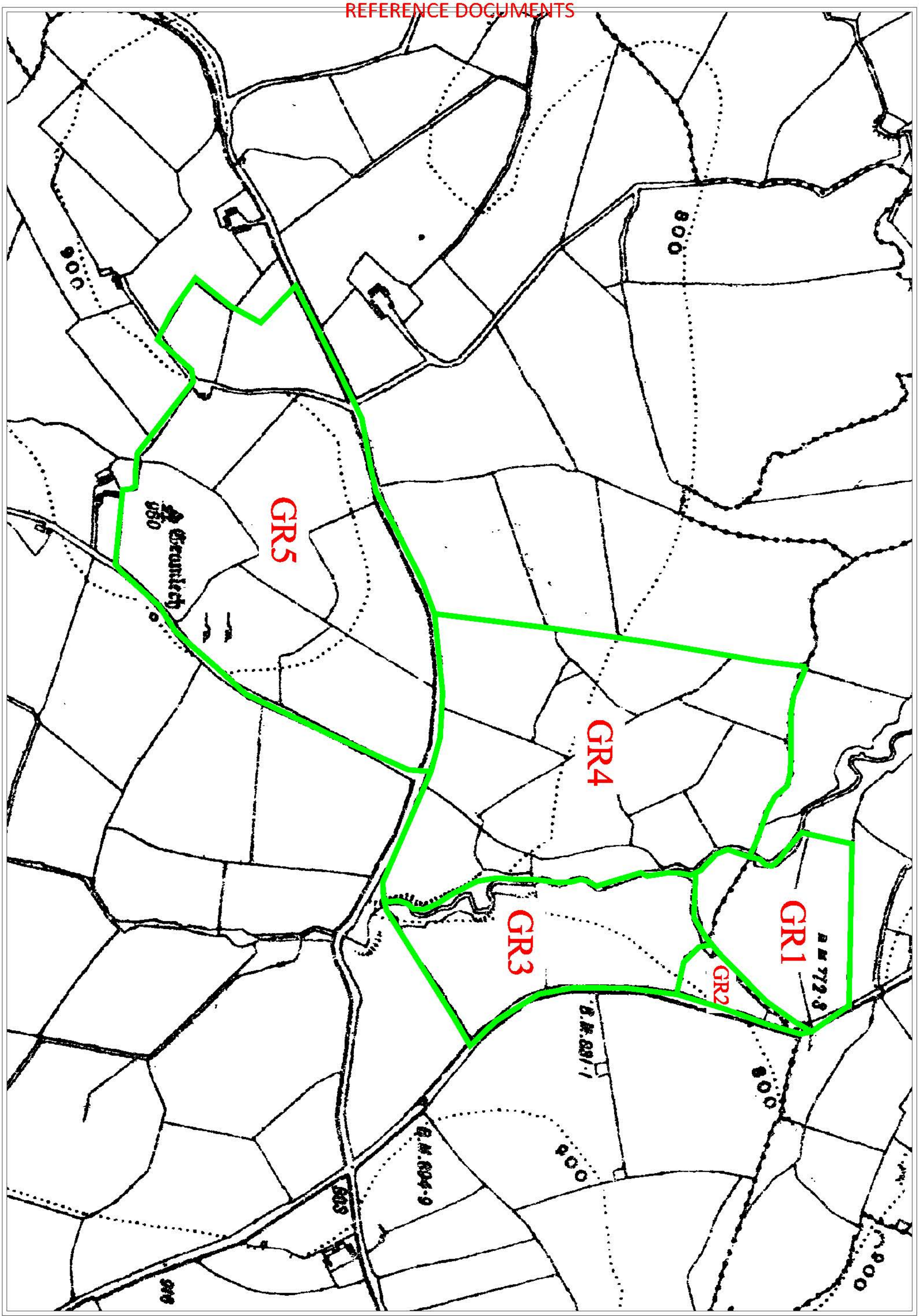
I undertake to manage these lands as described in the Hen Harrier Habitat Management Plan (HHHMP) as submitted in response to Further Information, Planning Ref. No. 13/51/0003.

I understand that this management plan will continue for the operational lifetime of the Upperchurch Windfarm.

I confirm that I have read and understand the HHHMP.

Gerard Ryan C,

Date: 23/11/2013


GR1
GR2
GR3
GR4
GR5
B.M. 772·3
B.M. 804·9
800
900

To:
Ecopower Development s Limited
Sion Road
Kilkenny

I, Patrick Quinlan of Knockcurraghbola, Upperchurch, Thurles, Co. Tipperary confirm that I am the owner of the lands outlined on the attached map containing 27 hectares in area.

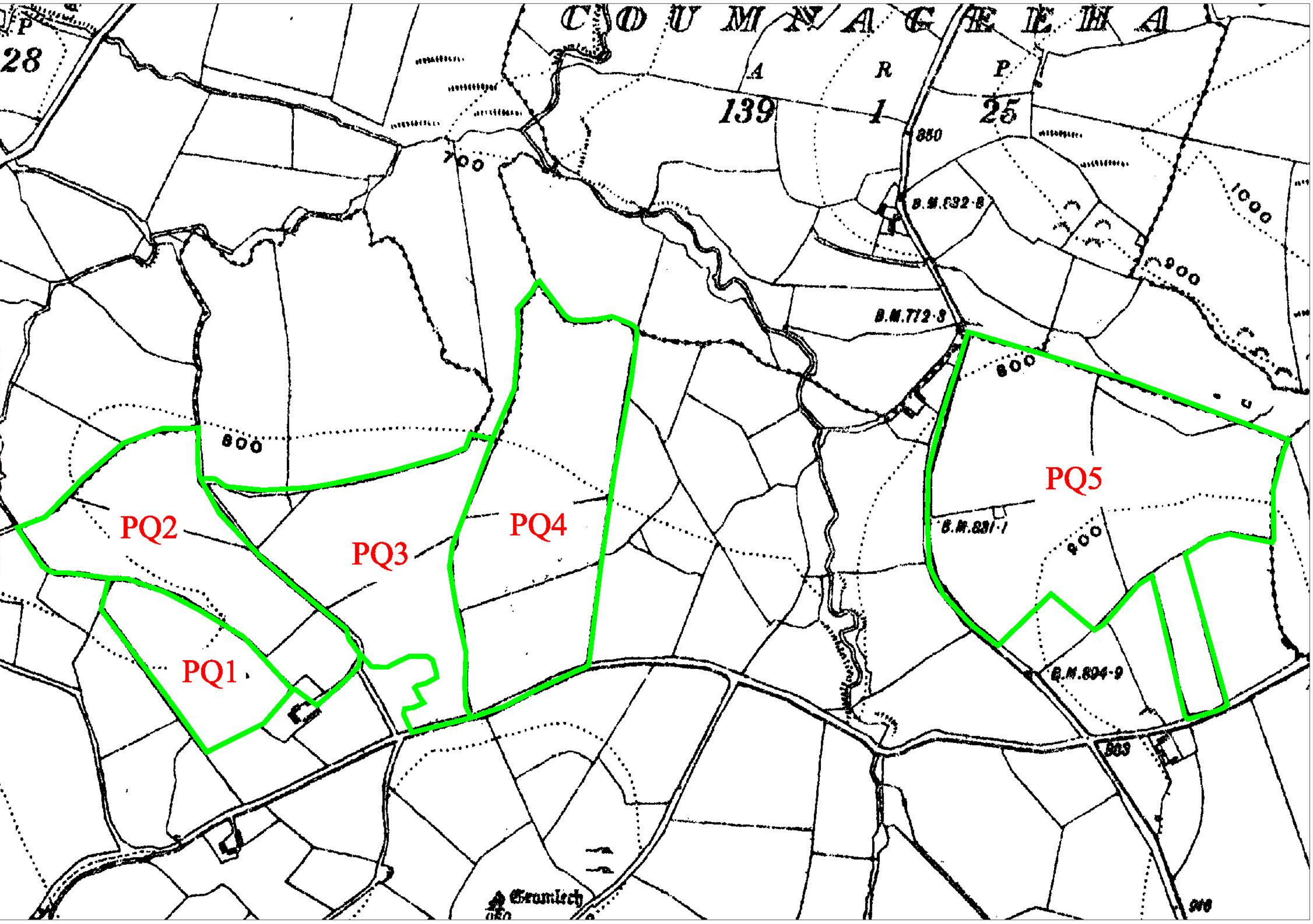
I undertake to manage these lands as described in the Hen Harrier Habitat Management Plan (HHHMP) as submitted in response to Further Information, Planning Ref. No. 13/51/0003.

I understand that this management plan will continue for the operational lifetime of the Upperchurch Windfarm.

I confirm that I have read and understand the HHHMP.

Patrick Quinlan ....

Date: 25/11/2013


COUMNAGEEHA
A
R
P
139
1
25
28
850
B.M.832·8
B.M.772·8
B.M.831·1
B.M.804·9
1000
900
800
700
PQ1
PQ2
PQ3
PQ4
PQ5
Cromlech

To:
Ecopower Development s Limited
Sion Road
Kilkenny

I, Vincent O Dwyer of 14, Cluain Dara, Monadreen, Thurles, Co. Tipperary confirm that I am the owner of the lands outlined on the attached map containing 8 hectares in area.

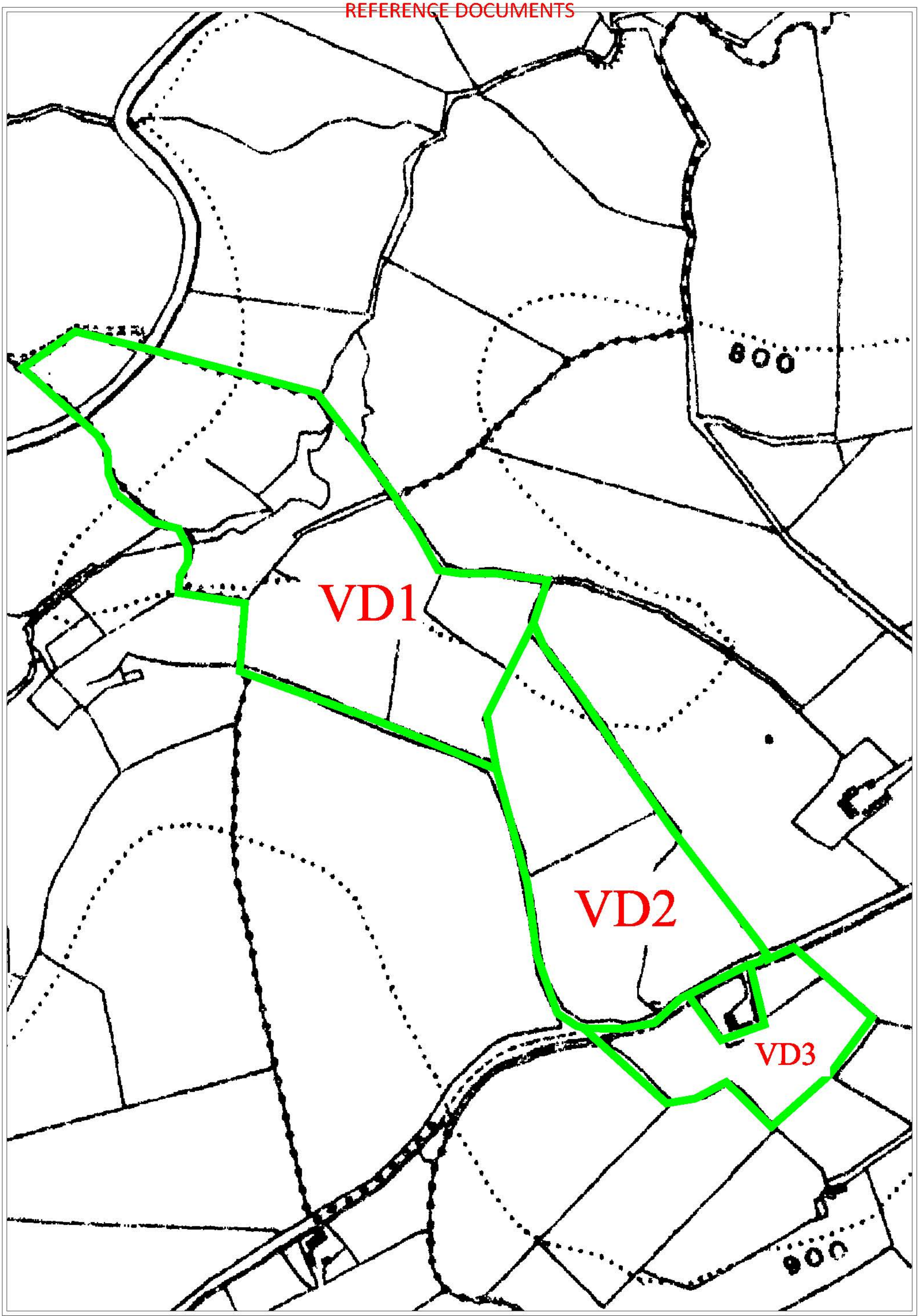
I undertake to manage these lands as described in the Hen Harrier Habitat Management Plan (HHHMP) as submitted in response to Further Information, Planning Ref. No. 13/51/0003.

I understand that this management plan will continue for the operational lifetime of the Upperchurch Windfarm.

I confirm that I have read and understand the HHHMP.

Vincent O'Dwyer.
....

Date: 25/11/13


800
VD1
VD2
VD3
900

To:
Ecopower Development s Limited
Sion Road
Kilkenny

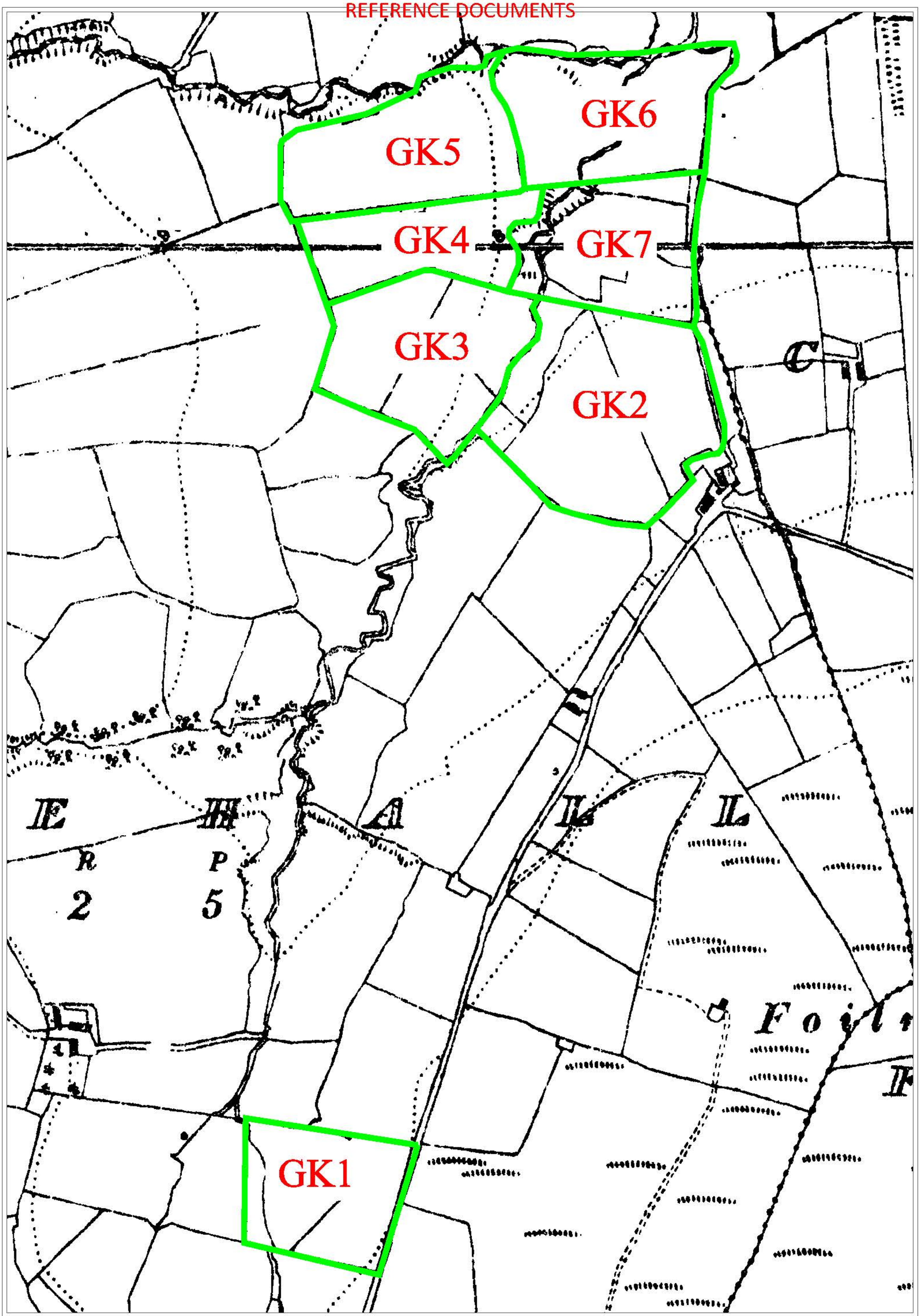
I, Gerard Kennedy, Foilnamon, Milestone, Thurles, Co. Tipperary confirm that I am the owner of the lands outlined on the attached map containing ~~15.7~~ hectares in area.
15.7

I undertake to manage these lands as described in the Hen Harrier Habitat Management Plan (HHHMP) as submitted in response to Further Information, Planning Ref. No. 13/51/0003. I understand that this management plan will continue for the operational lifetime of the Upperchurch Windfarm.

I confirm that I have read and understand the HHHMP.

Gerard Kennedy

Date: 26/11/2013


GK6
GK5
GK4
GK7
GK3
C
GK2
E
H
A
L
L
R
P
2
5
Foil
F
GK1

To:
Ecopower Development s Limited
Sion Road
Kilkenny

I, John Quinlan, Grousehall, Milestone, Thurles, Co. Tipperary confirm that I am the owner of the lands outlined on the attached map containing 26.5 hectares in area.

I undertake to manage these lands as described in the Hen Harrier Habitat Management Plan (HHHMP) as submitted in response to Further Information, Planning Ref. No. 13/51/0003.

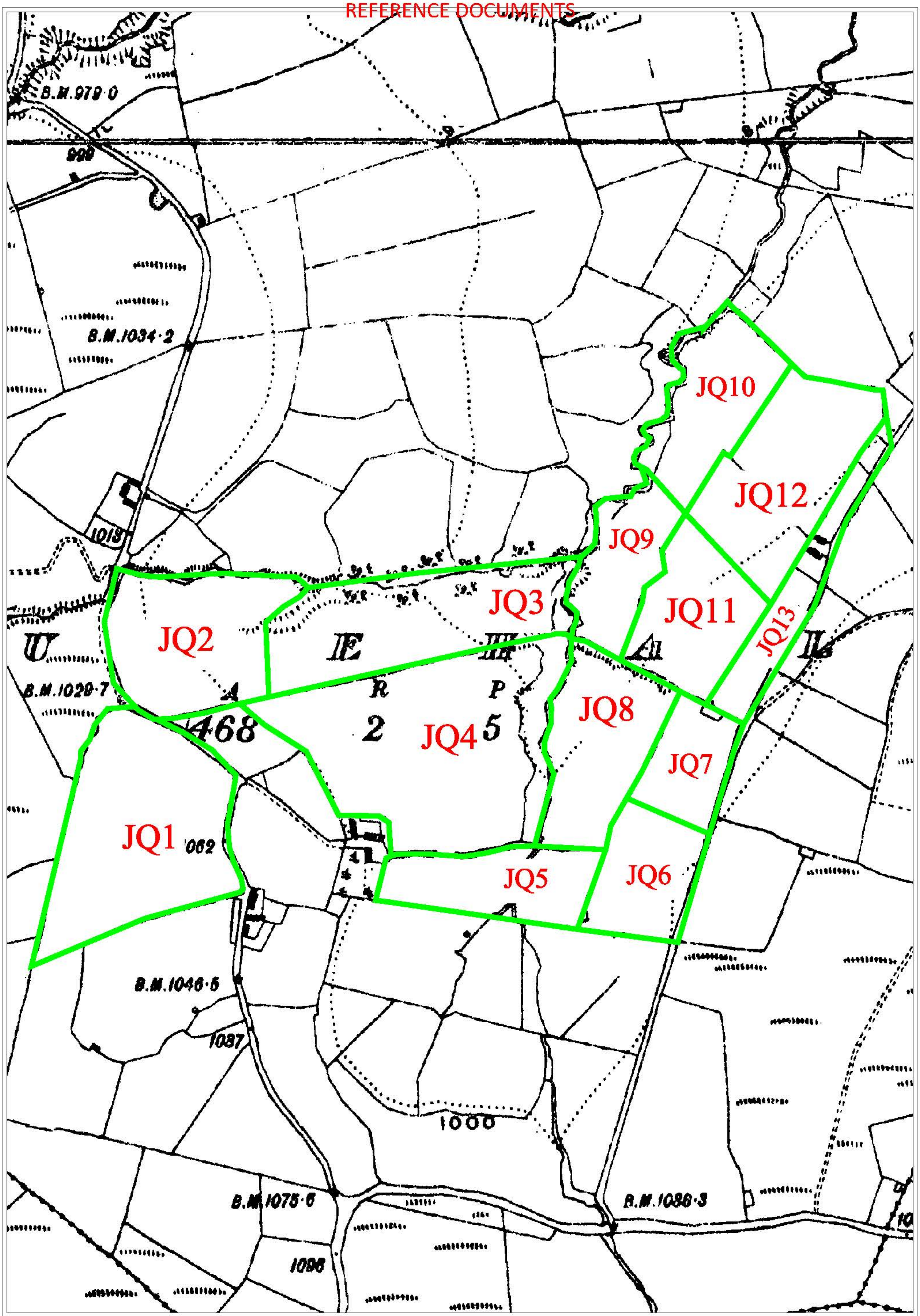
I understand that this management plan will continue for the operational lifetime of the Upperchurch Windfarm.

I confirm that I have read and understand the HHHMP.

....

Date: 26/11/13

REFERENCE DOCUMENTS



To:
Ecopower Development s Limited
Sion Road
Kilkenny

I, John (SEAN) Ryan of Knockmcroe Kilcommon

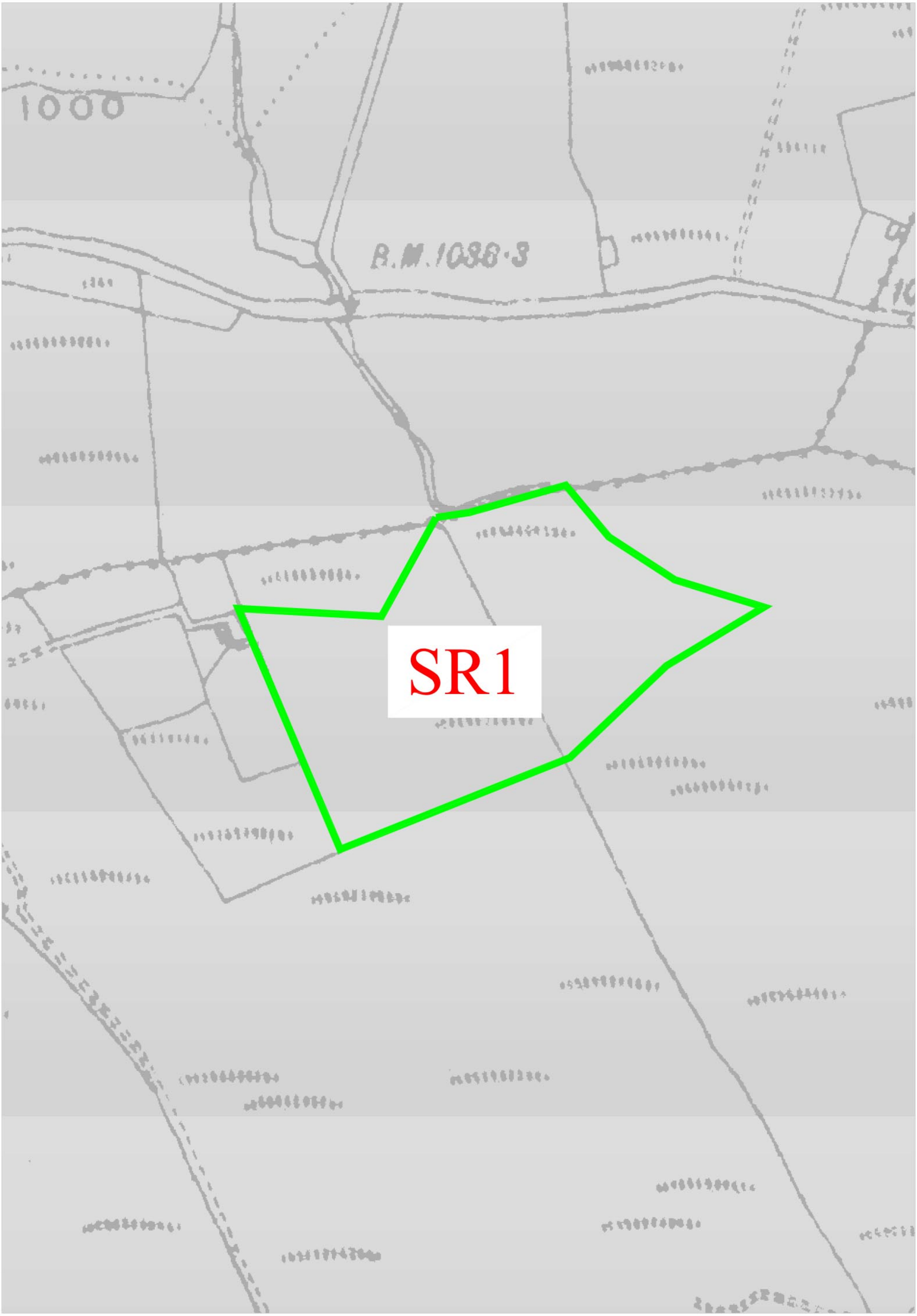
Co. Tipperary confirm that I am the owner of the lands outlined on the attached map containing 2.8 hectares in area.

I undertake to manage these lands as described in the Hen Harrier Habitat Management Plan (HHHMP) as submitted in response to Further Information, Planning Ref. No. 13/51/0003. I understand that this management plan will continue for the operational lifetime of the Upperchurch Windfarm.

I confirm that I have read and understand the HHHMP.

Sean Ryan

Date: 26/11/13



1000
B.M.1038·3
SR1

To:
Ecopower Development s Limited
Sion Road
Kilkenny

I, Andrew Ryan ...., of Feldramon ....

Co. Tipperary confirm that I am the owner of the lands outlined on the attached map containing ..5...... hectares in area.

I undertake to manage these lands as described in the Hen Harrier Habitat Management Plan (HHHMP) as submitted in response to Further Information, Planning Ref. No. 13/51/0003. I understand that this management plan will continue for the operational lifetime of the Upperchurch Windfarm.

I confirm that I have read and understand the HHHMP.

Andy Ryan

Date: 26/11/2013

700
AR1
800

To:
Ecopower Development s Limited
Sion Road
Kilkenny

I, Michael Carey..................., of Foilnamon...

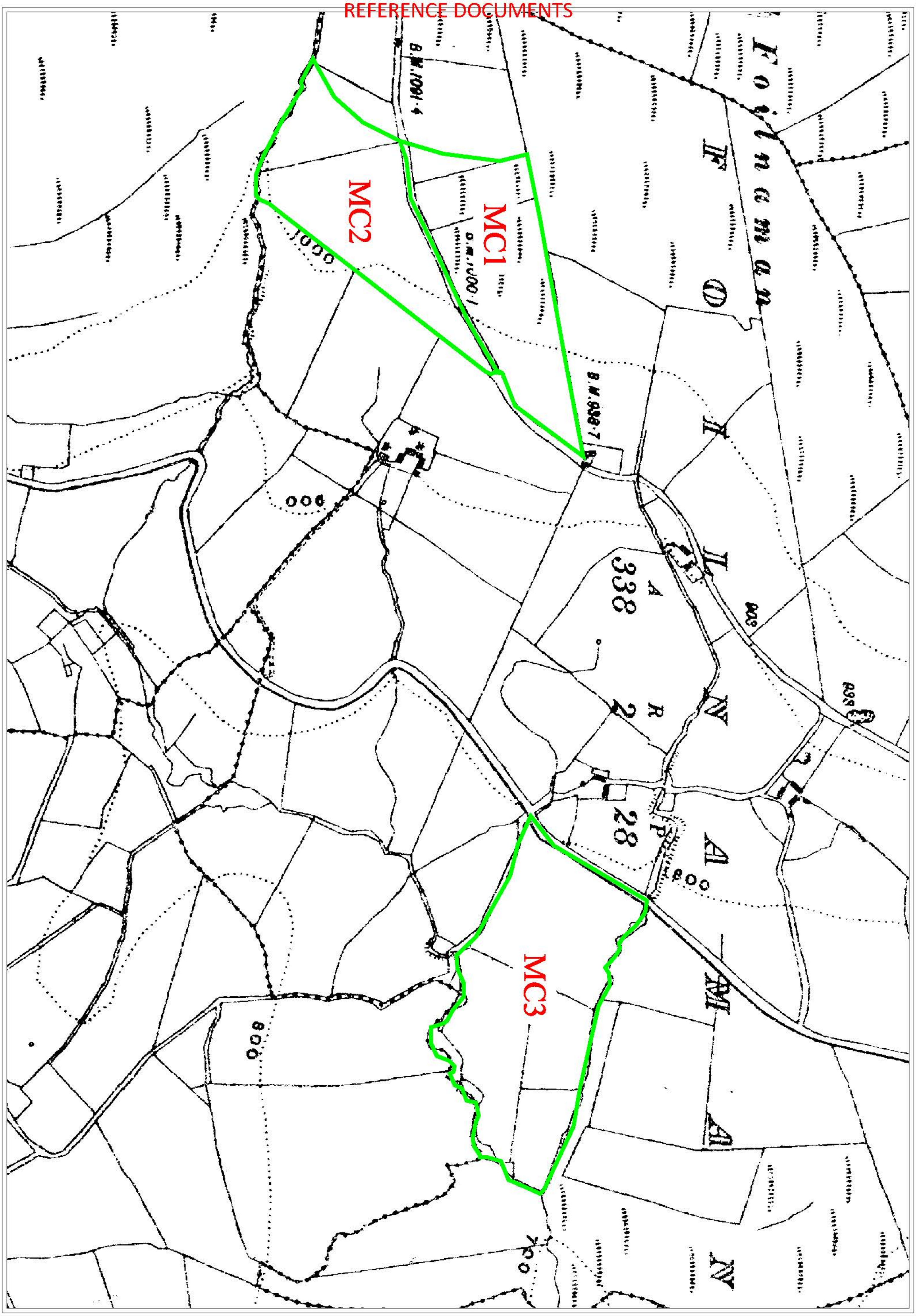
Co. Tipperary confirm that I am the owner of the lands outlined on the attached map containing ..12.. hectares in area.

I undertake to manage these lands as described in the Hen Harrier Habitat Management Plan (HHHMP) as submitted in response to Further Information, Planning Ref. No. 13/51/0003. I understand that this management plan will continue for the operational lifetime of the Upperchurch Windfarm.

I confirm that I have read and understand the HHHMP.

Michael Carey.........

Date: 26/11/2013


MC1
MC2
MC3
Foilnaman
B.M.1091·4
B.M.1000·1
B.M.938·7
1000
900
800
700
338
28

To:
Ecopower Development s Limited
Sion Road
Kilkenny

I, Michael Ryan, of Glown, Upperchurch

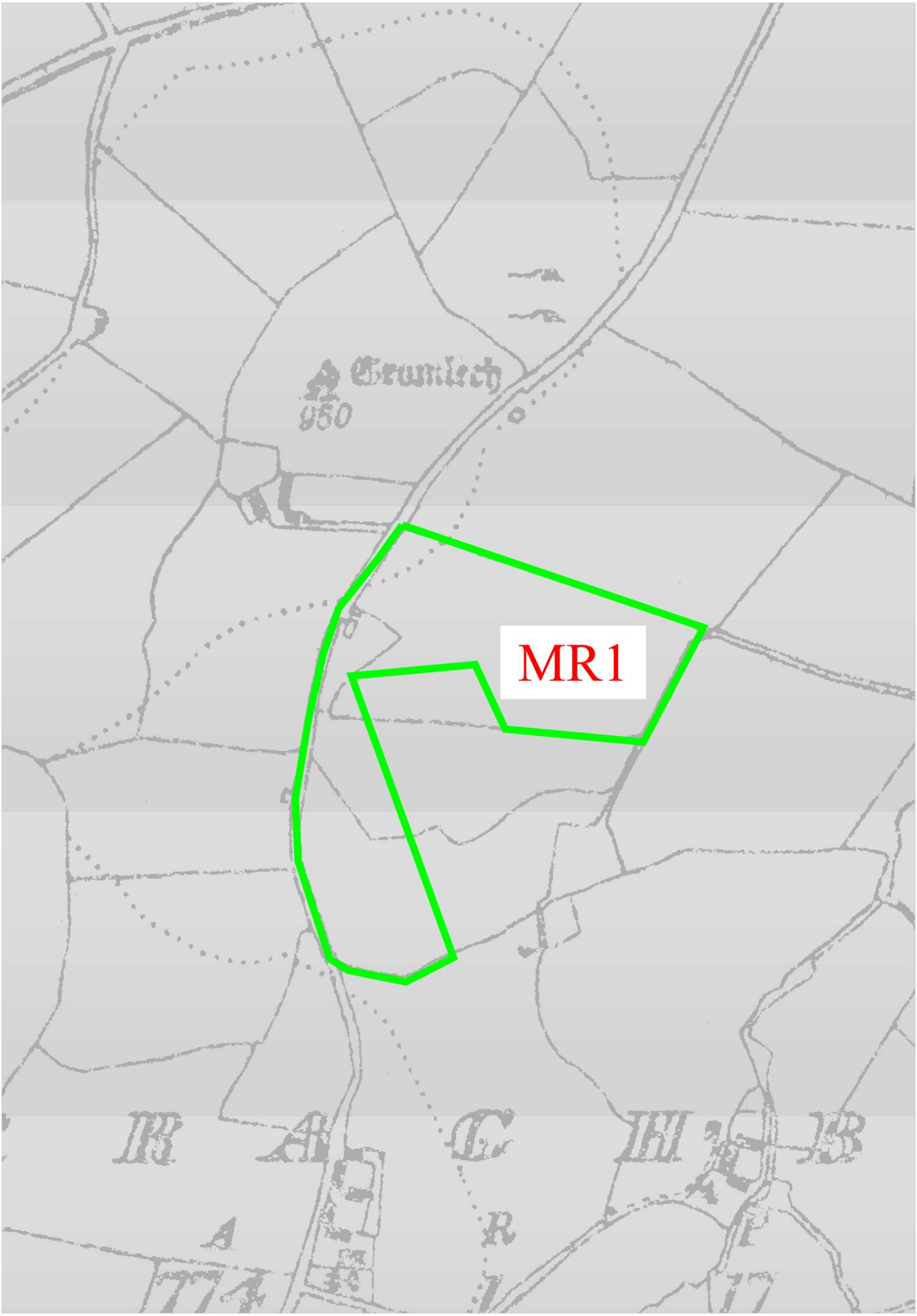
Co. Tipperary confirm that I am the owner of the lands outlined on the attached map containing ..2... hectares in area.

I undertake to manage these lands as described in the Hen Harrier Habitat Management Plan (HHHMP) as submitted in response to Further Information, Planning Ref. No. 13/51/0003. I understand that this management plan will continue for the operational lifetime of the Upperchurch Windfarm.

I confirm that I have read and understand the HHHMP.

Michael Ryan

Date: 26/11/2013


Cromlech
950
MR1

Appendix 4

Hen Harrier Habitat Area Matrix

Area A

Measures/Field ID:	GK1	GK2	GK3	GK4	GK5	GK6	GK7	GK8	JQ1	JQ2	JQ3	JQ4	JQ5	JQ6	JQ7	JQ8	JQ9	JQ10	JQ11	JQ12	SR1	MC1	MC2	MC3
A: Wet Grassland, B Agri/Wet, C: Agri. R: riparian W: Willow Scrub	B	CR	BR	A	C	AR	BR	B	B	BR	BR	BR	BR	B	B	BR	BR	BR	B	B	A	B	B	B
Size in Hectares	1.6	3.3	2.3	1.7	2.4	2.2	1.6	0.8	3.5	2.4	2.9	4.6	1.6	1.3	1	1.8	1.2	1.7	1.7	2.6	2.8	3.5	3.5	5.4
Plant hedgerow with broadleaved native species					60	55			88	60	73									65	70	88	88	180
Fence off and plant/maintain enclosure with broadleaved native species	0.4			0.2			0.1									0.2								
Enhance riparian corridor: Plant woody scrub		√					√						√			√	√	√						√
Enhance riparian corridor: stockproof fencing		√	√	√		√	√			√	√	√	√			√	√	√						
Land will be allowed to revert back to wet grassland			√			√	√		√	√							√	√			√	√	√	√
Achieve 30 - 70% rush coverage optimum	√		√			√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Rush coverage is controlled with grazing	√		√	√		√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Rush coverage is controlled with cutting, usually every second year	√		√	√			√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Target stocking level: Min 0.6 LU/Ha, Max 1.6 LU/Ha	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Mark electric fence lines with plastic fliers	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Restrictions:																								
Limited spreading of fertiliser	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√			
Limited spreading of lime	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
No burning	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
No excavation of new drains or reclaiming heath or bog	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
No removal of hedgerows	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
No recreational off-roading with vehicles	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
No use of poisons or stupefying baits	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
No new forestry plantation	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√

REFERENCE DOCUMENTS

Area B

Measures/Field ID:	GR1	GR2	GR3	GR4	GR5	PQ1	PQ2	PQ3	PQ4	PQ5	VD1	VD2	VD3	AR1	MR1
A: Wet Grassland, B Agri/Wet, C: Agri. R: riparian W: Willow Scrub	C	W	BR	BR	B	B	B	B	B	B	B	B	B	BR	B
Size in Hectares	2.4	0.4	3	9.1	9.4	2.1	4.5	4.7	5.9	9.8	3.3	2.4	1.1	5	2.2
Plant hedgerow with broadleaved native species	60		75	410	540	53	100	100	200	560	83	63		120	70
Fence off and plant/maintain enclosure with broadleaved native species								0.3						0.9	
Enhance riparian corridor: Plant woody scrub			√	√											
Enhance riparian corridor: stockproof fencing															
Land will be allowed to revert back to wet grassland			√	√	√						√	√	√		√
Achieve 30 - 70% rush coverage optimum	√		√	√	√	√	√	√	√	√	√	√	√	√	√
Rush coverage is controlled with grazing	√		√	√	√	√	√	√	√	√	√	√	√	√	√
Rush coverage is controlled with cutting, usually every second year	√		√	√		√	√	√	√	√	√	√	√	√	√
Target stocking level: Min 0.6 LU/Ha, Max 1.6 LU/Ha	√		√	√	√	√	√	√	√	√	√	√	√	√	√
Mark electric fence lines with plastic fliers	√		√	√	√	√	√	√	√	√	√	√	√	√	√
Restrictions:															
Limited spreading of fertiliser	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Limited spreading of lime	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
No burning	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
No excavation of new drains or reclaiming heath or bog	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
No removal of hedgerows	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
No recreational off-roading with vehicles	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
No use of poisons or stupefying baits	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
No new forestry plantation	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√

REFERENCE DOCUMENTS

Q6.*Please submit a preliminary Environmental Management Plan (EnvMP) in relation to the proposed construction and operational phases of all relevant aspects of the proposed development. Such plan shall deal with the management and implementation methodology associated with all relevant environmental issues, constraints and proposed mitigation measures/propositions as identified in the EIS and documents submitted as part of this application. In addition please submit a Surface Water Management Plan (inclusive of annotated drawings) in relation to all relevant aspects (e.g. bridge crossings, borrow pits etc.) of the proposed development including potential impacts that may arise upon the downstream Lower Rivet Suir SAC.*

The answer to Q.6 follows (Over);

UPPERCHURCH WINDFARM
PRELIMINARY ENVIRONMENTAL MANAGEMENT PLAN

REFERENCE DOCUMENTS

13 /51/0003 – response to RFI dated 28th February, 2013

Further Information 13/51/0003 (22 No. wind Turbines at Upperchurch)

REFERENCE DOCUMENTS

REFERENCE DOCUMENTS

Malachy Walsh and Partners
Engineering and Environmental Consultants

Preliminary Environmental Management Plan

For

Upperchurch Wind Farm

On behalf of

ECOPOWER DEVELOPMENTS LIMITED

15388
November 2013

Job number	Revision	Prepared by	Checked by	Status	Date
15388-6001	B	Helen Burman-Roy	Monica Kane	Final	21/11/2013

MWP ENVIRONMENT AND PLANNING

Table of contents

LIST OF APPENDICES

1 INTRODUCTION

1.1 BACKGROUND TO PRELIMINARY ENVIRONMENTAL MANAGEMENT PLAN

All construction projects require the preparation of a site specific construction phase Environmental Management Plan in order to ensure that the project is constructed in accordance with best practice, with the minimum impact on the surrounding environment, in adherence with all environmental mitigation measures recommended in the Environmental Impact Statement and in compliance with any planning conditions which may be attached to a Grant of Permission by North Tipperary County Council.

This Environmental Management Plan (EMP) has been prepared by Malachy Walsh and Partners, on behalf of Ecopower Developments Limited, as a preliminary EMP at the planning stage of the project. The document aims to incorporate all mitigation measures recommended in the Environmental Impact Statement, and any additional mitigation measures recommended by specialist reports prepared as part of a response to a Request for Further Information (RFI) from North Tipperary County Council.

This EMP provides the information which will be contained in the final Contractor-developed Plan at the construction stage of the project. Furthermore, there will be a requirement on the Contractor to update these details, in particular to the roles and responsibilities of those appointed on the site for the construction of the project.

1.2 PLANNING CONTEXT

Ecopower Developments Limited applied to North Tipperary County Council (NTCC) for permission to construct a wind farm at Graniera, Shevry, Knockcurraghbola Commons, Knockmaroe, Grousehall, Cummer, Foilnaman, Gleninchnaveigh, Coumnageeha, Coumbeg, Knocknamena Commons, Glenbeg, Seskin, Co. Tipperary in January 2013. The proposed wind farm consists of 22 no. wind turbines, of overall height up to 126.6m, 2 no. meteorological masts up to 80m in height, access roads, substation and compound, and all ancillary site works. The permission sought is for 10 years and the application was supported by an Environmental Impact Statement and Appropriate Assessment (Natura Impact Statement). The NTCC Planning Reference is 13/51/0003. On 28th February 2013, NTCC issued a Request for Further Information which included the provision of a preliminary Environmental Management Plan. The plan set out in this document *will require revision* and further input in the event of a grant of permission, to incorporate all details of the planning conditions and upon appointment of the Contractor, details of the personnel, roles, responsibilities and methods.

1.3 SCOPE AND PURPOSE OF ENVIRONMENTAL MANAGEMENT PLAN

1.3.1 Scope of the EMP

The Environmental Management Plan for the Upperchurch Wind Farm will detail all aspects of the construction stage of the project in compliance with the *planning conditions* of the grant of planning and relevant environmental mitigation measures. The EMP includes the following:

- Introduction
  - Background
  - Scope and Purpose
  - Roles and Responsibilities
- Existing Site
- Construction Works
  - Project Overview
  - Access
  - Engineering Works and Phases
  - Method Statements
  - Construction Schedule
- Environmental Requirements
  - Environmental Policy
  - Register of Mitigation Measures and Planning Requirements
  - Environmental Management Procedures
  - Environmental Monitoring Schedule

In as much as is possible at this stage of the project, the relevant information is included in the EMP.

1.3.2 Supporting Information in Appendices

Technical reports have been completed relating to the management of surface water run-off and the drainage details of the project, and the management of ecology. The following reports are included in the appendices and requirements of these assessments incorporated into the EMP;

- Ecological Management Plan
- Surface Water Management Plan

A table of Environmental Mitigation Measures is also included as an appendix.
The *revised EMP* will also include a Waste Management Plan, Traffic Management Plan, Method Statements, Checklists and an Organisational Structure in the Appendices.

1.3.3 Purpose of EMP

This EMP defines the management and implementation methodology of the relevant environmental issues of the proposed development. The work practices, construction management procedures and management responsibilities relating to the construction of the Upperchurch Wind Farm are outlined.

This EMP describes how the Contractor (when appointed) will implement a site construction management system on this project to meet the specified requirements which will include contractual, regulatory and statutory requirements, environmental mitigation measures and planning conditions. It is the contractor's responsibility to implement an effective management system to ensure that Ecopower Developments requirements for the construction of this wind farm are met.

All site personnel will be required to be familiar with the plan's requirements as related to their role on site. The plan describes the project organisation, sets out the procedures that will be adopted on site and outlines the key performance indicators for the site.

The EMP also defines the roles and responsibilities of the various parties to the construction contract, as set out below.

1.4 ROLES AND RESPONSIBILITIES/MANAGEMENT STRUCTURE

The roles and responsibilities outlined below are indicative at this stage in the project and will be updated upon appointment of the Contractor.

The appointed Contractor will be *required to finalise the Organisational Structure* for the project to oversee this EMP and to outline the specific responsibilities for the roles required (*Organisational Structure to be appended)*. The roles may be outlined as follows;

- Contractor's Project Manager
- Site Agent
- Geotechnical Engineer
- Environmental Officer
- Health and Safety (PSDP& PSCS)
- Project Ecologist
- Project Archaeologist

Pending planning permission, conditions of planning and the appointment of a Contractor, details of the personnel and their responsibilities must be added to the EMP. *An outline of potential roles is provided below but will require revision.*

1.4.1 Project Manager – *To be updated upon appointment of Contractor/finalisation of EMP*

The Contractor's Project Manager is responsible for:

- the implementation of the Environmental Management Plan
- management of the construction project
- co-ordinating all construction teams
- implementing the Health and Safety Plan
- liaison with the client/developer
- production of construction schedule
- maintaining a site project diary

1.4.2 Site Agent – ***<u>To be updated upon appointment of Contractor/finalisation of EMP</u>***

The Site Agent, reports to the Project Manager and is responsible for:

- implementing the Environmental Management Plan
- assigned project management duties
- implementing the Health and Safety Plan
- liaison with the client/developer
- production of construction schedule
- maintaining a site project diary

1.4.3 Geotechnical Engineer – ***<u>To be updated upon appointment of Contractor/finalisation of EMP</u>***

The Geotechnical Engineer reports to the Project Manager and is responsible for:

- implementing the Environmental Management Plan
- materials procurement
- design of Temporary Works
- programming and planning of excavation works
- review and approval of method statements
- implementing the Health and Safety Plan
- maintaining a site project diary

1.4.4 Environmental Officer – ***<u>To be updated upon appointment of Contractor/finalisation of EMP</u>***

The Environmental Officer is appointed by the Contractor and reports to the Project Manager. He is responsible for:

- implementing the environmental procedures of the EMP and updating it as necessary
- management of all environmental aspects of the construction works and audit of controls
- review and approval of method statements relating to environmental aspects
- ensuring implementation of mitigation measures
- training of staff in all environmental issues
- liaison with the client/developer
- auditing the construction works from an environmental viewpoint

1.4.5 Health and Safety Personnel – ***<u>To be updated upon appointment of Contractor/finalisation of EMP</u>***

The Health and Safety personnel for the construction projectis appointed by the Contractorin line with the Construction Regulations:

- carrying out duty of Project Supervisor Design Process
- carrying out duty of Project Supervisor Construction Stage
- responsible for safety induction of all staff and personnel on site
- implementing the Health and Safety Plan
- auditing and updating the Health & Safety Plan
- all other required legal duties with regard to health and safety

1.4.6 Project Ecologist– ***<u>To be updated upon appointment of Contractor/finalisation of EMP</u>***

The Project Ecologist may be appointed by the Developer or the Contractor and is responsible for:

- review and approval of method statements relating to ecology, such as hedgerow removal
- ensuring implementation of ecological mitigation measures, such as recommended buffers
- implementation of the Ecological Management Plan
- management of ecology related site landscaping and re-vegetation activities
- liaison with the project manager/site agent
- liaison with the contractor/client/developer

1.4.7 Project Archaeologist – ***<u>To be updated upon appointment of Contractor/finalisation of EMP</u>***

The Archaeologist may be appointed by the Developer or the Contractor and is responsible for:

- review and approval of method statements relating to archaeology
- ensuring implementation of archaeological mitigation measures, such as recommended buffers
- monitoring of groundworks associated with the development
- liaison with the project manager/site agent
- liaison with the contractor/client/developer

1.5 REFERENCE DOCUMENTS

The following reference documents apply to this EMP:

- Environmental Impact Statement for the Upperchurch Wind Farm (January 2013), prepared in respect of planning reference 13/51/0003.
- Response to the Request for Further Information and the technical reports prepared.
- Planning permission (and associated conditions) *if granted by North Tipperary County Council.*
- Tender documents for construction of Upperchurch Wind Farm, including any associated site investigation and geotechnical reports (*if granted by North Tipperary County Council).*

The following best practice guidelines may also be considered applicable to this EMP:

- National Roads Authority Construction Phase Noise Guidelines
- Guidelines for the Assessment of Archaeological Heritage Impacts of National Road Schemes (NRA)
- Guidelines for Assessment of Ecological Impacts of National Road Schemes (NRA)
- Guidelines for the crossing of watercourses during the construction of National Road Schemes. Environmental Series on Construction Impacts. Dublin (NRA, 2006)
- Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes (NRA)
- Consultation with Inland Fisheries Ireland and other relevant authorities, having regard to relevant pollution prevention guidelines. All works in or adjacent to watercourses will comply with the EPA/Inland Fisheries /NTCC/OPW requirements.
- Pollution Prevention Guidelines, Scottish Environmental Protection Agency
- The Planning System and Flood Risk Management Guidelines for Planning Authorities,Department of Environment, Heritage and Local Government (DoEHLG) 2009
- Advice and licensing regulations of the NPWS and under the guidelines of the National Roads Authority (NRA, 2004 & 2006)
- Windfarm Planning Guidelines 2006, Department of Environment, Heritage and Local Government
- Best Practice Guidelines for the Irish Wind Energy Industry, IWEA & SEAI

2 EXISTING SITE

2.1 SITE DESCRIPTION

The site of the Upperchurch Wind Farm is located within a series of small hills or drumlins 2km to the west of Upperchurch village and 18 kilometres to the west of Thurles. The proposal is to construct 22 turbines in the townlands of Graniera, Shevry, Knockcurraghbola Commons, Knockmaroe, Grousehall, Cummer, Foilnaman, Gleninchnaveigh, Coumnageeha, Coumbeg, Knocknamena Commons, Glenbeg, Seskin, west of Upperchurch village, Co. Tipperary. The turbines, which are numbered T01 to T22 are arranged in four clusters within an overall area of $12km^2$.

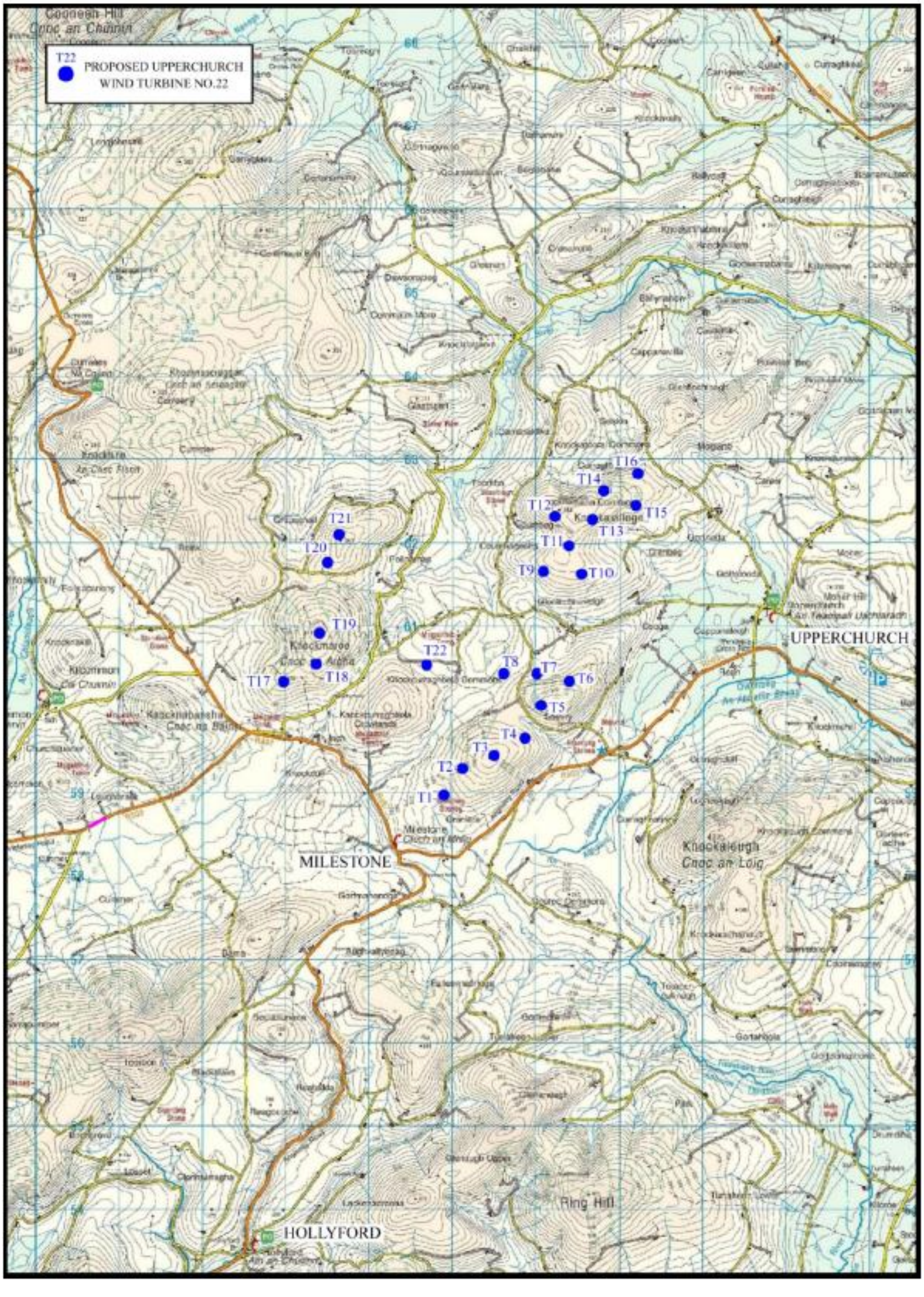
The four clusters are as follows

- T01 to T08 are arranged around two hills at Shevry;
- T09 to T16 are arranged around the hill at Knocknameana Commons;
- T17 to T21 are arranged around two hills at Knockmaroe and Foilnaman;
- T22 is a single turbine on the northeast side of the hill at Knockcurraghbola Crownlands.

The Upperchurch site lies just north and east of the junctions between the regional road from Limerick to Thurles (R503) and the regional road from Tipperary Town to Nenagh (R497). The regional road from Limerick to Thurles (R503) dissects the Silvermine Mountains from north to south. The regional road from Tipperary Town to Nenagh (R497) dissects the Silvermine Mountains from west to east

The Silvermine Mountains comprise many rounded peaks, with intervening valleys of sloping pasture and winding rivers and streams and extend over an area of $c.330km^2$. The proposed turbines are arranged in four clusters within an overall area of $12km^2$on the eastern margins of these mountains. The proposal is to construct 22 wind turbines together with ancillary service roadways and a 110kV substation compound. It is planned to access the site at Graniera, 1km before Milestone, at Site Entrance No. 1. From this point the construction vehicles will access the full site using newly built windfarm roadways, upgraded farm and forestry tracks and site entrances from the Third Class Road network within the site area. The electricity generated will be cabled underground to the windfarm substation compound in Knockcurraghbola Commons.

Figure 2-1. Proposed Layout of the Upperchurch Wind Farm



2.2 HABITATS AND SPECIES AT THE SITE

The habitats identified within the proposed 22-turbine windfarm study area are the improved agricultural grassland (GA1), wet grassland (GS4), coniferous plantation (WD4), wet heath (HH3), upland blanket bog (PB2), acid grassland (GS3), upland/eroding streams (FW1), spoil and bare ground (ED2), buildings and artificial surfaces (BL3), neutral grassland (GS1), hedgerows (WL1), drainage ditches (FW4) and treelines (WL2).

The proposed windfarm lies within 15 km of Lower River Shannon cSAC (site code002165), Bolingbrook Hill cSAC (site code 002124), Lower River Suir cSAC (sitecode 002137), Anglesey Road cSAC (site code 002125), Slievefelim to Silvermines Mountains SPA (site code 004165), Silvermines mountains West SAC (site code002258), Keeper Hill SAC (site code 001197), Kilduff, Devilsbit Mountain SAC (sitecode 000934) and Philipston Marsh SAC (site code 001847). An Appropriate Assessment has been undertaken to determine the significance of the impact on Natura 2000 sites. No adverse impact is expected to arise to Natura 2000 Sites as a result of the proposed development. No adverse impact is expected to arise to NHAs not covered by Natura 2000 sites.

The main potential negative impacts identified relate to habitat loss, disturbance to fauna during the construction phase of the development, risk of collision for the hen harrier and the pollution of waterways downstream of the drains/streams within the proposed site. Mitigation measures have been recommended throughout the Environmental Impact Statement and included in Appendix 1 of this EMP.

3 CONSTRUCTION WORKS

The following detail on the construction works is taken from the Environmental Impact Statement. The detail can be revised, *pending planning conditions and the appointment of a Contractor*.

3.1 PROJECT OVERVIEW

The first stage in the construction of a wind farm is building the on-site roads. This is followed by excavation of foundations, pouring of concrete, erection of the turbines and met masts and construction of the substation compound. The electricity generated by the turbines will be cabled underground to the windfarm substation compound in Knockcurraghbola Commons. The windfarm will be connected to the National Grid at the Killonan Nenagh 110kV line c.20km to the west of the substation compound.

Technical operation and monitoring activities will be carried out remotely using computers and there will also be four full time maintenance personnel employed to monitor and maintain turbine operational safety and performance.The turbines have a design life of 25 years. All the electrical equipment - main transformer and individual turbine transformers, switch gear and control gear have a design life of 40 years. The options after 25 years would be to retrofit the turbines and continue generating or to decommission the wind farm and reinstate the site.

3.2 ACCESS REQUIREMENTS

The access requirements for the project can be divided into six phases:

- Civil engineering works

- Electrical works
- Wind turbine delivery and erection
- Routine inspection and maintenance
- Major maintenance and
- Final decommissioning

3.3 CIVIL ENGINEERING WORKS AND PROJECT PHASES

3.3.1 On site roads and hardstands

The Upperchurch Windfarm on-site roads (8km) and hardstands will be laid to a depth of 400mm with crushed stone. The roadway including both new and upgraded existing forestry and farm roads along with hardstanding areas will require approximately 4,010 loads of crushed stone. The developer will endeavour to win as much of this stone as possible from borrow pits onsite to reduce the volume of construction traffic.

3.3.2 Turbine Foundations

Foundations for the 22 turbines will require approximately 345m³ per base. This amounts to approximately 950 truckloads of ready mix concrete required for the 22 bases. Other building materials, including pre-cast concrete pipes for drainage will be procured locally. Crushed stone not won on site, sand and concrete products will be sourced from local suppliers.

3.3.3 Steel Reinforcing

14 tonnes per turbine will be needed. This amounts to approximately 15 deliveries by flatbed articulated truck in total.

3.3.4 Haul Route Surveys

Prior to construction, Pavement Condition Surveys to include FWD analysis, width and forward stopping sight distance analysis and culvert/bridge strength analysis, will be carried out on the local roads that transverse the Upperchurch windfarm site to determine suitability for use and whether they will require strengthening and/or restoration after the construction phase. Any strengthening or reinstatement required will be carried out by the developer in agreement with the Roads Department. The haul route proposed for Upperchurch Windfarm follows along the same haul route which has just been used for the construction traffic for Garracummer windfarm and previously for Glenough Windfarm. The main site entrance for Upperchurch Windfarm at Graniera (Site Entrance No.1) is situated along the Regional Road R503.

3.3.5 Traffic for Electrical Works

The following deliveries will be required

- articulated trucks carrying cable rolls – 1 load
- delivery trucks carrying equipment for the turbines - 1 load

3.3.6 Wind Turbine Delivery and Erection

The components will be delivered to the site by articulated trucks. The maximum load per axle, for delivery of the turbine components and construction materials will be confined to within legal limits.

A proposed route for carriage of turbine components from the M7 was discussed with the North Tipperary Area Roads Engineers. The entire haul route is within the Newport Area and the Thurles Area. Any strengthening or reinstatement required will be carried out by the developer inagreement with the roads engineers.

The erection of wind turbines involves the assembly and lifting into position of the main components of the turbine (the tower, nacelle and rotor assembly).

The following loads are required per turbine:

Component	Transportation Requirement
Nacelle (2 loads)	2 truck load-carried on a 8 axle rear- steering trailer and 3 axletractor unit
Tower section (top)	1 truck load (carried on 5 axle rear steering trailer and 3 axletractor unit)
Tower section (middle)	1 truck load (carried on 5 axle rear steering trailer and 3 axletractor unit)
Tower section (bottom)	1 truck load (carried on 5 axle rear steering trailer and 3 axletractor unit)
3 Blades	1 truck load per blade (carried on 2 axle rear steering trailerand 2 axle tractor unit)

This amounts to approximately 8 truckloads per turbine with a total number of 176 deliveries over the delivery period for all 22 turbines. Axle weights per axle will not exceed legal limits.

3.3.7 Craning Requirements

A crane, with a lifting capacity of circa 500 tonnes, will be used to remove the heavier components from the trucks and this crane will also be used during the erection of the turbines. This crane will likely be an 8-axle crane weighing approximately 97 tonnes. It will be equipped with large low ground pressure tyres carrying approximately 12 tonnes per axle. A smaller crane will be used to remove the blades from the trailer and for assisting assembly (tailing of the turbines).

3.3.8 Routine Inspection and Maintenance

The operational phase will involve daily remote monitoring by the owner’s operator and visits by maintenance crews to carry out scheduled and un-scheduled maintenance and repairs. A light four-wheel drive vehicle will be required for access for maintenance personnel.

3.3.9 Major Maintenance

On the few occasions of major component failure a crane would be needed to be brought on site. This major maintenance, if required, may involve the replacement of a gear box, blade or transformer component. While it is an unlikely to be a regular event, these components would require to be lifted from position by crane for repair or replacement.

3.3.10 Final Decommissioning

If the site is to be decommissioned, cranes of similar size to those used for construction will disassemble each turbine. The towers, blades and all components will then be removed. The turbine transformers, substation building, compounds and monitoring masts will also be removed from site. It is likely that any turbine component will be reused as they have a life well in excess of the wind farm proposal i.e. greater than 25 years. Wind farm components may also be recycled.

3.4 METHOD STATEMENTS

Method statements are used to explain the project requirements through planned systems of work including work instructions for site staff and construction personnel. They are prepared for activities identified in the civil engineering works (outlined above), environmental protection and risk assessments. Method statements are issued to all responsible personnel and those involved with the specified activity.

The proposed method of working is defined for an element of work taking into account the particular requirements of the project including site conditions, safety and environmental hazards, the contract drawings, project specifications or code of practice. This is to allow the personnel involved to be aware of the particular risks associated with the task. Method statements may include the proposed use of plant, personnel and materials required, as well as any permits or certification required. They have supporting drawings and documentation as required.

The principle aim of a method statement is to ensure that:

- the necessary resources are available prior to commencing;
- the tasks are planned out in advance;
- all environmental recommendations are adhered to; and
- safety legislation is adhered to, safe working methods are defined and all personnel are informed.

Upon appointment and prior to the commencement of any activities, particularly where there is environmental or safety risk, the Contractor will develop a written method statement. As the project progresses, new activities or amendments will also require Method Statements. Method Statements may also be revised based on new information or improvements on site.

Method Statements will also be relevant to site safety and be attached to the site safety file for the project. However, any Method Statements relevant to environmental protection should be developed and appended to the EMP and communicated with the appropriate personnel.

Method Statements will be job-specific for the main activities. They will describe the task, the responsible personnel, the risks and the required controls or mitigation measures. The Appointed Contractor will apply a standard format for all statements.

Detailed method statements will be prepared by the appointed Contractor, prior to the commencement of the wind farm construction. A register of Method Statements required throughout the project will be maintained in the site office.

3.5 CONSTRUCTION SCHEDULE

It is estimated that the construction of the wind farm will take approximately 8 months. The Contractor appointed to the construction of the project will be responsible for preparing a detailed construction schedule, taking account of any relevant planning conditions, seasonal requirements and health and safety considerations.

At this stage, it is envisaged that the estimated Construction Timetable is as follows;

- Civil engineering works - 4 months
- Electrical works - 4 months, which be carried out in conjunction with the civil works.
- Turbine erection and commissioning – 16 weeks. Turbines are normally installed when the majority of the civil works are completed.

On appointment, the Contractor will provide a detailed construction schedule, which may include a sequence of elements such as;

- Clearance and construction of hardcore area for temporary compound and mobilisation of site offices.
- Construction of bunded area for fuel and diesel tanks.
- Construction of new access roads and hardstandings. Use site won stone for construction in so far as is possible. Where rock is encountered, break out using breaker on hydraulic excavator.
- Construction of drainage per Surface Water Management Plan.
- Installation of meteorological mast.
- Excavation of the turbine bases and storage of soil locally for backfilling and re-use.
- Place blinding concrete to turbine bases. Fix reinforcing steel and anchorage system for turbine tower section. Construct shuttering and fix any ducts to be cast in.
- Pour and cure concrete for turbine bases, removing shutters thereafter.
- Excavation of cable trenches; lay cables and backfill. Provide ducts at road crossings.

- Partially backfill foundations where necessary for crane operations.
- Erect towers, nacelles and blades.
- Complete earthings to towers and complete backfilling to foundations.
- Construction of substation compound.
- Complete electrical installation, SCADA system.
- ESB grid connection
- Commission and test all plant.
- Complete site works and site housekeeping.
- Demobilise temporary compound and offices.
- Provide any gates, landscaping and signage, which may be required.

4 ENVIRONMENTAL REQUIREMENTS

4.1 INTRODUCTION

The Upperchurch Wind Farm EIS identified mitigation measures that have to be put in place to minimise/eliminate potential for environmental impacts from the project. There are a number of environmental mitigation measures which are to be implemented during the construction stage, as required by the Environmental Impact Statement, the reply to Further Information, and any further controls or mitigation measures which may be conditioned upon grant of planning permission by North Tipperary County Council. Some of the mitigation measures included in the Ecological Management Plan are to be implemented in the early operational phase. These include ornithological surveys, water quality monitoring and monitoring of badgers and bats (Appendix 3).

4.2 ENVIRONMENTAL POLICY

Once appointed, the Contractor's Environmental Policy will be incorporated into future revisions and the following paragraph describes what is typically expected of such a policy.

The environmental policy for the Upperchurch project will be realistic and site specific. It will state a commitment to continual improvement of environmental performance. This will be achieved through the realisation of the environmental objectives and targets that are based on the identified environmental impacts associated with site activities. It will be used as a benchmark for environmental performance. The policy will be approved by the contractor's senior management, signed by the project manager and communicated to all employees associated with the development. A register of aspects will be implemented and relevant targets established to identify evidence of any impacts on the environment arising from the Upperchurch Windfarm development.

- The policy will be a controlled document and will be reviewed and revised as necessary.
- A copy of the policy will be located on the site staff notice board.
- A copy of the environmental policy will be included in this section of the construction management plan.
- All employees, suppliers and contractors whose work activities cause/could cause impacts on the environment will be made aware of the environmental policy and its contents.

4.3 TABLE OF MITIGATION MEASURES AND PLANNING REQUIREMENTS

A table of the required mitigation measures has been compiled, based on the mitigation measures recommended in the EIS and in further detailed assessments conducted as part of the Further Information request. *This will require revision to include any measures relevant to planning conditions if granted by North Tipperary County Council*. This table is included in Appendix 1. The table identifies the environmental aspect and the overall responsibility for implementing each listed mitigation measure. Where there is a relevant environmental procedure or management plan, this is also cross-referenced.

Upon receipt of planning permission and appointment of the Contractor, the EMP and associated documentation, including the Table of Mitigation Measures, will require revision and finalisation.

4.4 ENVIRONMENTAL MANAGEMENT PROCEDURES

A selection of environmental management procedures are included below. These procedures will be used by the Appointed Contractor for the environmental management of the Upperchurch project. Once appointed, it is the Contractor's responsibility, to update and add relevant project-specific procedures to this EMP. The Contractor must ensure that procedures are communicated to all site staff, including sub-contractors, through induction, training and at relevant meetings.

The following procedures are included in this document as a preliminary selection. The Contractor, when appointed, will be responsible for formulating these procedures, and may wish to amend these procedures when appointed. These procedures will form part of the EMP, and will be continually updated where necessary. These procedures can only be amended by improvement with regards to environmental protection and must take cognisance of all mitigation measures recommended in the EIS and additional technical reports carried out as part of the further information planning stage. Furthermore, these procedures may be updated or amended pending specific conditions attached to planning permission.

Ref:	Procedure:
EMP-1	Site Environmental Training and Awareness Procedure
EMP-2	Environmental Emergency Response Plan
EMP-3	Wheel Wash and Dewatering Procedure
EMP-4	Concrete Control Procedure
EMP-5	Fuel and Oil Management Plan
EMP-6	Surface Water management Plan
EMP-7	Traffic Management Plan
EMP-8	Protection of Archaeological and Cultural Heritage
EMP-9	Management of Excavation and Spoil
EMP-10	Management of Borrow Pits
EMP-11	Waste Management Plan
EMP-12	Air, Dust and Noise Management Plan
EMP-13	Site Reinstatement Procedure (post construction)
EMP-14	Monitoring and Auditing Procedure
EMP-15	Environmental Accidents, Incidents and Corrective Actions Procedure
EMP-16	Environmental Complaints Procedure
EMP-17	Environmental Monitoring Committee Procedure

4.4.1 Site Environmental Training and Awareness

EMP-1: Site Environmental Training and Awareness Procedure

Purpose

To describe measures for the training of all site personnel in the protection of the environment and the relevant controls.

Scope

All site personnel and construction teams which may influence environmental impacts.

Responsibility

Project Manager

Site Agent

Construction personnel

Procedure

An initial site environmental induction and ongoing training will be provided to communicate the main provisions of this Environmental Management Plan to all site personnel.

Two-way communication will be encouraged to promote a culture of environmental protection.

The following outlines some of the information which must be communicated to site staff;

- Environmental procedures of the EMP
- Environmental buffers and exclusion zones
- Housekeeping of materials and waste storage areas
- Environmental Emergency Response Plan

Environmental training records are to be retained in the site office.

Details of Induction and Training to be finalised by Appointed Contractor

4.4.2 Environmental Emergency Response Plan

EMP-2: Environmental Emergency Response Plan

Purpose

To describe measures for the prevention of an environmental accident or incident and the response required to minimise such an event

Scope

All site activities which pose a potential threat to the environment by way of an unplanned event (accident or incident)

Responsibility

Project Manager

Environmental Emergency Response Plan Manager – *to be nominated*

Environmental officer

Site Agent, Construction personnel & all site personnel

All personnel are to be inducted in the provisions of the **Environmental Emergency Response Plan.**

Procedure

In the event of an environmental emergency, all personnel will react quickly and adhere to this procedure (*to be finalised by Contractor)*. The following outlines some of the information, on the types of emergency, which must be communicated to site staff;

- Release of hazardous substance - Fuel or oil spill
- Concrete spill or release of concrete
- Flood event – extreme rainfall event
- Environmental buffers and exclusion zones breach
- Housekeeping of materials and waste storage areas breach
- Stop works order due to environmental issue or concern (threat to archaeological or ecological feature)
- Fire on site (cross-reference site Safety Emergency Plan as appropriate)

If any of the above situations occur; the **Plan** is activated. The Plan manager must be immediately informed and report to the scene. The Plan manager must be aware of the;

- Nature of the situation – brief description of what has happened
- Location of the incident
- Whether any spill has been released
- Whether the situation is under control

Details of Environmental Emergency Response Plan to be finalised by Appointed Contractor. Full details of the actual procedure to include the chain of responsibility, the location of controls (spill kits etc) and the response required to each situation above and any additional scenarios.

4.4.3 Wheel Wash and Dewatering Procedure

EMP-3: Wheel Wash and Dewatering Procedure

Purpose

To describe measures for the protection of watercourses from dirty water from vehicles

Scope

All site vehicle movements and dewatering systems

Responsibility

Project Manager

Site Agent

Construction personnel

Procedure

The Appointed Contractor will reduce the potential for the roads being dirtied by heavy vehicle traffic, by including the following:

- A wheel wash area will be provided and the resultant waste water will be diverted to a siltation pond for settling out of solids.
- Any pumping, dewatering system will be well planned and pumped water will be treated in the adequate settlement pond and silt trap.

Details of site wheel wash and dewatering procedure to be finalised by Appointed Contractor

4.4.4 Concrete Control Procedure

EMP-4: Concrete Control Procedure

Purpose

To describe measures for the protection of watercourses from concrete spills or washings

Scope

All site concrete wash-out areas and concrete pour areas

Responsibility

Project Manager

Site Agent

Construction personnel

Procedure

It is important to prevent concrete from entering waterways within and in close proximity to the site and always to prevent it entering watercourses. Concrete will be used for construction of the turbine foundations and the site control building and the following measures will be implemented:

- Trucks that deliver concrete to site will be washed out at the supplier's facilities and not on site.
- The only cement washing that will need to occur on site is the hand washing of the chutes at the rear of the cement trucks after the cement has been deposited.
- Designate a concrete washout area away from drains and watercourses for washing out the chutes;
- A designated trained operator experienced in working with concrete will be employed during the concrete pouring phase;
- Run-off from wind turbine foundation concrete pours shall not be permitted to enter the watercourses and shall be contained within the foundation excavations and designated areas that are suitably sited and designed; and
- Large volumes of concrete water can be pumped into a skip to settle out; settled solids will need to be appropriately disposed of off-site. The total volume will be reduced by only permitting concrete chutes to be washed on site.

Details of concrete control to be finalised by Appointed Contractor including information on location of wash out area etc.

4.4.5 Fuel and Oil Management Plan

EMP-4: Fuel and Oil Management Plan

Purpose

To describe measures for the management of all fuels on site for the protection of watercourses from any spills

Scope

All site fuel storage and refuelling activities

Responsibility

Project Manager

Site Agent

Construction personnel

Procedure

The Appointed Contractor will implement a fuel management plan which will incorporate the following elements:

- Mobile bowsers, tanks and drums will be stored in secure, impermeable storage area, away from drains and open water;
- Fuel containers must be stored within a secondary containment system e.g. bund for static tanks or a drip tray for mobile stores;
- Ancillary equipment such as hoses, pipes must be contained within the bund;
- Taps, nozzles or valves must be fitted with a lock system;
- Fuel and oil stores including tanks and drums must be regularly inspected for leaks and signs of damage;
- Only designated trained operators are authorised to refuel plant on site and emergency spill kits will be present at equipment for all refuelling events;
- Procedures and contingency plans will be set up to deal with an emergency accidents or spills; and
- An emergency spill kit with oil boom, absorbers etc. is to be kept on site in the event of an accidental spill.

Details of fuel and oil management plan to be finalised by Appointed Contractor

4.4.6 Surface Water Management Procedure

EMP-5: Surface Water Management Procedure

Purpose

To describe measures for the management of all surface water and run-off on the site, for the protection of watercourses

Scope

All site construction areas, and excavation and works footprint. All requirements of the Surface Water Management Plan

Responsibility

Project Manager
Site Agent
Geotechnical Engineer
Environmental Officer
Project Ecologist
Construction personnel

Procedure

The Surface Water Management Plan will be implemented and will outline clear responsibilities in terms of the monitoring and maintenance of all surface water controls.

Key Surface Water Management features incorporate the following elements:

- Implement erosion control to prevent runoff flowing across exposed ground and becoming polluted by sediments;
- Intercept and divert clean water runoff away from construction site runoff to avoid cross-contamination of clean water with soiled water;
- Implement sediment control to slow down runoff allowing suspended sediments to settle in situ particularly on roads;
- When working at each stage and section (e.g. access road, each turbine base, etc) of the development the associated erosion and sediment controls at each section will be put in place prior to construction of each section of road. Access roads will need to be constructed to access the proposed site for drains, sediment traps and settling ponds. The associated erosion and sediment controls will be constructed alongside these roads and in a conscientious manner to ensure that the potential risk to water quality is minimised;
- Minimise the area of exposed ground by maintaining existing vegetation that would otherwise be subject to erosion in the vicinity of the wind farm infrastructure and keeping excavated areas to a minimum;
- No work will take place within 50m buffer zones of watercourses except for clear span bridges or culverts and associated road construction;
- All construction method statements will be developed in consultation with Inland Fisheries Ireland – Shannon River Basin District and South Eastern River Basin District;

- Avoid working near watercourses during or after prolonged rainfall or an intense rainfall event and cease work entirely near drains when it is evident that pollution is occurring (refer to Environmental Emergency Response Plan included above as EMP-2);
- Install a series of silt fences or other appropriate silt retention measure where there is a risk of erosion runoff to watercourses from construction related activity particularly if working during prolonged wet weather period or if working during intense rainfall event;
- Implement sediment control measures that includes for the prevention of runoff from adjacent intact ground that is for the separation of clean and 'dirty' water;
- Install appropriate silt control measures such as silt-traps, check dams and sedimentation ponds;
- Provide recommendations for public road cleaning where needed particularly in the vicinity of drains; and
- Controls need to be regularly inspected and maintained otherwise a failure may result, such as a build up of silt or tear in a fence, which could lead to water pollution so controls must work well until the vegetation has re-established; inspection and maintenance is critical after prolonged or intense rainfall.

Details of Surface Water Management procedure to be finalised by Appointed Contractor – to include responsibilities for monitoring and maintenance of the constructed mitigation measures and silt fences etc.

4.4.7 Traffic Management Procedure

EMP-7: Traffic Management Procedure

Purpose

To describe measures for the management of all traffic, including construction traffic and oversized loads, for the minimisation of disturbance and nuisance to the local community.

Scope

All site construction areas, approach roads to the site, and the turbine haulage route.

Responsibility

Project Manager

Site Agent

Construction personnel

Sub-contractors as appropriate

Delivery personnel

Procedure

The Appointed Contractor will prepare a detailed Traffic Management Plan prior to the works commencing. This Plan will be finalised in agreement with the Gardaí and the Local Authority.

- The plan must include provision for communicating with the community, the Gardaí and the Local Authority.
- Details of site access and any site traffic rules must be included, including security, parking, loading and unloading, required speed or other relevant details.
- Details of the turbine component delivery and any road closures etc must be provided.
- Programme of maintenance and upkeep of public roads to be described.
- Site operating hours (including delivery) to be outlined.

Details of Traffic Management Plan to be finalised by Appointed Contractor

4.4.8 Protection of Archaeological and Cultural Heritage

EMP-8: Protection of Archaeological and Cultural Heritage Procedure

Purpose

To describe measures for the management and protection of archaeological and cultural heritage on the site

Scope

All site construction works and areas, particularly groundworks and excavation, and known archaeological features

Responsibility

Project Manager

Site Agent

Construction personnel

Sub-contractors as appropriate

Project Archaeologist

Procedure

The Appointed Contractor will maintain the buffer to known archaeological features and communicate this with all site personnel. The buffer will be maintained by the use of a fence to limit access to the known feature. An Archaeologist will be appointed under license for the monitoring duties throughout the project.

The following must be adhered to;

- All groundworks associated with the proposed development will be archaeologically monitored under licence to the National Monuments Service.
- All works must be immediately stopped under the order of the appointed Archaeologist should archaeological remains or features be uncovered.
- A buffer-zone, where development is precluded, will be instituted around the Recorded Monument in the proposed development area.
- This will measure a minimum of 30m around the feature and it will be fenced off.
- In addition no site offices, depots or storage facilities should be placed within any of these buffer zones.

Details of Archaeological Protection to be finalised by Appointed Contractor

4.4.9 Management of Excavation and Spoil

EMP-9: Management of Excavation and Spoil

Purpose

To describe measures for the management of all excavation and storage of earth materials and spoil on the site

Scope

All site construction areas, approach roads to the site, and the turbine haulage route.

Responsibility

Project Manager

Site Agent

Construction personnel

Geotechnical Engineer

Sub-contractors as appropriate

Procedure

The Appointed Contractor will prepare a detailed Excavation and Spoil Management Plan prior to the works commencing to ensure all measures relating to excavation, stockpiling and drainage are described – for appropriate management and the protection of watercourses.

For the management of excavation and spoil, the Contractor will;

- Implement Surface Water Management Plan (install drainage infrastructure) prior to excavation and include areas dedicated to spoil storage with the drainage infrastructure.
- Ensure all spoil and excavated materials to be stored in the dedicated areas only.
- Stockpiles will be covered with plastic sheeting to reduce sediment in runoff.
- Stockpiles and adjacent features of drainage infrastructure will be monitored and maintained appropriately.

Details of Excavation and Spoil Management to be finalised by Appointed Contractor

4.4.10 Management of Borrow Pits

EMP-10: Management of Borrow Pits

Purpose

To describe measures for the management of all excavation, storage and drainage of borrow pit locations

Scope

All borrow pits on site and associated controls

Responsibility

Project Manager

Site Agent

Construction personnel

Geotechnical Engineer

Sub-contractors as appropriate

Procedure

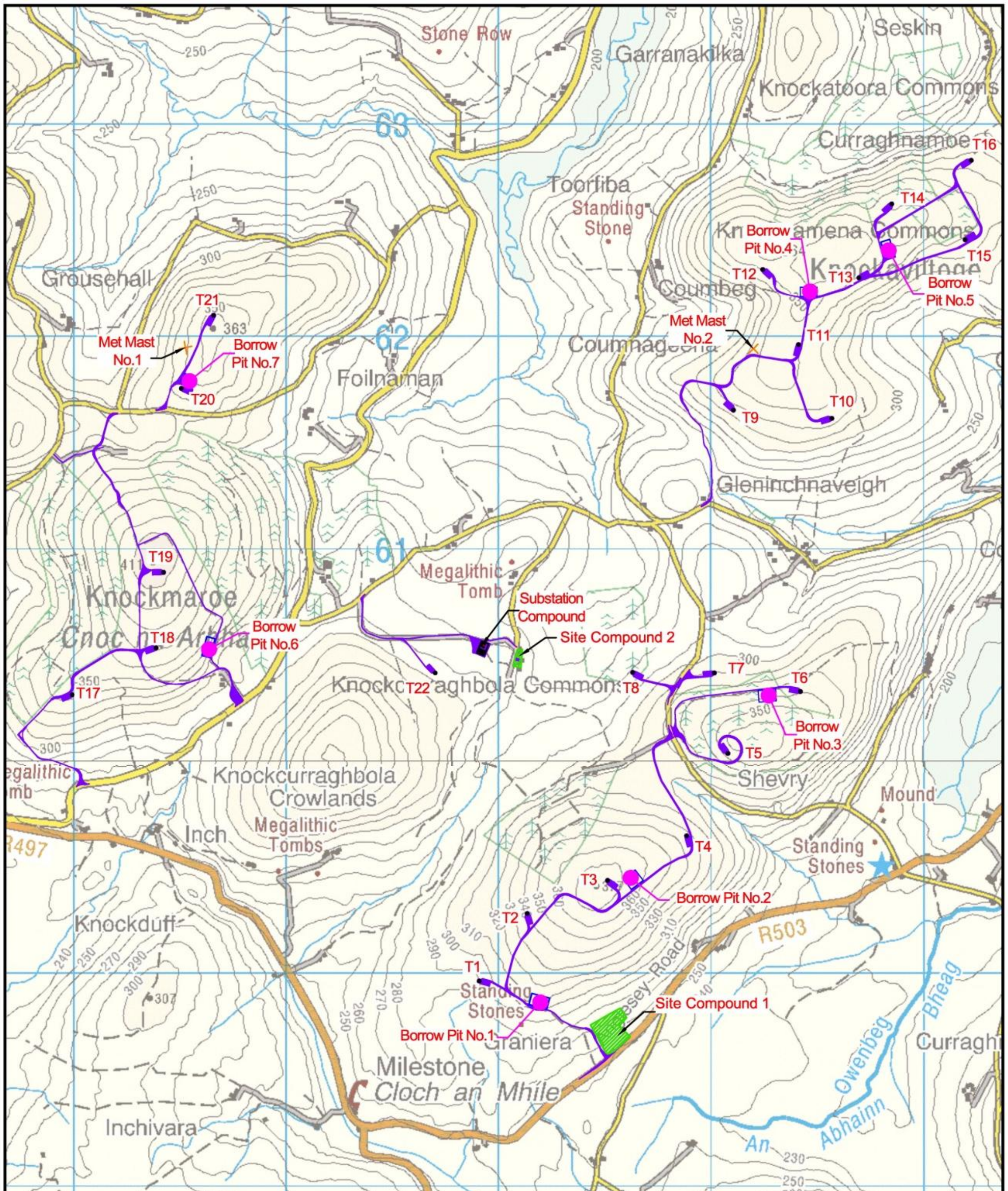
The Appointed Contractor will prepare a detailed Borrow Pit Management Plan prior to the works commencing to ensure all measures relating to excavation, stockpiling and drainage are described – for appropriate management and the protection of watercourses.

For the management of the borrow pits, the Contractor will;

- Implement Surface Water Management Plan (install drainage infrastructure) prior to borrow pit excavation.
- Reinstate the site borrow pits at the end of the construction phase.
- Surface Water Management to include any areas of stockpile and exposed ground associated with borrow pit activities.
- If required, any water from excavations to be pumped to the drainage infrastructure, of the Surface Water Management Plan.
- No works to be carried out within 50m buffer zones of watercourses.

The location of the borrow pits is presented in Drawing 15388-SK01 to follow.

Details of Borrow Pit Management to be finalised by Appointed Contractor



Project						
Upperchurch Wind Farm						
	A	21.11.13	Issued For Information	JK	HBR	HBR
	Rev.	Date	Description	by	ch'd	app
Title						
Borrow Pit Locations	Malachy Walsh and Partners Consulting Engineers Cork | Tralee | London | Limerick					
Client						
Ecopower Developments Ltd	Scales (A4) 1:25,000			Drg. No. 15388- SK01		Rev. A
	Drawn JK 21.11.13					
	Checked HBR 21.11.13					

4.4.11 Waste Management Plan

EMP-11: Waste Management Plan

Purpose

To describe measures for the management of all wastes associated with the construction of the wind farm.

Scope

All site construction areas, activities and phases, including all welfare facilities

Responsibility

Project Manager

Site Agent

Construction personnel

Sub-contractors as appropriate - Service personnel

Procedure

The Appointed Contractor will prepare a detailed Waste Management Plan prior to the works commencing. This Plan will include detail of all allocated waste storage areas, waste segregation and detail any records to be maintained.

The following wastes may be generated during the construction of the project;

- Construction waste (materials, timber, steel etc)
- Waste fuels; oil / diesel
- Paper / cardboard
- Non-hazardous office and canteen waste
- Wastewater from office and welfare facilities

Wastes must be segregated and stored in the allocated tanks, bins, skips or areas. The Appointed Contractor must finalise all storage areas and organise the relevant licensed contractors for the appropriate waste collections. The Appointed Contractor must ensure all permits and licences are in place and maintain relevant copies in the site office. Wastewater from holding tanks must be collected by an appropriate licensed contractor. Construction materials must be stored and managed in a way which promotes waste minimisation, including segregating materials for re-use as appropriate.

Details of Waste Management Plan to be finalised by Appointed Contractor

4.4.12 Air, Dust and Noise Management Plan

EMP-12: Air Dust and Noise Management Plan

Purpose

To describe measures for the management of impacts on air quality, nuisance dust and construction noise impacts

Scope

All site construction areas, activities and phases, and all construction personnel

Responsibility

Project Manager

Site Agent

Construction personnel

Sub-contractors as appropriate - Service personnel

Procedure

The Appointed Contractor must prepare a Management Plan to ensure that impacts to air and from noise are minimised. The following measures will be communicated to all staff on site.

- All Plant and Machinery will be maintained to ensure noise and air emissions are negated.
- Construction personnel must not leave any Plant and Machinery running unnecessarily.
- To reduce dust and particles blown around site, aggregate of not less than 5mm grade will be used in construction materials for the onsite road network

If required, additional dust suppression measures may be implemented in prolonged, dry and windy spell including standard dust suppression (spraying) if relevant.

Details of Air Dust and Noise Management to be finalised by Appointed Contractor

4.4.13 Site Reinstatement Procedure

EMP-13: Site Reinstatement Procedure

Purpose

To describe measures for the reinstatement of the site upon completion of the construction works (not the decommissioning and aftercare at end of project life)

Scope

All site areas, infrastructure, borrow pits and exposed areas; any other temporary construction areas

Responsibility

Project Manager

Site Agent

Construction personnel

Project Ecologist

Procedure

The Appointed Contractor will prepare a Site Reinstatement Plan to ensure the site is reinstated after the works.

The plan will include;

- Removal of the two temporary compounds
- Reinstatement and landscaping of the two temporary compound hardstands
- Details of landscaping and use of spoil
- Reinstatement of road verges (use of soil)
- Reinstatement of any temporary construction hardstands
- Reinstatement of the site borrow pits
- Natural re-vegetation policy
- Monitoring and assessment of re-vegetation and recovery success

The planting of new hedgerows is included in the Ecological Management Plan and may also be included as part of the post-construction reinstatement works. Exposed areas of the site that are slow to re-vegetate may need to be replanted with suitable vegetation – in consultation with the Project Ecologist.

Details of Site Reinstatement to be finalised by Appointed Contractor in consultation with the Project Ecologist

4.4.14 Monitoring and Auditing Procedure

EMP-14: Monitoring and Auditing Procedure

Purpose

To describe measures for environmental monitoring during the construction works and audit of control measures to ensure environmental protection

Scope

All monitoring activities of the aspects related to the project

Responsibility

Project Manager
Environmental Officer
Construction personnel
Project Ecologist
Project Archaeologist

Procedure

All mitigation measures, any planning conditions and relevant construction methods will be monitored on site. The Appointed Contractor will provide Audit Checklists to ensure regular checks of the site's control measures for the ongoing protection of the environment.

Monitoring is to be carried in adherence with the following;

- Protection of Archaeological and Cultural Heritage Procedure
- Surface Water Management Plan
- Ecological Management Plan
- Fuel and Oil Management Plan
- Waste Management Plan
- Construction Noise Monitoring (in line with recommended mitigation measures)

Checklists for daily, weekly or monthly site audits must be finalised by the Appointed Contractor and the relevant personnel informed of their duties. Checklists should include (but are not limited to) confirmation that fuel is stored appropriately, waste management rules are adhered to, all environmental buffers are maintained, sediment and erosion control measures of the Surface Water Management Plan are in place and functioning and concrete wash-out procedure is being followed. Checklists should be finalised with the Final Contractor's EMP.

All environmental records, including completed checklists, will be retained at the site office.

Details of Monitoring Procedure and Checklists to be finalised by Appointed Contractor in consultation with the Project Ecologist

4.4.15 Environmental Accidents, Incidents and Corrective Actions

EMP-15: Environmental Accidents, Incidents and Corrective Actions Procedure

Purpose

To describe measures for the recording, investigation and close-out of any environmental accidents or incidents on the site

Scope

All activities, personnel and sub-contractors operating on the site during the construction of the Upperchurch Wind Farm

Responsibility

Project Manager

Environmental Officer

Construction personnel

Project Ecologist

Project Archaeologist

Sub-contractors

Procedure

Any environmental accidents and incidents occurring on site during the works must be reported, recorded and investigated. Any corrective actions must be put in place and closed out after an accident or incident occurs.

This procedure will be updated (*by the Appointed Contractor*) to include the relevant personnel responsibilities and reporting structure and the finalised procedure must be communicated to all personnel.

Environmental accidents and incidents may include, but are not limited to;

- Accidents involving large spill of fuel or concrete from delivery truck (emergency response required)
- Spills of fuel and oil (minor)
- Waste or rubbish left around the site (not in dedicated waste areas)
- Breach of any buffers (archaeological, ecological, watercourse)
- Failure of any control measures (e.g. silt fences collapsed in a storm)
- Concrete chute wash out in a non-dedicated area
- Unplanned vehicle movement off the access tracks
- Unplanned vehicle movement within a buffer zone

If an environmental accident or incident occurs, personnel must inform *Project Manager/Environmental Officer/Nominated Person* immediately.

Once the situation is under control, the environmental accident or incident must be recorded and the cause investigated. Any remedial action required must be taken to mitigate any damage and prevent a reoccurrence.

Corrective actions must be communicated to personnel and sub-contractors where relevant – particularly where it results in a change in procedure.

Details of Environmental Accidents, Incidents and Corrective Actions Procedure, including a chain of responsibility, to be finalised by Appointed Contractor and communicated to all personnel and sub-contractors

4.4.16 Environmental Complaints Procedure

EMP-16: Environmental Complaints Procedure

Purpose

To describe measures for the recording and resolving complaints by third parties, including local residents or members of the public

Scope

All activities, personnel and sub-contractors operating on the site during the construction of the Upperchurch Wind Farm

Responsibility

Project Manager
Site Agent
Environmental Officer

Procedure

Any environmental complaints received, whether internal or external, must be recorded and investigated. Immediate action must be taken as relevant to resolve environmental complaints to avoid any nuisance to the local community or environmental damage.

This procedure includes;

- Recording of any complaints to a Site Log
- Follow up by the relevant site representative – Environmental Officer
- Remedial measures where required
- Ongoing communication with complainant to confirm resolution
- Any required training or communication with site personnel and sub-contractors as a result

Details of Environmental Complaints Procedure to be finalised by Appointed Contractor

4.4.17 Environmental Monitoring Committee Procedure

EMP-17: Environmental Monitoring Committee Procedure

Purpose

To describe measures for the establishment of an Environmental Monitoring Committee during the construction of the wind farm

Scope

To facilitate a committee which will meet and discuss all site activities and any environmental issues or perceived issues which may affect the local community

Responsibility

Project Manager

Site Agent

Environmental Officer

Procedure

An Environmental Monitoring Committee will be established for the construction phase of the Upperchurch Wind Farm. The Committee shall include representatives of the developer, North Tipperary County Council, Inland Fisheries Ireland, the project Ecologist, and representatives of the local community.

Ecopower Developments have successfully organised an Environmental Monitoring Committee for the construction stages of both Raheen Barr Windfarm and Derrynadivva Windfarm in County Mayo, to foster open communication during the construction of projects.

The Environmental Monitoring Committee will conduct the following;

- Hold monthly meetings throughout the construction project
- Agreement on actions required in relation to any site environmental issues
- Follow-up of any items raised or discussed at previous meetings

The meeting agenda can include updates on;

- Project progress and phases
- Works planned for the month ahead, e.g. scheduled concrete pours of bases
- Environmental monitoring results, e.g. noise and water monitoring results
- Traffic or haulage schedules
- Any community issues or queries

Details of the establishment of the Environmental Monitoring Committee to be finalised upon commencement of the construction project

4.5 ENVIRONMENTAL MONITORING SCHEDULE

A *Preliminary Monitoring Schedule* is provided below and will be finalised pending the grant of planning permission, the incorporation of planning conditions and the appointment of the Contractor. The Appointed Contractor will assign an on-site Environmental Officer to monitor the construction activities on a day to day basis. The duties will include completing the required checklists (*to be developed*) and coordinating with the Project Ecologist, Project Archaeologist and the Geotechnical Engineer as required to ensure all environmental monitoring is carried out. The Appointed Contractor will finalise the environmental monitoring schedule prior to construction commencing on site.

Aspect	Monitoring Required	Frequency	Note	Responsibility
Water	Sediment & Erosion Controls	Daily	Daily Site Checks	Environmental Officer
Water	Fuel & Oil Storage inspection	Weekly	Weekly Site Audit	Environmental Officer
Water	Hydro-chemical Monitoring	Monthly	Year 1 (reduce Year 2 if no issues)	Environmental Officer
Water	Q-Sampling	Monthly	Year 1 (reduce Year 2 if no issues)	Environmental Officer
Water	Concrete Pours	As Required	To be scheduled with pours	Environmental Officer
Birds	Pre-Construction Surveys	As Required	Breeding Bird Survey	Ecologist
Birds	Post-Construction Surveys	As Required	3 years / per method	Ecologist
Ecology	Material and Waste Storage	Weekly	Weekly Site Audit	Environmental Officer
Ecology	Habitat Monitoring	Annually	5 Years	Ecologist
Ecology	Vegetation Monitoring	Annually	5 Years	Ecologist
Ecology	Badger Surveys	Annually	1 Pre-construction survey	Ecologist
Ecology	Badger Surveys	Annually	3 years Post-construction survey	Ecologist
Ecology	Bat Surveys (pre-Con)	Annually	1 Pre-construction survey	Ecologist
Ecology	Bat Surveys (post-Con)	Annually	3 years Post-construction survey	Ecologist
Ecology	Fatality Survey (post-Con)	Annually	1 Post-construction Birds & Bats	Ecologist
Archaeology	Archaeological Monitoring	As Required	Monitor groundworks, excavation	Archaeologist
Noise	Construction Noise Monitoring	As Required	During noisy activities closest to residential receptors	Noise Specialist

The environmental Monitoring Schedule will take cognisance of all mitigation measures outlined in the EIS and any relevant measures conditioned by North Tipperary County Council. The Monitoring Schedule for construction may also provide for the checking of equipment, materials storage and transfer areas and specific sediment and erosion controls.

4.6 ENVIRONMENTAL PERFORMANCE INDICATORS

The Appointed Contractor will outline the key performance indicators for the site in gauging successful site management in the prevention of pollution and the protection of the environment.

Environmental performance indicators may include:

- Number of environmental accidents logged;
- Number of environmental incidents logged;
- Breach of procedure and corrective actions;
- Number of environmental complaints received;
- Results of construction noise monitoring;
- Results of monthly water monitoring; and
- Results of site audits.

The performance indicators will be finalised by the Appointed Contractor and communicated to all relevant personnel and sub-contractors. The review periods for analysing site performance indicators must also be specified.

5 CONCLUSION

As described throughout this EMP, this is a ***preliminary plan*** which will require an update to all details pending the receipt of a grant of planning permission, any relevant planning conditions and the appointment of the Contractor.

This EMP provides the information which will be contained in the final Contractor-developed Plan at the construction stage of the project. The requirement on the Contractor to update these details has been explained, and there is a particular requirement for an update to the roles and responsibilities of those appointed on the site for the construction of the project.

Appendices

REFERENCE DOCUMENTS

APPENDIX 1 TABLE OF ENVIRONMENTAL MITIGATION MEASURES

Following is a Table of Mitigation Measures identified through the Environmental Impact Assessment and through further technical reports. Pending planning permission, this table may require revision to include any conditional elements specified by North Tipperary County Council. This table includes mitigation of most relevance to the Contractor and the construction phase of the project.

Aspect	Impact	Mitigation Measure	Responsibility	Key Info/ Comments	Relevant Procedure
Hydrology	Water quality impacts - sediment loading or pollution of stream.	50m Constraint Buffer.	Appointed Contractor	With exception of one stream crossing (250m to north of T4), *no roads or turbine foundations within 50m of a watercourse.*	Monitoring and Audit Procedure
Hydrology	Water quality impacts - sediment loading or pollution of stream – from felling.	All associated tree felling will be undertaken using good working practices as outlined by the Forest Service in their *'Forestry Harvesting and Environment Guidelines' (2000)* and the *'Forestry and Water Quality Guidelines ' (2000)*.	Developer & Appointed Contractor	All felled *brash will be removed* off site to avoid release and runoff of phosphorous into sensitive watercourses.	
Hydrology	Impact to watercourse from construction of stream crossing.	No construction activities during or after prolonged rainfall or an exceptional rainfall event.	Appointed Contractor	Construction activities at one location only - one stream crossing (250m to north of T4).	
Hydrology	Water quality impacts – flow from land drains.	Culverts will be installed at locations where land drains are intercepted and designed to facilitate the large flows associated with intense or prolonged rainfall events.	Appointed Contractor	Construction of culverts at manmade land drains only.	
Hydrology	Impact to watercourse from construction of	Method statements for stream crossing, culverts and drainage to	Developer &	*Consultation required prior to construction* - with Inland Fisheries	Method Statements

Aspect	Impact	Mitigation Measure	Responsibility	Key Info/ Comments	Relevant Procedure
	stream crossing.	be developed in consultation with Inland Fisheries Ireland and South Eastern River Basin District and Shannon River Basin District prior to initiation of construction works.	Appointed Contractor	Ireland and South Eastern River Basin District and Shannon River Basin District.	(stream crossing and culverts)
Hydrology	Impacts to natural surface water flow – change to natural sediment regime.	Constructed Drainage – per designed Sediment and Erosion Control Drawings.	Appointed Contractor	Drainage to be constructed per *Surface Water Management Plan* (based on original Sediment and Erosion Control Plan and Drawings).	Surface Water Management Plan
Hydrology	Water quality impacts - pollution of stream or groundwater.	Fuel and Oil Management Plan And Concrete Control Plan	Appointed Contractor	Plans to be finalised by Contractor and to outline management and emergency measures.	Fuel and Oil Management Plan Concrete Control Plan
Ecology	Impact to bats	50m Constraint Buffer. Maintain a buffer in design of wind farm layout. Buffer to turbine tip. Hedgerows in proximity to be removed to maintain this buffer.	Appointed Contractor	*No turbine blade tip is within 50m buffer* of bat habitat features (trees, hedge).	Felling Licence to incorporate tree felling for maintaining Bat buffer
Ecology	Impact on hedgerow (from removal)	360m of new hedgerow will be planted to mitigate this loss of habitat. Existing hedgerows in poor condition will be planted with native species to increase their ecological value.	Appointed Contractor & Project Ecologist	Native species will be replanted within the proposed new hedgerows.	Ecological Management Plan
Ecology	Impacts to Aquatic Species	Constructed Drainage – per designed Sediment and Erosion Control Drawings.	Appointed Contractor	Drainage to be constructed per *Surface Water Management Plan* (based on original Sediment and Erosion Control Plan and Drawings).	Surface Water Management Plan
Ecology	Impacts to Aquatic Species	Fuel and Oil Management Plan	Appointed Contractor	Plans to be finalised by Contractor and to outline management and emergency measures.	Fuel and Oil Management Plan

REFERENCE DOCUMENTS

Aspect	Impact	Mitigation Measure	Responsibility	Key Info/ Comments	Relevant Procedure
Ecology	Impact to Aquatic Habitat	Method statements for stream crossing, culverts and drainage to be designed in consultation with Inland Fisheries Ireland and South Eastern River Basin District and Shannon River Basin District prior to initiation of construction works.	Developer & Appointed Contractor	*Consultation required prior to construction* - with Inland Fisheries Ireland and South Eastern River Basin District and Shannon River Basin District.	Method Statements (stream crossing and culverts)
Ecology	Impacts to Aquatic Species and Habitats	Wheel Wash Management, Dewatering and Concrete management	Appointed Contractor	Wheel Wash to be provided. Plans to be finalised by Contractor and to outline management and emergency measures.	Wheel Wash Plan Concrete Control Plan
Ecology	Impacts to Aquatic Species and Habitats from felling practice	Felling undertaken using good working practices per the 'Forestry Harvesting and Environment Guidelines' (2000a) and the 'Forestry and Water Quality Guidelines'(2000b).	Appointed Contractor	All *excess felled brash should be removed off site* to avoid release and runoff of phosphorous into sensitive watercourses.	Felling Licence
Ecology	Impacts to nesting birds from felling	Pre-felling bird survey to be carried out to ensure that potential nesting birds are not impacted if felling is carried out within the breeding bird season (April to July).	Appointed Contractor & Project Ecologist	Bird survey to be completed *prior to felling*	Ecological Management Plan (Bird surveys)
Ecology	Impact to site due to felling and infrastructure	Exposed areas of the site that are slow to re-vegetate may need to be replanted with suitable vegetation.	Developer & Project Ecologist	Management of re-vegetation to be incorporated into *Ecological Management Plan*	Ecological Management Plan
Ecology	Impact to species and habitats on site	An Ecological Management Plan (EMP) will be developed prior to construction to provide a framework for the conservation and enhancement of valuable features within the site.	Developer & Project Ecologist	*Ecological Management Plan* to include relevant monitoring.	Ecological Management Plan

REFERENCE DOCUMENTS

REFERENCE DOCUMENTS

Aspect	Impact	Mitigation Measure	Responsibility	Key Info/ Comments	Relevant Procedure
Ecology	Impact of lights on turbines impacting on birds and bats	Intermittent lighting is less likely to cause species to collide with turbines. The use of "white lights" on the turbines should be avoided.	Developer & Project Ecologist		Lighting to be agreed in advance with the Irish Aviation Authority.
Ecology	Impact to water quality	Water Quality Monitoring Programme.	Developer & Project Ecologist	Monitoring to be carried out in years 1 and 2 of operation to determine if water quality has been impacted.	Ecological Management Plan
Noise and Vibration	Impact to community	Construction Noise Monitoring. It is recommended that noise monitoring is undertaken during the construction phase to ensure any limits set down by the planning authority are complied with.	Appointed Contractor & Developer	Mitigation will also monitor the effectiveness of any noise attenuation measures being employed.	Monitoring Procedure (and preliminary environmental monitoring schedule)
Noise and Vibration	Impact to community from blasting	*No blasting* will occur during the construction of the Upperchurch Wind Farm	Appointed Contractor & Developer	Mitigation by avoidance	
Transport	Traffic	Temporary facilities will be provided on the proposed site for construction traffic parking, temporary site offices and storage areas	Appointed Contractor		
Transport	Traffic	Detailed pre-construction condition survey with county council engineer	Developer & Engineer	Identify those sections of road which may require strengthening or realignment and as a basis for agreeing remedial works to be carried out by the developer with North Tipperary County Council on completion of the project.	
Transport	Traffic	In the interest of road safety during the construction stage, measures regarding traffic control will be	Appointed Contractor & Developer	Contractor to finalise Traffic Management Plan, in agreement with Developer and relevant authorities.	Traffic Management Plan

REFERENCE DOCUMENTS

Aspect	Impact	Mitigation Measure	Responsibility	Key Info/ Comments	Relevant Procedure
		implemented.			
Geotechnical	Impact on geotechnical environment causing instability	Drains will be established to effectively drain grounds prior to excavation or earthworks of each section of road. Such drains will be positioned at an oblique angle to slope contours to ensure ground stability.	Appointed Contractor	Include in contractor's *method statement*	
Geotechnical	Impact on geotechnical environment causing instability	All site excavations and construction will be supervised by a suitably qualified engineer.	Appointed Contractor & Geotechnical Engineer	The contractor's *method statement* will be reviewed and approved by a suitably qualified geotechnical engineer prior to site operations.	Management of Excavation and Spoil
Geotechnical	Impact to soil and geology	All excavated earth materials must be either re-used in an environmentally appropriate and safe manner, e.g. used for landscaping, or removed from the development site at the end of the construction phase.	Appointed Contractor	Include in contractor's *method statement.* Ensure excavated material kept to minimum.	Management of Excavation and Spoil
Geotechnical	Impact to soil and geology	Any excavations will be backfilled as soon as is possible to prevent any infiltration of potentially polluting compounds to the subsurface.	Appointed Contractor	Include in contractor's *method statement*	
Geotechnical	Impact to soil and geology	Vehicular movements will be restricted to the footprint of the proposed development.	Appointed Contractor	Vehicles restricted to site roads and hardstands except for advancing excavations.	Site Drawings
Geotechnical	Impact to soil and geology and hydrology	Construct the access road network and upgrade the existing roads and the spine roads in particular so that they are capped with limestone or	Appointed Contractor	To reduce the potential for road degradation and indirectly for sediment loading in run-off. Include in contractor's *method*	

Aspect	Impact	Mitigation Measure	Responsibility	Key Info/ Comments	Relevant Procedure
		similar quality stone.		*statement*	
Air Quality	Impact of nuisance dust from construction	Dust minimisation by selection of construction materials for the onsite road network to include the use of aggregate of not less than 5mm grade and to also ensure that surface dressing is compressed quickly.	Appointed Contractor	Include in contractor's *method statement*	Air, Dust and Noise Management Plan
Air Quality	Impact from vehicle emissions	Site machinery and vehicles onsite will not be left running unnecessarily.	Appointed Contractor		Air, Dust and Noise Management Plan
Archaeology	Impact to Recorded Monument	Buffer zone of 30m recommended	Appointed Contractor	No development or temporary compounds to be placed within buffer zone	Protection of Archaeological and Cultural Heritage
Archaeology	Impact to unknown archaeology	Monitoring of groundworks associated with the development	Appointed Contractor & Archaeologist	Monitoring – under licence as appropriate	Protection of Archaeological and Cultural Heritage

REFERENCE DOCUMENTS

Malachy Walsh and Partners
Engineering and Environmental Consultants

Environmental Management Plan (Early Operational Phase)

of

Upperchurch Wind Farm

On behalf of

ECOPOWER DEVELOPMENTS LIMITED

15388
November 2013

Job number	Revision	Prepared by	Checked by	Status	Date
15388-6007	A	Helen Burman-Roy	Monica Kane	Final	22/11/2013

Table of contents

1 INTRODUCTION

1.1 ENVIRONMENTAL MANAGEMENT DURING EARLY OPERATIONAL PHASE

This document provides details on the Environmental Management Plan relevant to mitigation measures to be undertaken in the early Operational Phase. This document has been detached from the *construction phase* Environmental Management Plan due to the nature of separate 'Construction' and 'Operation and Maintenance' Contracts. It is likely that post-construction mitigation measures will be implemented on site after the Appointed Construction Contractor is finished with that contract phase. Relevant aspects of the operational phase are included as appropriate, including the monitoring as detailed in the Ecological Management Plan (appended to this EMP) and included in the (*preliminary*) Environmental Monitoring Schedule included as section 4.3.

This Plan will ensure adherence with all environmental mitigation measures recommended in the Environmental Impact Statement and in compliance with any planning conditions which may be attached to a Grant of Permission by North Tipperary County Council, relating to the operational phase of the wind farm. A Table of Mitigation Measures is included as Appendix 1. This table will require an update should planning permission be granted.

This Plan has been prepared by Malachy Walsh and Partners, on behalf of Ecopower Developments Limited, as an *Operational Phase* EMP at the planning stage of the project. The document aims to incorporate the relevant mitigation measures recommended in the Environmental Impact Statement, and any additional mitigation measures recommended by specialist reports prepared as part of a response to a Request for Further Information (RFI) from North Tipperary County Council.

1.2 PLANNING CONTEXT

Ecopower Developments Limited applied to North Tipperary County Council (NTCC) for permission to construct a wind farm at Graniera, Shevry, Knockcurraghbola Commons, Knockmaroe, Grousehall, Cummer, Foilnaman, Gleninchnaveigh, Coumnageeha, Coumbeg, Knocknamena Commons, Glenbeg, Seskin, Co. Tipperary in January 2013. The proposed wind farm consists of 22 no. wind turbines, of overall height up to 126.6m, 2 no. meteorological masts up to 80m in height, access roads, substation and compound, and all ancillary site works. The permission sought is for 10 years and the application was supported by an Environmental Impact Statement and Appropriate Assessment (Natura Impact Statement). The NTCC Planning Reference is 13/51/0003. On 28th February 2013, NTCC issued a Request for Further Information which included the provision of a preliminary Environmental Management Plan.

The plan set out in this document *will require revision* and further input in the event of a grant of permission, to incorporate all details of the planning conditions and upon agreement of the Operation and Maintenance Contract, after the wind farm is constructed.

1.3 SCOPE OF THE OPERATIONAL EMP

The Environmental Management Plan for the operation of the Upperchurch Wind Farm will detail the measures to be carried out in the early phase post-Construction and throughout the operational lifetime of the wind farm, in compliance with the *planning conditions* of the grant of planning and relevant environmental mitigation measures. The EMP includes the following:

- Introduction
  - Background
  - Scope
  - Roles and Responsibilities
- Existing Site
- Environmental Requirements
  - Register of Mitigation Measures and Planning Requirements
  - Environmental Management Procedures
  - Environmental Monitoring Schedule

In as much as is possible at this stage of the project, the relevant information is included in the EMP.

1.4 ROLES AND RESPONSIBILITIES/MANAGEMENT STRUCTURE

The roles and responsibilities outlined below are indicative at this stage in the project and will be updated upon appointment of the Contractor.

1.4.1 Project Manager

The Developer will appoint a Project Manager (internal or external) for the operational phase of the wind farm, responsible for:

- the implementation of this Environmental Management Plan
- co-ordinating with the Project Ecologist

1.4.2 Project Ecologist

The Project Ecologist will be appointed by the Developer and is responsible for:

- ensuring implementation of ecological mitigation measures, such as post-construction surveys and hen harrier habitat management
- implementation of the Ecological Management Plan
- management of ecology related site landscaping and re-vegetation activities
- liaison with the project manager/Developer

2 EXISTING SITE

2.1 SITE DESCRIPTION OF OPERATIONAL WIND FARM

The site of the Upperchurch Wind Farm is located within a series of small hills or drumlins 2km to the west of Upperchurch village and 18 kilometres to the west of Thurles.

The constructed wind farm will consist of 22 wind turbines arranged in four clusters on the eastern margins of the Silvermine Mountains. The wind farm also comprises ancillary service roadways and a 110kV substation compound. The electricity generated by the turbines will be cabled underground to the wind farm substation compound in Knockcurraghbola Commons.

3 POST-CONSTRUCTION PROJECT PHASES

Upon completion of the construction and commission of the Upperchurch Wind Farm, the following are the main work phases. Most of the ecological management measures including ecological monitoring relate to the early operational phases of the windfarm, though some remain throughout the lifetime of the windfarm. (Refer to Appendix 1 Ecological Management Plan).

3.1.1 Routine Inspection and Maintenance

The operational phase will involve daily remote monitoring by the owner's operator and visits by maintenance crews to carry out scheduled and un-scheduled maintenance and repairs. A light four-wheel drive vehicle will be required for access for maintenance personnel.

3.1.2 Major Maintenance

During the operational phase, on the few occasions of major component failure a crane would be needed to be brought on site. This major maintenance, *if required*, may involve the replacement of a gear box, blade or transformer component. While it is an unlikely to be a regular event, these components would require to be lifted from position by crane for repair or replacement.

Major Maintenance will be conducted under the Operation and Maintenance Contract and via provision of appropriate Method Statements and controls.

3.1.3 Final Decommissioning

If the site is to be decommissioned, cranes of similar size to those used for construction will disassemble each turbine. The towers, blades and all components will then be removed. The turbine transformers, substation building, compounds and monitoring masts will also be removed from site. It is likely that any turbine component will be reused as they have a life well in excess of the wind farm proposal i.e. greater than 25 years. Wind farm components may also be recycled.

Final Decommissioning will be conducted under the appropriate Reinstatement Programme as agreed with the North Tipperary County Council (NTCC). Any plan will be implemented under the appropriate Method Statements and controls. A Reinstatement Programme has been prepared for the Upperchurch Wind Farm and submitted to NTCC (refer to 15388-6006 Upperchurch Reinstatement Programme).

4 ENVIRONMENTAL REQUIREMENTS

4.1 INTRODUCTION

The Upperchurch Wind Farm EIS identified mitigation measures that have to be put in place to minimise/eliminate potential for environmental impacts from the project. There are a number of environmental mitigation measures which are included in the Ecological Management Plan and must be implemented in the early operational phase. These include ornithological surveys, water quality monitoring, and the monitoring of badgers and bats. The Ecological Management Plan also includes measures to be implemented through the lifetime of the wind farm, including the provision of alternative hen harrier habitat and the management of that habitat (Refer to Appendix 1). Routine inspections and maintenance of sediment and erosion control measures can also be continued through the early operational phase of the wind farm (Refer to Environmental Management Procedures in section 4.3).

4.2 ALTERNATIVE HEN HARRIER HABITAT

In order to compensate for foraging habitat for hen harrier that would be lost or altered, due to the construction of the Upperchurch Wind Farm, it is proposed to provide alternative habitat, adjacent to the area of development.

When choosing suitable mitigatory habitat, the following have been considered;

- The alternative (mitigatory) habitat must be of a quality that is suitable for foraging hen harrier or that can be managed to become suitable for foraging hen harrier;
- The proximity of the SPA to the mitigatory habitat must be considered, so that the mitigatory habitat chosen, acts as a continuation of the SPA

For details, refer to the Ecological Management Plan included as Appendix 2.

4.3 ENVIRONMENTAL MANAGEMENT PROCEDURES

There are limited environmental management procedures associated with mitigation measures for the operational phase. The three procedures included below are an indicative selection and follow on from the construction phase and the end of the Construction Contract. The site re-instatement will be completed as part of the final construction stage; however, the reinstated vegetation will be monitored in the early operational phase to ensure its establishment is a success. The procedures may be updated or amended pending specific conditions attached to planning permission.

Ref:	Procedure:
EMP-OP-1	Monitoring and Auditing Procedure
EMP-OP-2	Site Reinstatement Procedure (post construction)
EMP-OP-3	Procedure for Ecological Management (post construction)

4.3.1 Monitoring and Auditing Procedure

EMP-OP-1: Monitoring and Auditing Procedure

Purpose

To describe measures for environmental monitoring during the early operation of the wind farm and audit of control measures to ensure environmental protection

Scope

All monitoring activities of the aspects related to the project

Responsibility

Project Manager

Project Ecologist

Procedure

All mitigation measures and any relevant planning conditions will be monitored on site. The Developer's Project Manager will coordinate with the Project Ecologist to ensure all survey work and monitoring is carried out.

The Project Manager will manage the finalised Monitoring Schedule and ensure all environmental surveys and works are scheduled and carried out accordingly.

Monitoring is to be carried in adherence with the following;

- Ecological Management Plan (EcMP)
- Surface Water Management Plan

Routine inspections and maintenance of sediment and erosion control measures can be continued through the early operational phase of the wind farm (6 months post construction). Monthly water monitoring will also be carried out per the EcMP in the 1st year of operation.

All environmental records, including completed checklists, will be appropriately retained.

Details of Monitoring Procedure to be finalised by Project Manager in consultation with the Project Ecologist

4.3.2 Site Reinstatement Assessment Procedure

EMP-OP-2: Site Reinstatement Assessment Procedure

Purpose

To describe measures for the assessment of the site reinstatement in the early operational phase of the wind farm

Scope

All site areas, infrastructure, historic borrow pits and exposed areas; which were subject to the reinstatement plan

Responsibility

Project Manager

Project Ecologist

Procedure

The Project Manager will provide a copy of the Site Reinstatement Plan and the Ecological Management Plan to the Project Ecologist to ensure the site is reinstated successfully after the works and ecological enhancement measures are implemented.

The Project Ecologist will assess the success of the;

- Reinstatement of road verges (use of soil)
- Reinstatement of any temporary construction hardstands
- Natural re-vegetation policy
- Monitoring and assessment of re-vegetation and recovery success

The planting of new hedgerows is included in the Ecological Management Plan and may also be included as part of the post-construction reinstatement works. Exposed areas of the site that are slow to re-vegetate may need to be replanted with suitable vegetation – in consultation with the Project Ecologist.

Details of the Assessment of Site Reinstatement to be finalised in consultation with the Project Ecologist

4.3.3 Procedure for Ecological Management (post construction)

EMP-OP-3: Procedure for Ecological Management (post construction)

Purpose

To describe measures for carrying out the ecological mitigation measures required in the early operational phase of the wind farm

Scope

All site areas and any area related to the required surveys, assessments and management.

Responsibility

Project Manager

Project Ecologist

Procedure

The Project Manager will engage the Project Ecologist to carry out the requirements of the Ecological Management Plan (included as Appendix) to ensure the required operational phase mitigation measures are completed. .

The Project Ecologist will oversee/carry out the following;

- Hydro-chemical monitoring – Monthly (year 1 - reduce year 2 if no issues)
- Q-sampling – Monthly (year 1 - reduce year 2 if no issues)
- Post-construction bird surveys – As required (3 years / per method)
- Hen Harrier Habitat monitoring – Annually
- Vegetation monitoring – Annually (5 years)
- Badger surveys – Annually (3 years post-construction survey)
- Bat surveys – Annually (3 years post-construction survey)
- Fatality survey (post-con – Annually (1 post-construction birds & bats)

All above monitoring and surveys will be completed to standard accepted methods.

Details of the various surveys to be arranged by the Developer/Project Manager post-construction in consultation with the Project Ecologist

4.4 ENVIRONMENTAL MONITORING SCHEDULE

A *Preliminary Monitoring Schedule* is provided below and will be finalised pending the grant of planning permission, the incorporation of planning conditions and the appointment of the Project Manager for this phase of work. The Project Manager will monitor the progress of the various elements of the required monitoring and survey work post construction.

ASPECT	MONITORING REQUIRED	FREQUENCY	NOTE	RESPONSIBILITY
WATER	**Hydro-chemical monitoring**	**Monthly**	**Year 1 (reduce year 2 if no issues)**	**Environmental officer**
WATER	**Q-sampling**	**Monthly**	**Year 1 (reduce year 2 if no issues)**	**Environmental officer**
BIRDS	**Post-construction surveys**	**As required**	**3 years / per method**	**Ecologist**
ECOLOGY	**Hen Harrier Habitat monitoring**	**Annually**	**Ongoing monitoring**	**Ecologist**
ECOLOGY	**Vegetation monitoring**	**Annually**	**5 years**	**Ecologist**
ECOLOGY	**Badger surveys**	**Annually**	**3 years post-construction survey**	**Ecologist**
ECOLOGY	**Bat surveys**	**Annually**	**3 years post-construction survey**	**Ecologist**
ECOLOGY	**Fatality survey (post-con)**	**Annually**	**1 post-construction birds & bats**	**Ecologist**

5 CONCLUSION

This is a preliminary plan which requires finalisation upon the receipt of planning permission. This plan and the Environmental Monitoring Schedule will take cognisance of all mitigation measures outlined in the EIS and any relevant measures conditioned by North Tipperary County Council.

Appendices

REFERENCE DOCUMENTS

APPENDIX 1 TABLE OF ENVIRONMENTAL MITIGATION MEASURES (OPERATIONAL PHASE)

Following is a Table of Mitigation Measures identified through the Environmental Impact Assessment and through further technical reports. Pending planning permission, this table may require revision to include any conditional elements specified by North Tipperary County Council. This table includes mitigation of most relevance to the Contractor and the construction phase of the project.

Aspect	Impact	Mitigation Measure	Responsibility	Key Info/ Comments	Relevant Procedure
Hydrology	Impacts to natural surface water flow – change to natural sediment regime.	Monitoring and maintenance of the constructed drainage – in early operational phase.	Project Manager & Project Ecologist	Drainage per *Surface Water Management Plan* (to be monitored in 6 months post construction).	Monitoring and Auditing Procedure (Op)
Hydrology / Ecology	Impacts to Aquatic Species and Habitats	Water Quality monitoring required in first 2 years of operation. If results of year 1 monitoring are favourable, the programme can be reduced for year 2.	Project Manager & Project Ecologist	Hydro-chemical Monitoring and Q-Sampling required.	Ecological Management Plan
Ecology	Impact on hedgerow (from removal)	360m of new hedgerow will be planted to mitigate this loss of habitat. Existing hedgerows in poor condition will be planted with native species to increase their ecological value.	Project Manager & Project Ecologist	Native species will be replanted within the proposed new hedgerows. Success of establishment will be monitored in early operational phase.	Ecological Management Plan
Ecology	Impact to site due to felling and infrastructure	Exposed areas of the site that are slow to re-vegetate may need to be replanted with suitable vegetation.	Project Manager & Project Ecologist	Management of re-vegetation incorporated into *Ecological Management Plan*	Ecological Management Plan

Aspect	Impact	Mitigation Measure	Responsibility	Key Info/ Comments	Relevant Procedure
Ecology	Impacts to birds from wind farm	Post-construction bird survey to be carried out at operational wind farm.	Project Manager & Project Ecologist	*3 Years per method*	Ecological Management Plan (Bird surveys)
Ecology	Impacts to bats from wind farm	Post-construction bat survey to be carried out at operational wind farm.	Project Manager & Project Ecologist	*3 Years* of annual surveys	Ecological Management Plan (Bird surveys)
Ecology	Impacts to badgers from wind farm	Post-construction badger survey to be carried out at operational wind farm.	Project Manager & Project Ecologist	*3 Years* of annual surveys	Ecological Management Plan (Bird surveys)
Ecology	Impacts to birds and bats from wind farm	Post-construction fatality surveys to be carried out at operational wind farm.	Project Manager & Project Ecologist	1 x Fatality surveys for birds and bats	Ecological Management Plan
Ecology	Impacts to birds and bats from wind farm	Hen Harrier habitat management and monitoring	Project Manager & Project Ecologist	*Ecological Management Plan* includes relevant monitoring.	Ecological Management Plan
Ecology	Impact to species and habitats on site	An Ecological Management Plan (EMP) will be developed prior to construction to provide a framework for the conservation and enhancement of valuable features within the site.	Project Manager & Project Ecologist	*Ecological Management Plan* includes relevant monitoring.	Ecological Management Plan
Ecology	Impact to water quality	Water Quality Monitoring Programme.	Project Manager & Project Ecologist	Monitoring to be carried out in years 1 and 2 of operation to determine if water quality has been impacted.	Ecological Management Plan

Malachy Walsh and Partners
Engineering and Environmental Consultants

Surface Water Management Plan

For

Upperchurch Wind Farm

On behalf of

ECOPOWER DEVELOPMENTS LIMITED

15388
November 2013

Job number	Revision	Prepared by	Checked by	Status	Date
15388-6005	B	Helen Burman-Roy	Monica Kane	Final	26/11/2013

MWP ENVIRONMENT AND PLANNING

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Appendices

1 SURFACE WATER MANAGEMENT PLAN

1.1 INTRODUCTION

The purpose of this document is to outline the surface water management procedures for the construction of the Upperchurch Wind Farm in Co. Tipperary. The proposed wind farm consists of 22 no. wind turbines, of overall height up to 126.6m, 2 no. meteorological masts up to 80m in height, access roads, substation and compound, and all ancillary site works.

On 28th February 2013, North Tipperary County Council (NTCC) issued a Request for Further Information which included the provision of a Surface Water Management Plan (SWMP). This SWMP is based on the particulars previously submitted to NTCC by Ecopower Developments Limited in support of the wind farm planning application.

1.2 SCOPE

The Surface Water Management Plan for the wind farm was prepared taking into consideration the drainage information gathered during the Environmental Impact Assessment and the Sediment and Erosion Plan designed as part of the wind farm proposal. This document includes information on the main impacts and primarily describes the measures for sediment and erosion control. Reference is made to management controls relating to fuel and oil, concrete and vehicles. However, these measures have been included in the Environmental Management Plan and cross-reference is made to the relevant procedures.

This Surface Water Management Plan must be reviewed and implemented in accordance with the drawings included in the Appendix.

1.3 SITE DESCRIPTION

The site is located within a series of small hills or drumlins to the west of Upperchurch village and 18 kilometres to the west of Thurles. The hills are at elevations of between 363mOD and 411mOD and the peaks are generally at heights of 100m above the intervening lower terrain.

The Slievefelim to Silvermines Mountains SPA lies to the west of the site. Most of the site is within the South Eastern River Basin District and drains to the Owenbeg, Turraheen and Clodiagh Rivers and ultimately to the River Suir. The remaining part of the site at the south western extremity is within the Shannon River Basin District and drains to the Aughvana River and ultimately to the Mulkear River.

The area is underlain by Silurian Metasediments and Volcanics with subsoils consisting of Devonian / Carboniferous sandstone and shale till. Some rock outcropping occurs, most notably at the northeast part of the site. The area originally had shallow peat land cover but most of it has been reclaimed by deep ploughing and converted to pasture. The remaining peat areas are used for commercial forestry.

Overall it is a landscape much altered by human activity.

2 IMPACT OF THE WIND FARM DEVELOPMENT

2.1 INTRODUCTION

A Hydrological Impact Assessment was completed during the project Environmental Impact Assessment and was included as Chapter 15 of the Environmental Impact Statement. The assessment was based on a desk study, site walkover and investigation, legislative requirements and relevant Guidelines of the National Roads Authority and the Environmental Protection Agency. The assessment identified constraints, which informed the final wind farm design, including a 50m buffer to watercourses. The impacts outlined below are potential in the absence of mitigation measures.

2.2 CHARACTERISTICS OF THE PROPOSAL

The development is characterised by the following civil engineering works which will be undertaken to provide the necessary infrastructure to complete the wind farm:

- Excavation for the construction of 22 turbine bases with a minimum depth of 2.00m and 225m^2 plan area and hardstands with and excavation depth of 0.60m and 1,040m^2 plan area;
- Erection of 22 turbines with hub heights of up to 85m and maximum tip height of up to 126.60m;
- Construction of an electrical sub-station compound with excavation depth of 0.60m and 2,624m^2 plan area;
- Construction of 8.0km of 5.00m wide new roads;
- Widening and upgrading of 3.9km of existing farm roads (average 2m widening);
- Construction of a surface water drainage system along the road edges; and
- Importation of stone from local quarries for construction of access roads and hard standings.

A key component of the proposal is the surface water drainage system, as managed by the Sediment and Erosion Control Plan designed by Malachy Walsh and Partners.

2.3 SURFACE WATER AND DRAINAGE

The proposed site drains into streams that form the upper reaches of the Turraheen, Owenbeg, Clodiagh and Aughvana Rivers. The first three of these rivers form part of the South Eastern River Basin District and ultimately join the River Suir to the southeast. The Aughvana River, which forms part of the Shannon River Basin District, joins the Mulkear River and ultimately flows into the River Shannon to the east of Limerick City.

There are some EPA sampling stations in the vicinity of the proposed site as follows:

- The nearest sampling station on the Clodiagh River is at a bridge to the north of Castlehill (ING coordinates E: 198173, N: 165027), 5km downstream of the site and 2.4km to the north of turbine T16.
- The nearest sampling station on the Turraheen River (ING coordinates E: 197600, N: 155900) is 4km downstream of the site and 4km to the southeast of turbine T01.
- The nearest sampling station on the Owenbeg River is at a bridge on the local road immediately to the south of the R503 at Upperchurch (ING coordinates E: 198577, N: 160362) and 2.2km to the east of turbine T06.

The site drains to the different rivers as follows:

- The area around turbines T01 and T02 drains towards the west to an unnamed tributary of the Turraheen River.
- The area around turbines T03, T04, T05 and T06 drains to the southeast to the Owenbeg River and its tributaries.
- The area around turbines T07, T08 and T09 drains to the north to the streams that form the upper reaches of the Clodiagh River.
- The area around turbines T10, T11, T13 and T15 drains to the south and southeast to tributaries of the Owenbeg River.
- The area around turbines T12, T14 and T16 drain to the west and north to the Clodiagh River.
- The area around turbines T17 and T18 drains south to an unnamed tributary of the Aughvana River. This is the only part of the overall site that forms part of the Shannon River Basin District.
- The remaining areas around turbines T19, T20, T21 and T22 drain in different directions to unnamed tributaries of the Clodiagh River to the north.

2.4 SURFACE WATER FLOW

2.4.1 Interruption of existing drainage patterns

The existing drainage network on site, associated with wind farm tracks and natural streams, has some potential to be impacted upon by the construction phase of the wind farm. Excavation of new drainage channels, and modifications to the existing surface water drainage network to link new infrastructure has the potential to impact on surface water flow. There is a potential for moderate negative impacts to occur to surface water flows. However, the development of the Upperchurch wind farm will not have a significant impact provided mitigation measures are implemented.

2.5 SURFACE WATER QUALITY

2.5.1 Release of suspended solids

The mains risks to water quality arise from the following;

- Release of suspended solids, particularly from peat soils;
- Nutrient release from transported or suspended sediments;
- Nutrient release from brash from tree felling to facilitate the works.

There is a risk that suspended solids and nutrient release entering watercourses which would have a negative impact on the water quality of streams/rivers and an impact on aquatic ecology (see **Chapter 13 Ecological Impact Assessment**). Given the permeable nature of the existing soil and the small number of streams draining the site, the potential for a significant impact to surface water quality within the receiving catchments is low. Provided mitigation measures are implemented, the development of the Upperchurch wind farm will not have a significant impact.

2.5.2 Risk of pollution from hydrocarbon release

The construction of the wind farm infrastructure requires the use of mechanical plant and equipment. The use of plant on site introduces a risk of potential spillage of oils or hydrocarbons from vehicle and plant either working on site or delivering materials or equipment to site. Provided mitigation measures are implemented, the development of the Upperchurch wind farm will not have a significant impact.

2.5.3 Risk of pollution from cement

There is a risk of spillage and run off from cement trucks delivering concrete to site during the placing of concrete, but also in the washing out of chutes. The spillage of cementitous material into a watercourse would significantly impact on the pH of the water and thus impact on water quality. However, the development of the Upperchurch wind farm will not have a significant impact provided mitigation measures are implemented.

2.5.4 Risk of pollution from water sanitation

A risk of ground water pollution can occur where adequate toilet facilities are not provided on site. However, the development of the Upperchurch wind farm will not have a significant impact provided mitigation measures are implemented.

2.5.5 Risk of pollution from tree felling

In order to construct the proposed wind farm, felling of existing maturing conifer trees and clearing of young plantation will be required around turbines T3, T05, T9, T12, T14 and T22. The risk to water quality from felling comes from the brash and needles that remain from the felling process. Brash, if left on site, will eventually lose it needles and break down to effectively form a localised store of phosphorous.

In summary, there is a potential for minor-moderate negative impacts to occur to surface water quality due to tree felling. However, the development of the Upperchurch wind farm will not have a significant impact provided mitigation measures are implemented.

2.6 IMPACT TO THE LOWER RIVER SUIR SAC

Most of the Upperchurch site is within the South Eastern River Basin District and drains to the Owenbeg River and ultimately to the River Suir. The River Suir Catchment covers a large area of 3,546km2, which represents approximately 4% of the land area of the island of Ireland. The catchment includes extensive lowland areas, particularly along the major river valleys such as those of the Suir, the Aherlow, the Multeen and the Anner; and upland areas including parts the Comeragh Mountains, the Knockmealdown Mountains and the Galtee Mountains, rising to an altitude of 919m at Galtymore.

An Appropriate Assessment was undertaken to determine the significance of impacts on Natura 2000 sites. The assessment included the Lower River Suir cSAC (site code 002137). The Appropriate Assessment Screening (Stage 1) determined mitigation measures would be required to eliminate any risk to water quality. Therefore, the assessment was progressed to an Appropriate Assessment Natura Impact Statement (Stage 2).

The primary mitigation recommended was the provision of the Sediment and Erosion Control Plan. The main aspects of the plan are outlined hereunder:

- Reduce changes in run-off regimes
- Control surface water run-off within and its effects outside the site
- Protect aquatic environments
- Separate clean water from construction activity effected water
- Appropriately design and specify the provision of sediment series ponds and silt traps
- Prevent all sediment associated pollution entering watercourses and groundwater

The result of the Appropriate Assessment is that no adverse impact is expected to arise to Natura 2000 Sites as a result of the proposed development. With mitigation measures in place, no significant ecological residual impacts are expected as a result of the construction and operational phase of the proposed Upperchurch Windfarm.

3 MANAGEMENT CONTROLS AND MITIGATION MEASURES

3.1 MITIGATION BY AVOIDANCE

A process of *'mitigation by avoidance'* was undertaken by the EIA team during the design of the turbine and associated infrastructure layout. A 50m constraints buffer was applied to all streams within the site during the project design phase. There will be no roads or turbine foundations within 50m of a watercourse, except at the necessary stream crossing. The internal road crosses a stream at one location: 250m to the north of T04.

The stream crossing method statement will be designed in consultation with Inland Fisheries Ireland – South Eastern River Basin District and Shannon River Basin District prior to initiation of construction works. A clear span bridge will be used to cross this stream (See Drawing No. 15388-5005 attached in Appendix 1).

There will be no diversion, infilling or dewatering of existing surface water drainage as part of the proposed development; therefore no mitigation is required.

3.2 MITIGATION BY MANAGEMENT CONTROL

Management Controls for the protection of water quality have been included in the EIS as Mitigation Measures and included as environmental procedures in the *preliminary* Environmental Management Plan.

These controls include managing fuel on site, concrete washings and dirt transported from vehicles. These measures are controlled by the following procedures:

- Site Environmental Training and Awareness Procedure (EMP-1)
- Environmental Emergency Response Plan (EMP-2)
- Wheel Wash and Dewatering Procedure (EMP-3)
- Concrete Control Procedure (EMP-4)
- Fuel and Oil Management Procedure (EMP-5)
- Monitoring and Auditing Procedure (EMP-14)

3.3 MITIGATION BY DESIGN

A Sediment and Erosion Control Plan has been prepared as part of the wind farm design and will be implemented to prevent sediment and pollutant runoff into the local watercourses during the construction phase. The plan is designed to separate clean water run-off and 'dirty' water run-off, to mimic the natural hydrology with maximum recharge to the water table. This minimises the volume of contaminated water that has to be cleaned before it is released from the outflow weirs and dispersed across the existing vegetation.

4 SEDIMENT AND EROSION CONTROL PLAN

4.1 INTRODUCTION

Sediment such as peat, clay and silt can cause significant pollution during the construction phase of civil engineering projects due to erosion of exposed soil by surface water runoff. This plan has been prepared to control runoff and prevent erosion during the construction phase of the Upperchurch Wind Farm. The implementation of sediment and erosion control measures is essential in preventing sediment pollution. Erosion control is intended to prevent runoff flowing across exposed ground and becoming polluted with sediments while sediment control is designed to slow runoff (Murnane et al., 2006).

The sediment and erosion plan is compiled with regard to:

- Knowledge of the site's environmental conditions;
- Previous construction experience with wind farm developments in similar upland environments;
- Previous experience of environmental constraints and issues from construction in other wind farms in similar environmental conditions;
- Mitigation measures outlined in other EIS Chapters most notably the Hydrological Impact Assessment (Chapter 15); and
- A number of technical guidance and best management practice manuals.

The following site specific information was used to compile the sediment and erosion plan:

- High resolution aerial photography;
- OSi 10m Contour data;
- Wind farm infrastructure layout (turbines, sub-station, roads and ancillary development);
- Hydrology maps (watercourses and buffer zones);
- Soil and land use maps; and
- Modified Bilham Tables of rainfall intensity, duration and frequency.

4.2 CONTROL OF SEDIMENT AND EROSION

This plan has been designed to cause minimal disturbance to the current hydrological regime and minimise suspended sediment loading. Reduction of sediment loading is important as the site drains to a number of streams and rivers immediately to the north, east and south that ultimately drain to the River Suir and to the Mulkear River (a tributary of the River Shannon). Therefore, mitigation measures are required to protect against suspended solid loading of headwater drainage during the construction stage of the project.

The plan will be implemented early in the construction phase, prior to the site clearance works, to control increased runoff and associated suspended solids loads in discharging waters from the development areas. The plan can be implemented in phases as work progresses through the site. The events and locations with the highest potential for sediment runoff include:

- During and after heavy rainfall events or prolonged rainfall;
- Areas where construction activities (earthworks) are taking place;
- Steep slopes;
- Temporary stockpiles;
- Borrow pits;
- Areas of exposed ground;
- During bridge or drain works (e.g. during implementation of the drainage network) and
- Clear felling.

The proposed drainage layout and sediment control details are shown on the following drawings which are included with the drawing pack submitted as part of the further information:

- 15388-5001 Proposed Drainage Layout - Sheet 1 of 3
- 15388-5002 Proposed Drainage Layout - Sheet 2 of 3
- 15388-5003 Proposed Drainage Layout - Sheet 3 of 3
- 15388-5004 Proposed Site Drainage Details
- 15388-5006 Proposed Internal Road Details

It is likely that a clear span bridge will be used for the stream crossing and a standard drawing is also included in Appendix 1 at the end of the report:

- 15388-5005 Proposed Clear Span Bridge Detail

It is proposed to combine sediment and erosion control measures to reduce the pollution runoff from the site during the construction phase of the Upperchurch Wind Farm. It is important to reduce erosion of soil and peat where possible to prevent sediment suspension in runoff.

No work will take place within 50m buffer zones of watercourses except for the clear span bridge and the drain culverts and associated road construction. All construction method statements will be developed in consultation with Inland Fisheries Ireland – Shannon River Basin District and South Eastern River Basin District. Construction activities in the hydrological buffer zones will be avoided during or after prolonged rainfall or an exceptional rainfall event. Work will cease entirely near watercourses when it is evident that pollution is likely to occur. Culverts will be installed at locations where land drains are intercepted and will be diverted into the clean water drains. The culverts will be designed to facilitate the large flows that may occur following intense or prolonged rainfall events.

Generally, the footprint of the works area of a wind farm development represents only a small proportion of the overall catchment area intercepted by the site. Unless appropriate measures are put in place the works area can potentially contaminate the runoff from the upstream catchment, creating an excessive volume of contaminated water which is then difficult to manage. The aim of this sediment and erosion plan is t**o intercept the clean water runoff from the upstream catchment and to isolate it from the contaminated water flowing from the works areas**. This minimises the volume of contaminated water that has to be cleaned before it is dispersed across the existing vegetation via the outflow weir.

4.3 PROTECTION OF CLEAN WATER FROM THE UPSTREAM CATCHMENT

A fundamental principle of the design of the sediment and erosion plan is that clean water flowing in the upstream catchment, including overland flow and flow in existing streams, is not contaminated by silt from the works area. The single existing stream crossing will be crossed using a clear span bridge. New drains will be constructed to collect overland flow that is intercepted by the works areas or by the site roads. These will be constructed on the uphill side of the works and piped to the downhill side, bypassing the works areas, thereby preventing contamination with construction related runoff water. However, this will cause the normally dispersed flow to be concentrated at specific discharge points downstream of the works. In order to disperse the flow each clean water drain will be terminated in a discharge channel running parallel to the ground contours that will function as a weir to disperse the flow over a wider area of vegetation. This will prevent erosion of the ground surface and will attenuate the flow rate to the downstream receiving waters. The resultant diversion of clean water runoff will ensure that the sediment and erosion control measures will only need to deal with construction related runoff.

4.4 TREATMENT OF WATER FROM THE WORKS AREAS

Runoff from the works areas will be isolated from the clean catchment runoff by means of a series of open drains that will be constructed on the down-hill side of the works. These drains will be directed to settlement ponds that will be constructed throughout the site, downhill from the works areas. The ponds have been designed to a modular size to cater for a single turbine hard standing area or a 1,000m^2 area of internal access road. Each drain will incorporate a series of check dams that will attenuate the flow and provide storage for the increased runoff from exceptional rainfall events. Where larger areas of runoff have to be catered for at a single discharge point the size of the settlement lagoon will be increased pro rata. At locations where fine silt particles, less than 20 microns in size, are present in the runoff, larger settlement ponds will be required. Proprietary clarifiers may be used as an alternative, with the addition of flocculants where necessary.

Excavation of drains will cause an initial drawdown of the water table in the immediate vicinity at locations where it is above the drain invert. The clay layers will have low permeability and the underlying till will have moderate permeability. Some seepage can occur from these layers but, based on site investigation information, is expected to be minimal. The volume and rate of flow from this source are unlikely to be significant or to exceed the capacity of the settlement ponds which are designed for extreme storm events.

Dewatering of turbine base excavations can result in significant flow rates to the drainage and settlement system if high capacity pumps are used. In order to avoid the need for pumping it is proposed to provide drainage channels from the excavations so as to prevent a build up of water. Where this is not feasible, dewatering should only be carried out at a flow rate that is within the capacity of the sediment ponds

The design of the settlement ponds in outlined below.

4.5 SETTLEMENT PONDS

Drains carrying construction site runoff will be diverted into settlement ponds that reduce flow velocities, allowing silt to settle and reducing the sediment loading. Settlement ponds have been designed as a three-stage tiered system and this has been proven to work effectively on wind farm construction sites. The three-stage system also facilitates effective cleaning with minimal contamination of water exiting the pond. The settlement ponds have been designed with regard to the following:

- Size of construction area and associated runoff flow rate (clean water from the surrounding catchment will be diverted away from construction area);
- Modified Bilham Tables for rainfall intensity and duration;
- Expected sedimentation rates; and
- Character of the impermeable areas (runoff coefficients).

Settlement ponds will require inspection and cleaning when necessary. This will be carried out under low or zero flow conditions so as not to contaminate the clean effluent from the pond. The water level would first be lowered to a minimum level by pumping without disturbing the settled sediment. The sediment would then be removed by mechanical excavator and disposed of in areas designated for deposition of spoil. Ponds will also require perimeter fencing and signage to ensure that there are no health and safety risks.

Contaminated runoff can be generated on the site access roads, construction compounds, sub-station sites and turbine hard standing areas and is mainly due to excavation for the infrastructure or movement of delivery vehicles and on-site traffic. A modular approach has been adopted for the design of the settlement ponds which have been sized to cater for a catchment area of 1,000m^2 works area. This is equivalent to a road length of 200m or the area of a typical turbine hard standing.

Generally, high intensity rainfall events have a short duration and lower intensity rainfall events tend to have a longer duration. The Bilham Table for statistical rainfall events demonstrates that exceedance probability decreases as intensity or duration increases. The runoff control measures for the wind farm site have been designed in the context of storm events of varying duration and intensity. The settlement ponds have been designed to cater for a maximum continuous flow rate associated with a medium-intensity rainfall event. Higher intensity runoff will be attenuated by the open drain collection system which provides temporary storage and limits the rate at which it enters the settlement ponds. This is achieved by the use of check dams within the open drains as described elsewhere in this document. Longer duration storms of 24 hours or more generally have very low intensity and are not critical in terms of the runoff rates that they generate. Since the design is for the construction phase only, no additional allowance has been made for possible increase in rainfall intensity due to climate change in the future. While the roadways are vulnerable to erosion during the construction and early operational phase (generally within the first 6 months post construction), it is not considered that they are vulnerable during the majority of the operational phase. The main source of sediment runoff from the roads is fine sediment, or fines as they are commonly known. Fines occur as a result of the physical impact of the constant HGV traffic during the construction phase. It is the crushing of the road stone from this impact that generates the fines, which become suspended in water during or after a rainfall event.

In contrast, there will be no HGV traffic during the operational phase, where light vehicles may visit the site intermittently as required for maintenance. This type and volume of traffic has virtually no physical impact on the road and will generate negligible amounts of fine sediment. Therefore, roads are virtually free of fines during the operational phase of the wind farm. Furthermore, the Sediment and Erosion Plan, outlined in this document, has been designed to mimic the natural hydrology, in isolation from natural watercourses, and with no release to any watercourse on the site.

4.5.1 Design flow rate

The modular settlement ponds are designed to operate effectively for the runoff rate associated with a continuous high rainfall event of 20mm/hour. This is equivalent to a 60 minute duration storm event with a 5-year return period (M5-60) or a 25 minute duration storm event with a 1-year return (M1-25).

The design runoff rate is calculated using the formula:

$Q = c\,i\,A$

where c is the runoff coefficient

i is the rainfall intensity in m/sec and

A is the catchment surface area in m^2

A runoff coefficient of 0.70 is assumed for the hardcore surface. For a rainfall intensity of 20mm/hour and an area of $1{,}000m^2$ the runoff rate is:

$Q = 0.70 \times (0.02/3600) \times 1{,}000\ m^3/sec$

$= 0.0039\ m^3/sec$ (3.90 litres/sec)

4.5.2 Pond surface area

The main design parameter for the settlement pond is the water surface area. The required surface area is the design flow rate in m^3/sec divided by the particle settlement velocity (V_s) in m/sec (Area = $Q/V_s\ m^2$). The particle settlement velocity is determined using the formula derived by Stokes in 1851 as follows:

$V_s = 2\,r^2\,(D_p - D_f) / (9\,n)$

where V_s is the particle settling velocity (m/sec)

r is the radius of the particle (metres),

D_p is the density of the particles (kg/m^3);

D_f is the density of the fluid (kg/m^3),

n is the viscosity of the fluid (0.000133 kg sec/m^2 @ 10°C).

For a particle density of $2{,}700kg/m^3$ and diameter of 20 microns the settlement velocity V_s is 0.000284m/sec.

The required settlement pond surface area is

$A = Q/V_s$

$= 0.0039/0.000284$

$= 13.70m^2$

Theoretically the pond depth is not relevant but in practice a minimum depth is required to ensure laminar flow and to allow temporary storage of settled silt. The modular settlement pond has been designed conservatively with a surface area of $24m^2$ (12m x 2m) and a depth of 1m. This is divided into three chambers of equal length and in practice it has been found that most of the settlement occurs in the first chamber with very low turbidity levels being achieved in the final effluent. The design is conservative and therefore has sufficient redundancy to cater for occasional higher runoff rates or sediment loads.

For practical reasons it may be necessary to increase the area directed to a settlement pond in which case the pond surface area will be increased pro rata.

4.5.3 Extreme flow rates

For rainfall intensities above the design value of 20mm/hour the excess runoff needs to be temporarily stored. The storage can be provided in the drainage channels by installing check dams at intervals along the channel as described below.

The storage volumes required for 10-year storm events of various durations are shown in the Table 1 below. The volumes are based on a catchment area of 1,000m^2 and a runoff coefficient of 0.70. The maximum storage volume required is 6.98m^3 for 20 minutes storm duration. This is equivalent to 30 minutes of flow through the settlement pond at the design through flow rate of 3.90 litres/second. The stored water will drain off gradually as runoff from the works area subsides. The storage volume represents an average depth of 0.06m in a 200m long, 0.60m wide open drain and can therefore be easily accommodated in the drainage system.

Storm Event	Duration (minutes)	Rainfall rate (mm/hour)	Excess (mm/hour)	Runoff Coefficient	Storage Volume (m^3)
M10-60min	60	24.50	4.50	0.70	3.15
M10-40min	40	32.40	12.40	0.70	5.79
M10-30min	30	39.10	19.10	0.70	6.69
M10-20min	20	49.90	29.90	0.70	**6.98**
M10-10min	10	71.40	51.40	0.70	6.00
M10-5min	5	94.90	74.90	0.70	4.37

TABLE 1 - CALCULATED STORAGE VOLUMES

The ability to limit flow rates is fundamental to the control of sediment during extreme storm events. It is not proposed to use any proprietary mechanical devices for this purpose but instead to rely on the check dams to effectively limit flow rates to the required levels. The check dams are constructed with gravel or other suitable material and will be of sufficient length and height to provide the required attenuation rates. This will vary depending on the gradient of the drainage channel with higher gradients requiring a greater number of dams with larger dimensions. Their ability to retain water and release it slowly can be confirmed visually.

4.5.4 Outflow Weirs

The effluent from each settlement pond will discharge to an open channel, 8 to 10 metres in length, running parallel to the ground contours. This will form a weir that will overflow on its downhill side and disperse the flow across the existing vegetation. A minimum buffer width of 20m is specified between the overflow weir and downstream watercourses. Buffer widths are designed in line with Scottish Forestry Commission Guidelines (2004) on protection of water courses during forestry operations and management. This method buffers the larger volumes of run-off discharging from the drainage system during periods of high precipitation, reducing the hydraulic loading and further reducing suspended sediment load to surface watercourses. The closest overflow weir is 44m from the watercourse, which represents twice the specified buffer and is closer to the 50m buffer applied during the wind farm design. In general, the outflow weirs should not be located on slopes steeper than 3:1 or in areas of high peat stability risk. However, since there are no areas of deep peat in the Upperchurch site, peat stability is not a particular risk in this case.

4.5.5 Check dams

Check dams will be placed at regular intervals based on bed gradient along all drains to slow down runoff, facilitate settlement and reduce scour and ditch erosion. Check dams are relatively small and composed of gravels or other suitable material. Depending on the longitudinal gradient they will be placed at distances and heights that allow small pools to develop behind them. This is required in order to attenuate flow to the settlement ponds during storm events where the runoff rate would otherwise exceed the settlement pond capacity.

4.6 SEDIMENT CONTROL MANAGEMENT

The settlement ponds and check dams described in the previous section provide the essential mechanism for the removal of silt from construction related runoff and the controlled return of the treated runoff to the downstream watercourses. Additional infrastructure and control methodologies are also required in order to minimise the sediment load from the runoff and to prevent contamination by other potential pollutants.

4.6.1 Working near watercourses

No work will take place within 50m buffer zones of watercourses except for clear span bridges or culverts and associated road construction. Working near watercourses during or after intense or prolonged rainfall events will be avoided and work will cease entirely near watercourses when it is evident that there is a risk that pollution could occur. All construction method statements will be developed in consultation with Inland Fisheries Ireland – Shannon and South Western River Basin Districts.

4.6.2 Minimise exposed area

The area of exposed ground will be kept to a minimum by maintaining where possible existing vegetation that would otherwise be subject to erosion in the vicinity of the wind farm infrastructure and keeping excavated areas to a minimum. The clearing of peat, where it occurs, will be delayed until before construction begins rather than stripping the entire site months in advance particularly during road construction.

4.6.3 Silt fences

Silt fences or other appropriate silt retention measures will be installed where there is a risk of erosion runoff to watercourses from construction related activity particularly if working during prolonged wet weather periods or if working during intense rainfall events. Silt fences can be used in conjunction with check dams in drains. Preliminary site works, and particularly the construction of the drainage system, will require the use of silt fences to prevent siltation due to ground disturbance caused by excavation works.

4.6.4 Engineered deposition areas

Temporary engineered deposition areas will be designated and designed to hold temporary stockpiles and located away from drains and watercourses. Stockpiles that are at risk of erosion will be protected by silt trapping apparatus such as a geo-textile silt fences to prevent contamination of runoff.

4.6.5 Felling

Permanent tree felling will take place to facilitate access to the wind farm infrastructure. All associated tree felling will be undertaken using good working practices as outlined in *Forestry Harvesting and the Environment Guidelines* and *Forestry and Water Quality Guidelines*, both published by the Forest Service, Department of Marine and Natural Resources, July 2000. The latter guidelines deal with sensitive areas, erosion, buffer zone guidelines for aquatic zones, ground preparation and drainage, chemicals, fuel and machine oils.

4.6.6 Establish vegetation

As part of the works, some areas of organic soil and peat will be permanently removed. These areas include the locations of new roads, upgraded existing roads, turbine bases, hard standings and electrical sub-station compound. The soil can be re-used to remediate exposed areas and prevent erosion in the future when the civil works have been completed.

In addition, some exposed areas of the site that are slow to re-vegetate may need to be replanted with suitable vegetation. This can be by natural regeneration or by reseeding. Natural regeneration relies on colonisation of bare ground by native species from adjacent habitats. A roughened surface will be provided, which can trap seeds and soil to provide initial regeneration areas. The need for replanting or reseeding will be decided by the developer in consultation with the project ecologist near the end of the construction phase and during the beginning of the operational phase (See both the Construction Environmental Management Plan and Operational Environmental Management Plan).

4.6.7 Road runoff

All access roads are to be stabilised and maintained after grading followed by a final capping with crushed limestone or similar quality stone. Limestone or similar quality stone can significantly reduce road related runoff resulting from construction traffic and the road stone. The road surface can become contaminated with clay or other silty material during construction. Road cleaning will, therefore, need to be undertaken regularly during wet weather to reduce the risk of sediment runoff to watercourses. This is normally achieved by scraping the road surface with the front bucket of an excavator and disposing of the material at designated locations within the site.

4.6.8 Wheel washes

Wheel washes will be provided for exiting heavy vehicles to ensure roads outside of the site boundary are clean. It is recommended that a designated bunded and impermeable wheel wash area is provided and resultant waste water is diverted to a settlement pond for settling out of solids. If a pumped dewatering system is required it will be well planned and pumped water will be adequately treated in the settlement pond.

4.7 OPERATIONAL PHASE

The measures for control of runoff and sediment relate to the construction phase of the project when there is continuous movement of site vehicles and delivery vehicles. Following construction the amount of on-site traffic will be negligible and there will be no particular risk of sediment runoff. It is therefore proposed to partly fill the sediment ponds with stone so that they will not present a long-term safety risk. Runoff from the roads, hard-standings, and other works areas will continue to be directed to these ponds and from there to the outfall weirs. Check dams within the drainage channels will also remain in place. The drainage infrastructure will be monitored post-construction during the first six months of the operational phase. The retention of this drainage infrastructure will ensure that runoff continues to be attenuated and dispersed across existing vegetation before reaching the downstream receiving waters.

4.8 FLOOD ATTENUATION

The creation of impermeable areas within a development site has the effect of increasing rates of runoff into the downstream drainage system and this may increase flood risk and flood severity downstream. This applies particularly to urban areas that drain to closed pipe systems which do not have the capacity to cater for increased hydraulic loads. The Upperchurch wind farm development is located within a large rural catchment with an open drainage system. The footprint of the impermeable areas and the associated increase in runoff rate is very small in the context of the catchment size and therefore presents a negligible increase in downstream flood risk. Notwithstanding the low increase in flood risk due to the development, the drainage system has been designed to prevent any increase in discharge rates above that which already exist in the undeveloped site.

The following flood attenuation measures have been incorporated into the design:

- Existing drains will bypass the works and no additional runoff will be routed directly into them;
- Overland flow of clean water that is intercepted by the works will be collected in open drains, piped to the downhill side of the works, and dispersed over existing vegetation by means of overflow weirs as described elsewhere in this document. These will be provided at intervals of approximately 200m, the exact locations being determined on site at construction stage.
- Runoff from roads, hard-standings and other new surfaces will be also be dispersed across existing vegetation downstream of the works following removal of sediment in the settlement ponds. This flow regime will remain in place permanently after completion of the works.
- Some attenuation will be provided by the use of a series of gravel dams placed at intervals within the open drains carrying silt contaminated runoff. These are intended to limit the flow rate to the settlement ponds during construction but they will also provide attenuation of flow to the downstream receiving waters in the longer term during the operational phase of the wind farm. The overflow weirs downstream of the settlement ponds will remain in place permanently so that the flow continues to be dispersed across existing vegetation and not directly to open drains or streams.

4.9 INSPECTION AND MAINTENANCE

Controls need to be regularly inspected and maintained to ensure that any failures, such as a build up of silt or a tear in a silt fence, are quickly identified and repaired so as to prevent to water pollution. Inspection and maintenance is critical after prolonged or intense rainfall while maintenance will ensure continued effectiveness of the sediment and erosion plan. A programme of inspection and maintenance will be designed and dedicated construction personnel assigned to manage this programme. A checklist of the inspection and maintenance control measures will be developed and records kept of inspections and maintenance works. Controls must work well during the operational phase of the wind farm until the vegetation has re-established. As aforementioned, the drainage infrastructure will also be monitored post-construction during the early operational phase.

4.10 WATER QUALITY MONITORING

Baseline water quality of all of the streams leaving the development site will be undertaken prior to construction. This baseline data will include the main components of a full hydrograph for the streams including both high spate flow and base flow where possible.

A weir or flume water level auto-logger and infra-red suspended solids sonde will be installed at select locations. This equipment will allow for continuous monitoring of water flow and associated suspended solids load during storm events. This equipment will be installed in time to monitor baseline conditions for at least 6 months prior to construction, and will be maintained during construction and post construction for at least 12 months.

During the construction phase of the project, water quality in the streams and outflow from the drainage and attenuation system will be monitored, field-tested and laboratory tested on a regular basis during different weather conditions. This monitoring along with the visual monitoring will help to ensure that the mitigation measures that are in place to protect water quality are working.

During the construction phase of the project, the development areas will be monitored regularly for evidence of groundwater seepage, water ponding and wetting of previously dry spots, and visual monitoring of the effectiveness of the constructed drainage and attenuation system to ensure it does not become blocked, eroded or damaged during the construction process.

4.11 CONCLUSION

Construction practices impact on the natural drainage patterns in a landscape. The intent is to keep clean water clean and to manage construction related runoff through a designed, managed and maintained sediment and erosion plan. Attenuation measures are incorporated into the design of the drainage and sediment control system.

The measures outlined above, in conjunction with the site drainage layout and details, will prevent sediment and erosion problems and will ensure that the development of the Upperchurch wind farm will not have a significant impact on the River Suir and River Shannon or their tributaries.

4.12 REFERENCES

Forestry Commission (2004). "*Forests and Water Guidelines*". 4th Edition. Forestry Commission, Edinburgh, Scotland.

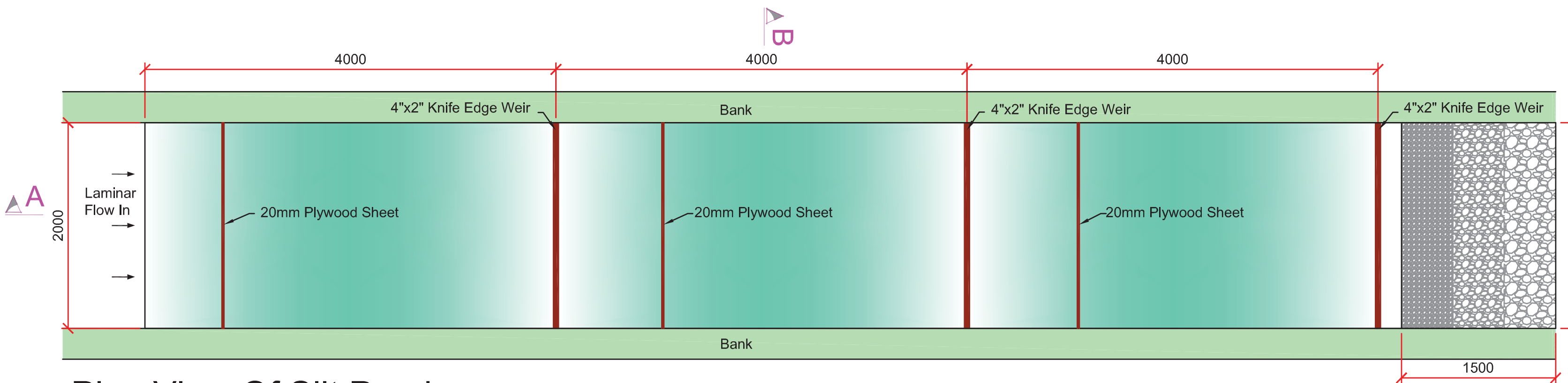
Forest Service, Department of Marine and Natural Resources, July 2000. Forest Harvesting and the Environment Guidelines.

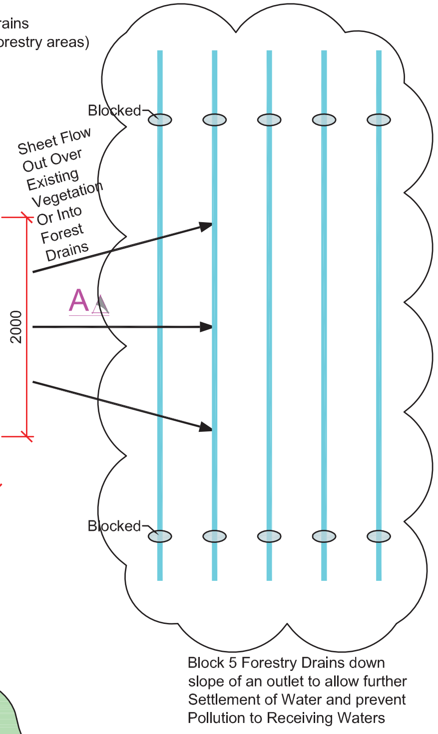
Forest Service, Department of Marine and Natural Resources, July 2000. Forestry and Water Quality Guidelines.

Murnane, E., Heap, A. and A. Swain, 2006. Control of water pollution from linear construction projects. A Technical Guidance. A CIRIA publication, UK.

Appendix 1

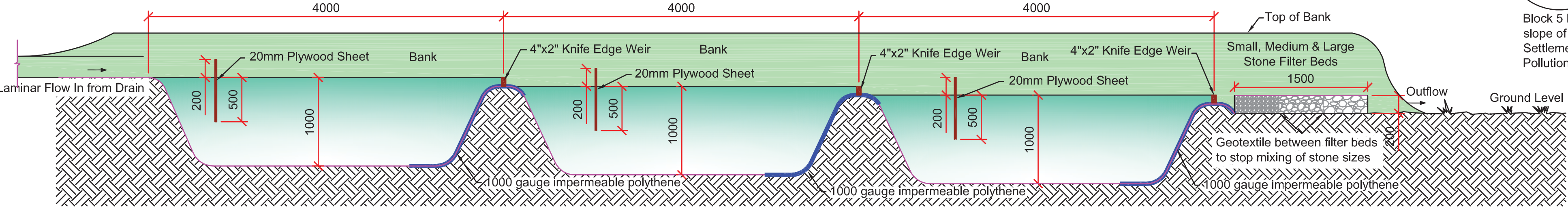
15388-5005 Proposed Clear Span Bridge Detail





Plan View Of Silt Ponds (with discharge to forestry drains where applicable) Scale 1:50

Small, Medium & Large Stone Filter Beds



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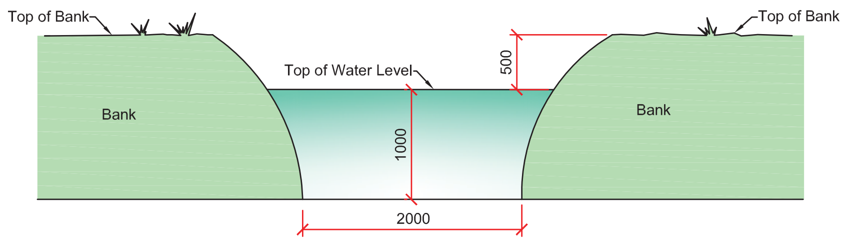


Section B-B Scale 1:50

A	26.11.13	Issued For RFI	JK	TB	JoL
Rev.	Date	Description	by	ch'd	app

Client: Ecopower Developments Ltd

Project: Upperchurch Wind Farm

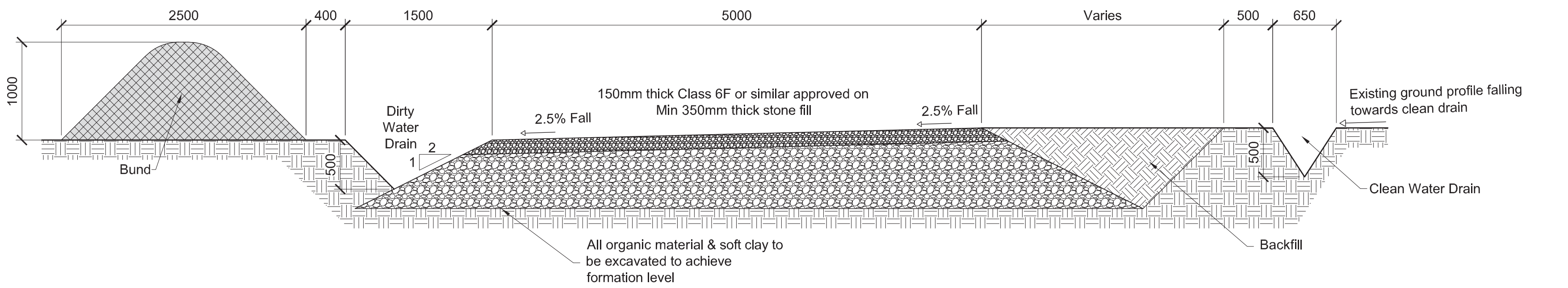
Title: Proposed Site Drainage Details

Malachy Walsh and Partners
Consulting Engineers
Cork | Tralee | London | Limerick

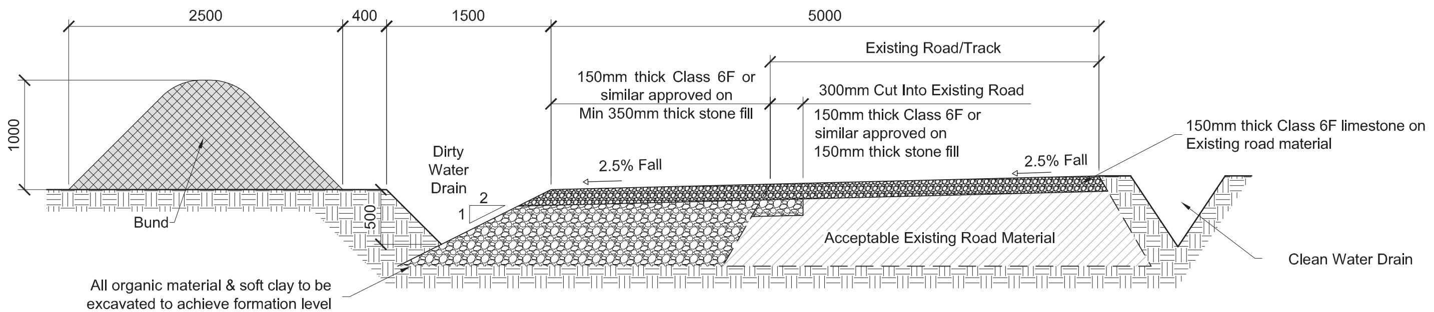
Scales (A3)	1:50	
Drawn	JK	26.11.2013
Checked	TB	26.11.2013

Drg. No. 15388-5004

Rev. A



Typical Excavated Access Track Detail Scale 1:50



Typical Widening To Existing Access Track Detail Scale 1:50

Rev.	Date	Description	by	ch'd	app
A	26.11.13	Issued For RFI	JK	TB	JoL

Client: Ecopower Developments Ltd

Project: Upperchurch Wind Farm

Title: Proposed Internal Road Details

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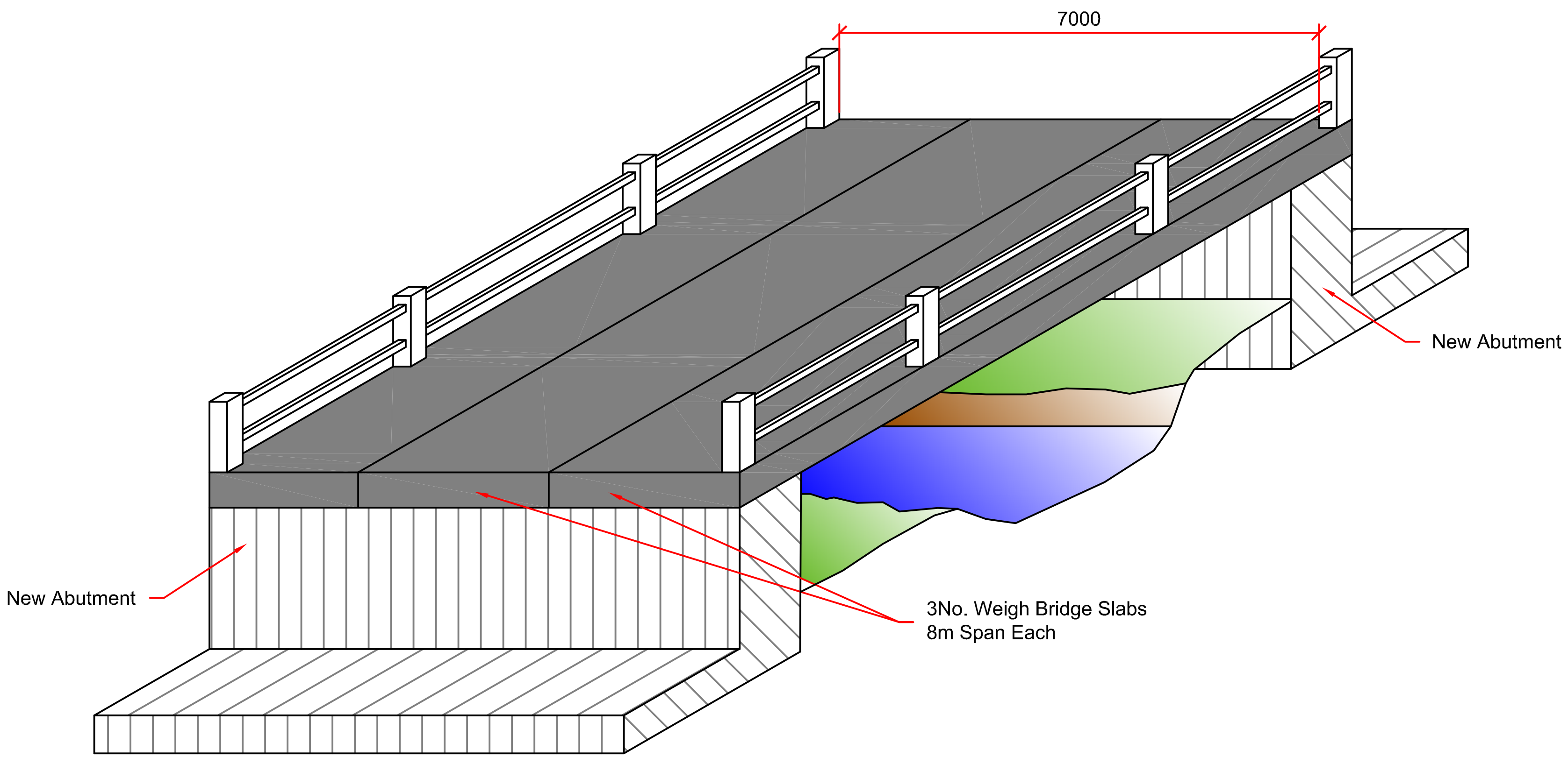
Cork | Tralee | London | Limerick

Scales (A3)	1:50	
Drawn	JK	26.11.2013
Checked	TB	26.11.2013

Drg. No. 15388 - 5006

Rev. A

REFERENCE DOCUMENTS



Proposed Clear Span Bridge Detail Scale 1:100

Rev.	Date	Description	by	ch'd	app
A	26.11.13	Issued For RFI	JK	TB	TB

Client: Ecopower Developments Ltd

Project: Upperchurch Wind Farm

Title: Proposed Clear Span Bridge Detail

Malachy Walsh and Partners
Consulting Engineers
Cork | Tralee | London | Limerick

Scales (A4)	1:100	
Drawn	JK	26.11.2013
Checked	TB	26.11.2013

Drg. No. 15388-5005

Rev. A

Q7.*Please submit a Reinstatement/Restoration & Aftercare programme for the wind farm, providing for example: removal of turbines, substation, foundations, roads and ancillary works etc. (itemise and describe precisely) and also detailed proposals for landscaping & screening [scheme] of the site. The scheme shall also provide for the replacement and renewal of any hedgerows damaged and / or removed in the course of the construction phase and the transportation of materials to/from the site and shall include timescale for implementation. The programme shall include proposals for:-*

(i) The satisfactory recycling or reuse of waste materials;.

(ii) The replacement of topsoil so as to render the land suitable for agricultural use or other use consistent, in appearance/utilisation of the surrounding land; and

(iii) The grading of any surface levels and the restoration of natural surface and subsoil drainage and the seeding and planting of the site.

Note*: The above shall be accompanied with fully annotated drawings,.colour coded, indicating extent and type of intended restoration works.*
*****Note****: 'Reinstatement' shall Include 'Landscaping Works and Earthworks Restoration, as required.*

(b) Based on the above programme, please submit a detailed estimate of the restoration/aftercare/landscaping costs of the proposed development including costs in relation to the removal of turbines, foundations, etc. Such-estimate shall indicate proposed works description, associated quantities with applied labour/plant costs' and all shall be certified by an indemnified, independent, Charted Quantity Surveyor. The developer should note that such estimate may be utilised by the Planning Authority in order to determine a fair and satisfactory amount of Restoration Bond required.

(c) Taking the above into account you are advised to submit revised proposals in relation to the proposed borrow-pits, post-excavation, taking into account.-

- Provision of appropriate side-slopes/base-slope conducive to restoration afteruse e.g. agriculture, forestry, ecological etc.
-Surface water ponding.

The answer to Q.7follows (Over);

REINSTATEMENT PROGRAMME

DECOMMISSIONING OF UPPERCHURCH WINDFARM

REFERENCE DOCUMENTS

13 /51/0003 – response to RFI dated 28th February, 2013

Further Information 13/51/0003 (22 No. wind Turbines at Upperchurch)

REFERENCE DOCUMENTS

Malachy Walsh and Partners

Engineering and Environmental Consultants

Reinstatement Programme

Decommissioning of Upperchurch Wind Farm

15388

November 2013

Job number	Revision	Prepared by	Checked by	Status	Date
15388	B	Peter Barry	Peter Barry	FINAL	22 November 2013

MWP ENVIRONMENT AND PLANNING

Table of Contents

1 INTRODUCTION

This document was prepared in response to FI request no 7. It must be noted however, that much of the site reinstatement works will take place once the construction is complete. For example, hedgerows will be replanted, and permanent felled areas will be re-vegetated. The borrow pits will also be re-instated post construction rather than at the decommissioning stage in 25 years time. Many of these elements are dealt with in detail in the Ecological Management Plan, and provisions for oversight and supervision, monitoring and auditing of these works are outlined in the Ecological Management Plan, the Construction Environmental Management Plan and the Operational Environmental Management Plan which accompany this reply to the further information request.

Further Information Request No. 7 is outlined below:
Please submit a Reinstatement/ Restoration & Aftercare programme for the wind farm, providing for example: removal of turbines, substation foundation, roads and ancillary works to (itemise and describe precisely) and also detailed proposals for landscaping & screening [scheme] of the site ***(See Sections 2 and 6).***

The scheme shall also provide for the replacement and renewal of any hedgerows damaged and / or removed in the course of the construction phase and transportation of materials to/from the site and shall include a timescale for implementation ***(See Section 3.1 and Ecological Management Plan)****.*
(a) The programme shall include proposals for:-
(i) The satisfactory recycling or reuse of waste materials;
(ii) The replacement of topsoil so as to render the land suitable for agricultural use or other use consistent, in appearance/utilisation of the surrounding land: and
(iii) The grading of any surface levels and the restoration of natural surface and subsoil drainage and the seeding and planting of the site.
Note: The above shall be accompanied with fully annotated drawings, colour coded, indicating extent and type of intended restoration works.
Note: 'Reinstatement' shall Include Landscaping Works and Earthworks Restoration; as required.* *(See Section3 and Figures 1 to 12)***

Cont…

(b) Based on the above programme, please submit a detailed estimate of the Restoration/Aftercare/Landscaping costs of the proposed development including costs in relation to the removal of turbine foundations, etc. Such-estimate-shall indicate proposed works' description associated quantities with applied labor and plant costs and shall be certified by an indemnified independent, Charted Quantity Surveyor. The developer should note that such estimate may be utilised by the Planning Authority in order to determine a fair and satisfactory amount of Restoration Bond required. ***(Section 6 and Appendix A)***

(c) Taking the above into account you are advised to submit revised proposals in relation to the proposed borrow-pits, post-excavation, taking into account.-

- Provision of appropriate side-slopes base-slope conducive to restoration after use e.g. agriculture, forestry, ecological etc. ***(see Section 3.3)***

-Surface water ponding ***(see Section 3.3)***

2 DECOMMISSIONING THE UPPERCHURCH WIND FARM

The permission for Upperchurch Wind Farm is for a period of 25 years from the date of commissioning of the wind farm. All the electrical equipment- main transformer and individual turbine transformers, switch gear and control gear have a design life of 40 years. The options after 25 years would be to;

- Refit the turbines with new gearboxes, generators and blades and generate as before
- Repower with the most up to date technology and continue production
- Decommission the wind farm and reinstate the site.

For the purposes of this response, it is assumed that the wind farm will be decommissioned. The decommissioning will involve the removal of all the turbines and their transformers, removal of the turbine foundations and some hardstanding areas and the re-instatement of vegetation over time. The requirements of decommissioning and reinstatement are detailed below. There is some cross over between this document, the Ecological Management Plan, the Construction Environmental Management Plan and the Operational and Environmental Management Plans.

2.1 WIND TURBINE REMOVAL

Wind turbines are bolted to the foundation and can be removed using the relevant cranes and equipment. The removed turbines may be re-used, but will most likely be disassembled and have a salvage value. The salvage value will differ, depending on the particular turbine models used. The machines can have components made of fiberglass, steel, or copper etc. Once the turbines are taken down to ground level, the component sections can be disassembled. The turbine blades, nacelle, tower and cabling can be broken down and stripped for the high value components. Cabling can be stripped for its high value copper conductor materials. A scrap company would be engaged to carry out the work on site and to organize for haul and salvage, or disposal. Transport from the site will be easier than with delivery, as components can be cut into transportable sections for delivery to a scrap metal purchaser. The transformers associated with each turbine, may be removed from the site and re-used as appropriate.

When the turbines and all components are removed, all scraps and debris will be removed from the area of the site. Each area of the 22 previous turbine locations will be cleaned appropriately post-removal. All oil based waste can be collected from the site and recycled by an approved waste disposal company.

2.2 PERMANENT METEORLOGICAL MAST REMOVAL

These will be removed and component parts recycled or reused. The hardstand and foundations will be removed to below ground level and covered with topsoil and reseeded or allowed to re-vegetate naturally.

2.3 TURBINE FOUNDATION REMOVAL

The turbine foundations can be left in situ as the foundations are below ground level and have a steel cylindrical ring protruding from the foundations up to ground level onto which the turbine tower is bolted. This ring can be cut away and the steel recycled. The foundations can then be covered with topsoil and reseeded or allowed to re-vegetate naturally, where appropriate. The surface area will be contoured to maintain the natural surface water flow across the site.

2.4 TURBINE HARDSTAND REMOVAL/REMEDIATION

Once the wind turbine and transformer are removed, and the use of a crane is no longer required, remediation of the turbine hardstand areas can then be undertaken. Vegetation may have grown on hardstands during the lifetime of the wind farm and if the hardstand is below the surface level of the surrounding land, it is envisioned that the hardstands will roughened and covered in topsoil to the level of the surrounding land and reseeded or allowed to re-vegetate naturally. If the level of any hardstand areas is above the surrounding levels, the top layer of the hardstand will be removed to below the level of the surrounding lands and then covered in topoil and reseeded or allowed to re-vegetate naturally.

2.5 ELECTRICAL CABLES REMOVAL

The onsite electrical cables will be buried at an approximate depth of 1.2m. Cable proximal to the turbine transformers will be cut and removed. It is envisioned that the bulk of the cables, which connected the turbine transformers, will remain buried in situ. These cables will be in place for 25 years and will not pose an environmental risk. It is considered more intrusive to remove all cables and that any environmental and agricultural impacts may be minimized by leaving the cables in place. When the electrical cables are removed, all scraps and debris will be removed from the area of the site. Each area of the previous turbine locations will be cleaned appropriately post-removal.

2.6 ACCESS ROADS REMOVAL

To minimise the environmental impact, the access roads of the Upperchurch Wind Farm were designed to use and upgrade suitable existing agricultural tracks. At the decommissioning stage the access roads could be removed, however it is expected that they will be retained in situ as an integral part of the infrastructure for use by the landowner as farm tracks.

If it is decided at the time of decommissioning that tracks are to be removed, the underlying material will be treated to relieve compaction and / or to promote re-vegetation. This may include the careful manipulation of the soil or building up ground levels with additional topsoil.

2.6.1 Road Drainage

There is a significant amount of soil in the roadside bunds, excavated for road construction and drainage. This topsoil will be used to infill associated roadside drainage and remaining soil will be used for hardstands and foundations.

2.7 ELECTRICAL SUBSTATION

The substation compound will be used by the ESB and includes an ESB room, a wind farm control room and equipment such as switch gear. It is most likely that the substation will remain after the wind farm site is reinstated. Any equipment associated with the wind farm side of the substation will be electrically isolated and removed off site and disposed of appropriately. If at the decommission stage the planning authority requests the substation is screened, a stand of conifer trees can be planted around the substation.

3 REINSTATING THE UPPERCHURCH SITE

There is a significant amount of topsoil contained in the roadside bunds. The soil in these bunds comes from both the roads and the drains. Following reinstatement of the drains there will be soil remaining which will be used for the foundation and hardstand areas. Where necessary excavations made during the decommissioning will be in-filled with sub-grade materials, if required, and topsoil will be used to replace the soil covering in these areas. The topsoil will be replaced to re-establish the original depth and to match the original surface contours where possible. The new soils surface and any other disturbed soil areas will be re-seeded to encourage the return to the original land use in line with the surrounding lands and land-use.

The wind farm infrastructure is predominantly located in areas of improved agricultural grassland. Any re-seeding of lands will be agreed with the landowner to ensure consistency with the surrounding land uses. In areas of felled forestry, acid and wet grass land, heath and bog, these areas will be allowed to naturally re-vegetate and be managed for nature conservation purposes (see also Ecological Management Plan).

3.1 REPLACEMENT AND RENEWAL OF HEDGEROWS

The scheme shall also provide for the replacement and renewal of any hedgerows damaged and / or removed in the course of the construction phase and transportation of materials to/from the site and shall include a timescale for implementation.

Any hedgerows to be removed will be done during the construction phase. Approximately 980m of hedgerows will be removed as part of the construction of infrastructure. As part of the proposed development, approximately 980m of new hedgerow will be planted to mitigate this loss of habitat. Included in the Hen Harrier Habitat Management Plan (Appendix to the Ecological Management Plan) existing hedgerows in poor condition will be planted with native species, to increase the ecological value. The location of new hedgerow will be identified by the project ecologist, prior to construction. New hedgerow will adjoin existing hedgerow or tree lines. Native species will be replanted within the proposed new hedgerows. A list of potential species is presented in Table 1 below. The reinstated hedgerow will be planted towards the end of the construction phase (see also Ecological Management Plan).

Table 1: List of species which may be used for new hedgerows

Common name	Latin name
Ash	*Fraxinus excelsior*
Bay Willow	*Salix pentandra*
Black Alder	*Alnus glutinosa*
Blackthorn/Sloe	*Prunus spinosa*
Crab apple	*Malus sylvestris*
Common/Wild Cherry	*Prunus avium*
Downey Birch	*Betula pubescens*
Goat Willow	*Salix caprea*
Grey Willow	*Salix atrocinerea*
Hawthorn	*Crataegus monogyna*
Mountain Ash/Rowan	*Sorbus aucuparia*
Pedunculate Oak	*Quercus robur*
Sessile Oak	*Quercus petraea*
Wych Elm	*Ulmus glabra*
Yew	*Taxus baccata*

3.2 REINSTATEMENT OF KEYHOLE FELLED CONIFER PLANTATON

Areas of existing conifer plantation will require permanent felling, in order to accommodate wind farm infrastructure and the erection of turbines. A portion of these felled areas will not be required to accommodate the elements of wind farm infrastructure and will be allowed to naturally regenerate and be managed for nature conservation purposes. This regeneration will take place post construction. In the event that the natural establishment of vegetation is slow, it is proposed to harvest seeds from purple-moor grass (*Molinia caerulea*) and other suitable species from a suitable location outside the site, and plant them within the bare felled areas. Similarly, areas of acid and wet grassland and bog will be allowed to re-vegetate naturally (see also Ecological Management Plan).

3.3 REINSTATEMENT OF BORROW PITS

Borrow pits will be re-instated post construction. Borrow pits will be backfilled and covered with topsoil and reseeded. The finished levels will follow the natural contours of the ground to prevent ponding and maintain the natural surface water flow. Depressions will be avoided to ensure surface water ponding does not occur. The re-instatement of the borrow pits is described in more detail in the Construction Environmental Management Plan, See EMP 13 Reinstatement of Borrow Pits. The Construction Environmental Management Plan also accompanies this reply to the further information request.

Similarly, site compounds will be re-instated post construction and are not considered here further. Please refer to the Construction Environmental Management Plan for further detail on the re-instatement of site compounds.

4 MONITORING OF REINSTATED AREAS

4.1 POST CONSTRUCTION

This is addressed in detail in the Ecological Management plan. Post construction restoration and reinstatement works will be monitored during years 1, 2, 3 and 5. At the end of the 5-year vegetation monitoring, the data will be analysed and long-term monitoring or management will be proposed, if necessary. Please refer to the Ecological Management Plan for more detail.

4.2 POST DECOMMISSIONING

Monitoring of the reinstated areas will be undertaken following the completion of decommissioning works to confirm the successful reinstatement of the vegetation, the turbine foundation and hardstand areas and possibly the access tracks. A monitoring period, of two years, will allow for the observation of the re-establishment of the flora. This will ensure remedial action is taken as necessary, which may include further re-seeding as required.

5 INFORMATION TO THE LANDOWNER

The landowner will be consulted prior to commencement of the Decommissioning and Reinstatement Programme to discuss the following;

- location and details of buried infrastructure including buried foundations and cables;
- access tracks – upgraded agricultural tracks; and
- seeding of lands and agreement on the seed mix.

6 ESTIMATED COSTS OF DECOMMISSIONING AND REINSTATEMENT

The estimated costs are outlined in the table below. The costs present the civil engineering and reinstatement costs and also the value associated with the materials recovered. The economics below are presented per turbine. The cost for decommission per turbine has been calculated at €10,025. These figures have been verified by a Chartered Quantity Surveyor (See Appendix A).

REFERENCE DOCUMENTS

Decommissioning cost per Turbine (in current €)	Description	Number	Rate	Cost	Value
				Decommission	Salvage / Scrap
Removal of Blades	Manhours	50	50	€2,500.00	
	Crane (60T)	15	100	€1,500.00	
Disposal of fibreglass	15 Tonne	15	100	€1,500.00	
Scrap Value	2.5 Tonne Steel	2.5	200		-€500.00
Removal of Nacelle	Manhours	70	50	€3,500.00	
	Crane (500T)	15	900	€13,500.00	
Disposal of oil	5 Tonne	15	100	€1,500.00	
Scrap Value	40 Tonne Steel	40	200		-€8,000.00
Scrap Value	10 Tonne Copper	10	3000		-€30,000.00
Scrap Value	0.5 Tonne Aluminium	0.5	650		-€325.00
Removal of Tower	Manhours	60	50	€3,000.00	
	Crane (500T)	10	900	€9,000.00	
Breaking up and removal of Concrete to approval facility (Item)		1	18175	€18,175.00	
Reinstate Area upon Completion (Imported Soil / seeding etc)(Item)		1	6950	€6,950.00	
Scrap Value	70 Tonne Steel	70	200		-€14,000.00
Scrap Value	0.5 Tonne Copper	0.5	3000		-€1,500.00
Scrap Value	1.5 Tonne Aluminium	1.5	650		-€975.00
Scrap Value	4 Tonne Steel	4	200		-€800.00
Sundry reinstatement costs and monitoring programme		1	5000	€5,000.00	
	Totals			**€66,125.00**	**-€56,100.00**

APPENDIX A

Chartered Quantity Surveyor

Tim Murphy Chartered Surveyors

Tim Murphy Chartered Surveyors
Quantity Surveyors / Project Managers / Conservation Surveyors / Insurance Loss Assessors
First Floor | Kealgorm House | Limerick Road | Castleisland I Co Kerry
Tel: 066 7143640 I Mob: 087 2077131 | Fax: 066 7143660
tmqs@eircom.net

22nd November 2013

FAO Monica Kane,
Malachy Walsh & Partners,
Consulting Engineers,
Reen Point,
Blenerville,
Tralee,
Co. Kerry.

REF: DECOMMISSIONING COSTS OF WIND TURBINES & RESTORATION OF AREA UPON COMPLETION – PROPOSED UPPERCHURCH WIND FARM, CO. TIPPERARY.

Dear Monica,

I refer to the above and wish to confirm that I have completed an estimate to reflect the cost of disassembling each turbine, reinstating the ground upon completion while also taking account of the Salvage Value of the dismantled material. The rates used are current as of November 2013.

Turbine Decommissioning Cost per Turbine (As Per Attached Sheet)	€ 66,125.00
Total Salvage Value of Materials per Turbine (As Per Attached Sheet)	€ 56,100.00
Total "Decommissioning" Cost of Turbine (1nr)	**€ 10,025.00**

Please also find a copy of my Professional Qualification Certificates and a copy of my Professional Indemnity Insurance Policy.

Yours Sincerely,

____

Tim Murphy
MSCSI, MRICS, McInstCES
Chartered Quantity Surveyor
Chartered Civil Engineering Surveyor

Decommissioning cost per Turbine (in current €)	Description	Number	Rate	Cost	Value
				Decommission	Salvage / Scrap
Removal of Blades	Manhours	50	50	€2,500.00	
	Crane (60T)	15	100	€1,500.00	
Disposal of fibreglass	15 Tonne	15	100	€1,500.00	
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Removal of Nacelle	Manhours	70	50	€3,500.00	
	Crane (500T)	15	900	€13,500.00	
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Scrap Value	40 Tonne Steel	40	200		-€8,000.00
Scrap Value	10 Tonne Copper	10	3000		-€30,000.00
Scrap Value	0.5 Tonne Aluminium	0.5	650		-€325.00
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	Crane (500T)	10	900	€9,000.00	
Breaking up and removal of Concrete to approval facility (Item)		1	18175	€18,175.00	
Reinstate Area upon Completion (Imported Soil / seeding etc)(Item)		1	6950	€6,950.00	
Scrap Value	70 Tonne Steel	70	200		-€14,000.00
Scrap Value	0.5 Tonne Copper	0.5	3000		-€1,500.00
Scrap Value	1.5 Tonne Aluminium	1.5	650		-€975.00
Scrap Value	4 Tonne Steel	4	200		-€800.00
Sundry reinstatement costs and monitoring programme		1	5000	€5,000.00	
	Totals			**€66,125.00**	**-€56,100.00**

HERIOT-WATT UNIVERSITY

Regional Technical College, Limerick

We, the undersigned Principal and Vice-Chancellor of the University, the Secretary of the University and the Principal of Regional Technical College, Limerick, certify that

Timothy Martin Murphy

has duly completed an approved course of study in Regional Technical College, Limerick and satisfied the examiners and, by resolution of the Senate of the University, been awarded

the degree of

Bachelor of Science in Quantity Surveying

and is entitled to all the academic privileges attendant thereto.

In witness whereof this certificate is sealed with the Common Seal of the University on the Fourteenth day of July 1994.

Alistair G.J. MacFarlane — *Principal and Vice-Chancellor*

Peter L Wilson — *Secretary of the University*

James P. MacDonagh — *Principal of Regional Technical College, Limerick*

The Society of Chartered Surveyors

This is to certify that

Tim Murphy

Register number

2411A

is elected as an Associate

of

The Society of Chartered Surveyors

06/02/2008

Date elected

Chairman, Education Board

President, Society of Chartered Surveyors

This Diploma is held from year to year subject to the provisions of the Bye-Laws of the Society

REFERENCE DOCUMENTS

ROYAL INSTITUTION OF CHARTERED SURVEYORS

Tim Murphy

WAS ELECTED A PROFESSIONAL MEMBER OF THE

ROYAL INSTITUTION OF CHARTERED SURVEYORS

17 April 2009

Peter Goodacre

PRESIDENT OF THE ROYAL INSTITUTION OF CHARTERED SURVEYORS

MEMBERSHIP NO. *0834957*

THIS DIPLOMA IS HELD FROM YEAR TO YEAR SUBJECT TO THE PROVISIONS OF THE BYE-LAWS OF THE INSTITUTION

chartered
ICES

This is to certify that

Tim Murphy

was elected

Member

of the Chartered Institution of
Civil Engineering Surveyors

on

16 May 2013

and is entitled to use the designation

MCInstCES

Chief Executive Officer:

President:

Membership No: 2113413

Chartered Institution of CIVIL ENGINEERING SURVEYORS
Dominion House, Sibson Road, Sale, Cheshire M33 7PP United Kingdom

REFERENCE DOCUMENTS

Certificate of Registration

Quantity Surveyor

2012

Section 33(6) of the Building Control Act 2007 states that a registration certificate must be displayed at the place where a quantity surveyor practices quantity surveying at all times during which his or her registration continues, but not otherwise.

Tim Murphy

HAS BEEN ENTERED IN THE REGISTER FOR QUANTITY SURVEYORS UNDER THE

BUILDING CONTROL ACT 2007

Q0266

REGISTRATION NUMBER

Ciara Murphy

REGISTRAR

The Society of Chartered Surveyors Ireland, 38 Merrion Square, Dublin 2
e registration@scsi.ie w www.scsi.ie/register t +353 (0)1 644 5500

XL Group
Insurance
Reinsurance

XL INSURANCE COMPANY LIMITED

SURVEYORS / VALUERS / AUCTIONEERS / ESTATE AGENTS PROFESSIONAL INDEMNITY POLICY

SCHEDULE

NAMED INSURED:	Tim Murphy Chartered Surveyors Limited and Tim Murphy & Company
ADDRESS:	First Floor Kealgorm House Limerick Road Castleisland Co. Kerry
PROFESSIONAL SERVICES:	Quantity Surveying, Project Management, Project Co-Ordination, Planning Consultancy, Insurance Agency Work, and Valuation Work
POLICY NUMBER:	IE00014789EO12A
POLICY PERIOD:	14 December 2012 – 13 December 2013
LIMIT OF LIABILITY:	€2,000,000 Any One Claim
EXCESS:	€2,500 Each and Every Claim
PREMIUM:	€2,625.00 Inclusive of Government Levy
RETROACTIVE DATE:	Not Applicable
ENDORSEMENTS:	Not Applicable

IN WITNESS WHEREOF this Policy has been signed as follows:

100% XL Insurance Company Limited (Irish Branch)

Signed in Dublin on 18 December 2012

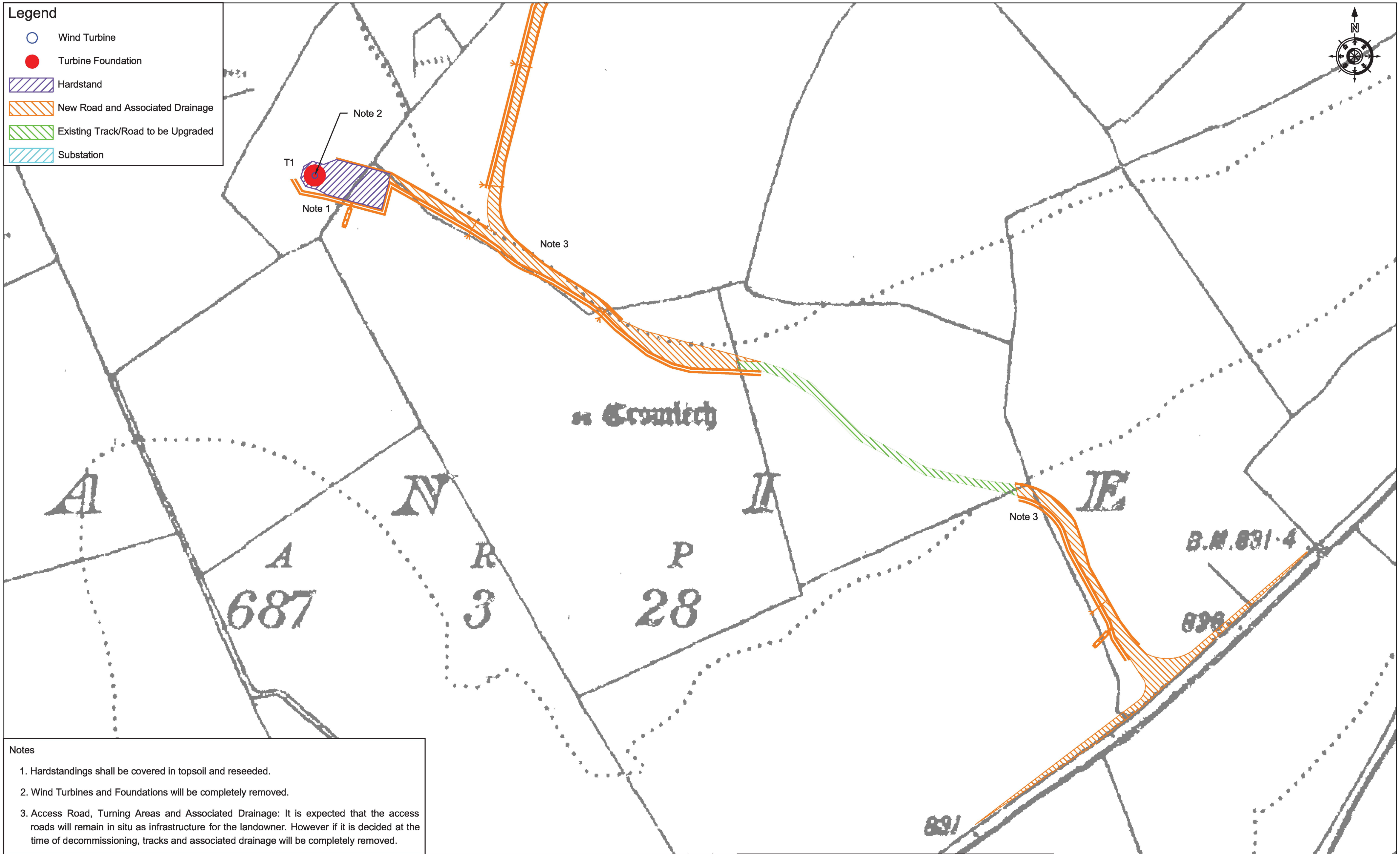
Neil O' Brien

For and on behalf of XL Insurance Company Limited

APPENDIX B

Drawings

REFERENCE DOCUMENTS



Notes

1. Hardstandings shall be covered in topsoil and reseeded.
2. Wind Turbines and Foundations will be completely removed.
3. Access Road, Turning Areas and Associated Drainage: It is expected that the access roads will remain in situ as infrastructure for the landowner. However if it is decided at the time of decommissioning, tracks and associated drainage will be completely removed.

Notes

Please see main body of report for more detail on the notes above.

Please see Construction Environmental Management Plan for details of reinstatement of Borrow Pits and Site Compounds.

Rev.	Date	Description	by	ch'd	app
A	22.11.13	Issued For Information	JK	PB	PB

Client: Ecopower Developments Ltd

Project: Upperchurch Wind Farm

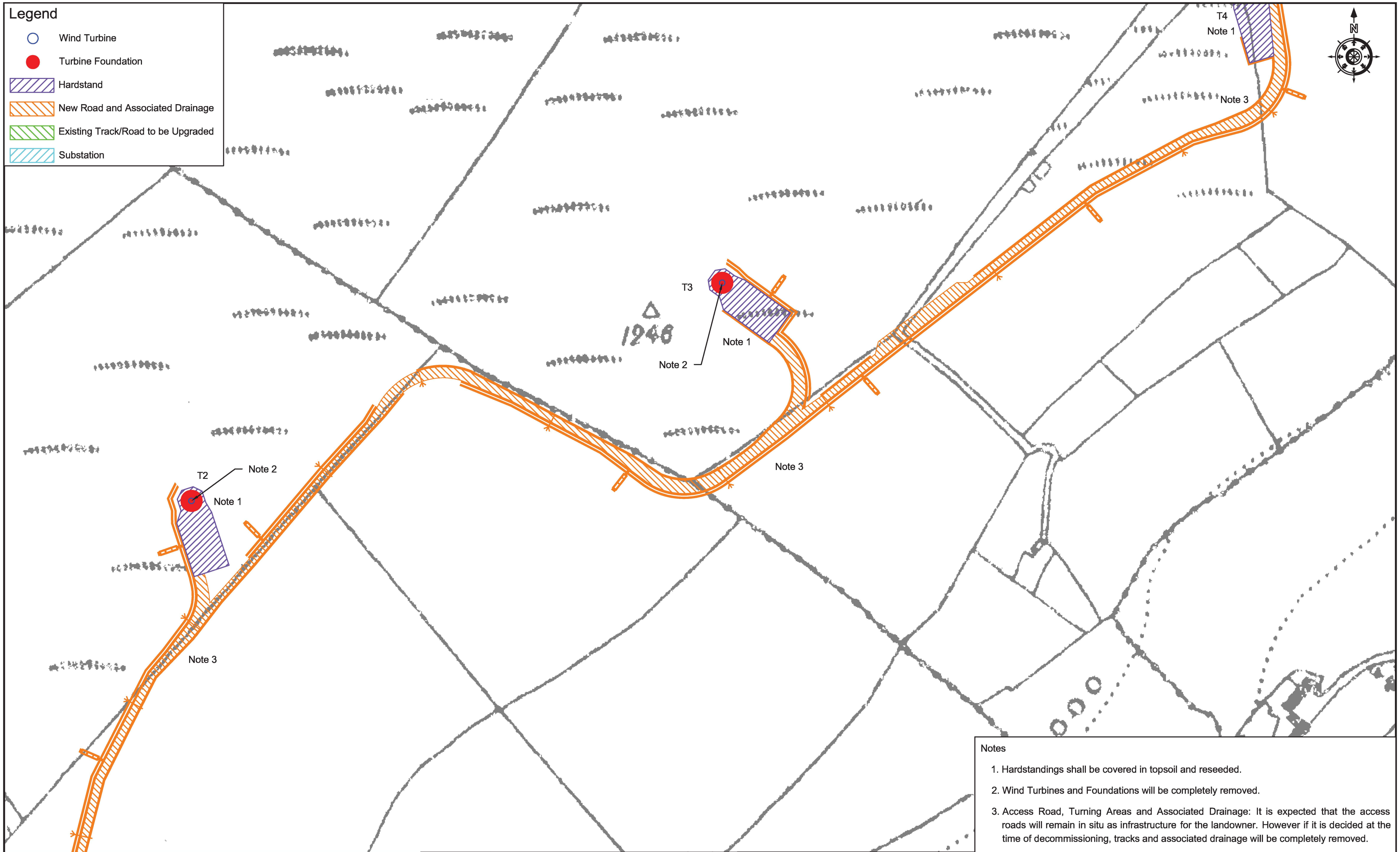
Title: Restoration Plan Sheet 1 of 12

Malachy Walsh and Partners
Consulting Engineers
Cork | Tralee | London | Limerick

Scales (A3)	1:2,500	
Drawn	JK	21.11.13
Checked	PB	21.11.13

Drg. No. 15388-1001

Rev. A



REFERENCE DOCUMENTS

Notes

1. Hardstandings shall be covered in topsoil and reseeded.
2. Wind Turbines and Foundations will be completely removed.
3. Access Road, Turning Areas and Associated Drainage: It is expected that the access roads will remain in situ as infrastructure for the landowner. However if it is decided at the time of decommissioning, tracks and associated drainage will be completely removed.

Notes

Please see main body of report for more detail on the notes above.

Please see Construction Environmental Management Plan for details of reinstatement of Borrow Pits and Site Compounds.

Rev.	Date	Description	by	ch'd	app
A	22.11.13	Issued For Information	JK	PB	PB

Client: Ecopower Developments Ltd

Project: Upperchurch Wind Farm

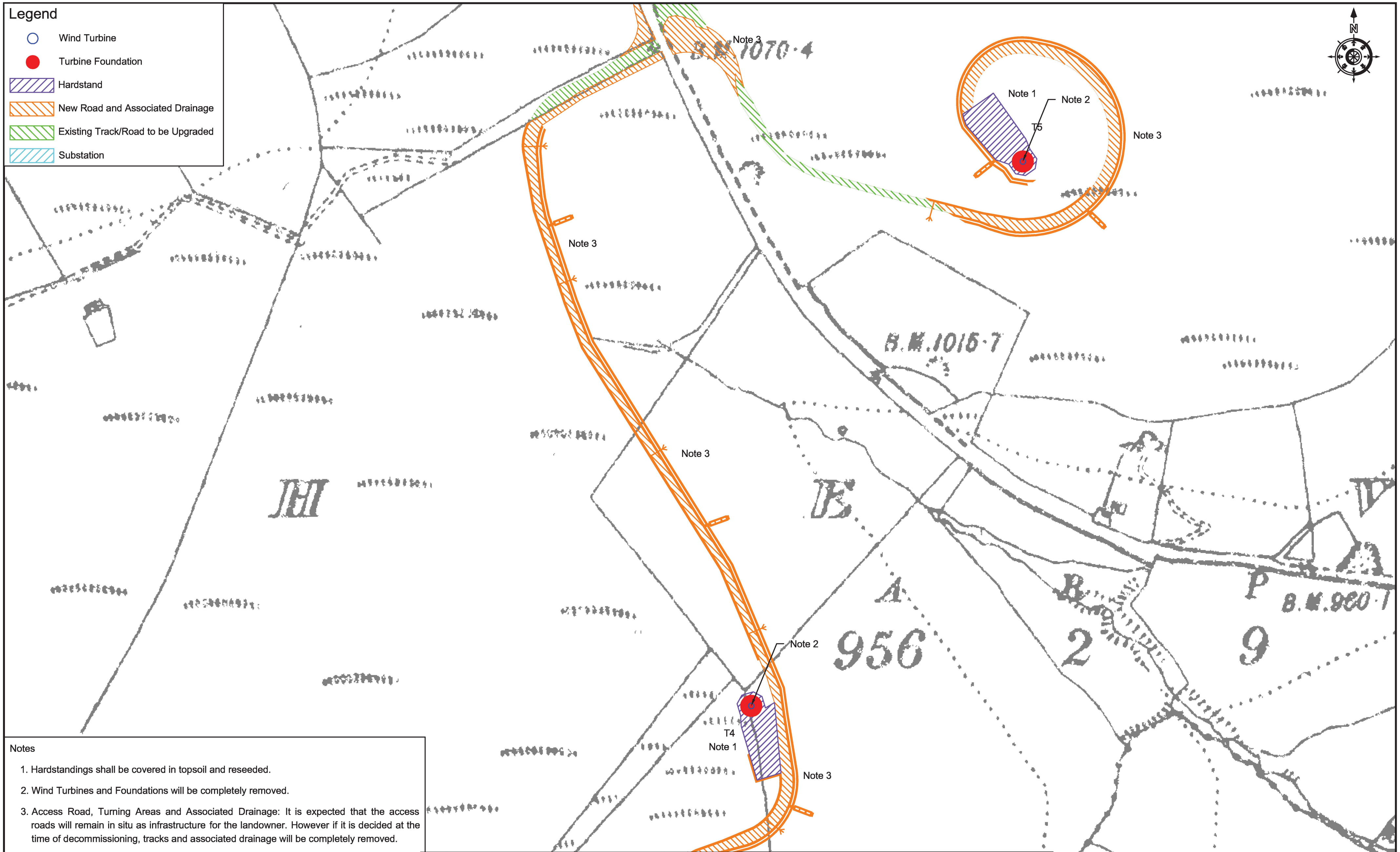
Title: Restoration Plan
Sheet 2 of 12

Malachy Walsh and Partners
Consulting Engineers
Cork | Tralee | London | Limerick

Scales (A3)	1:2,500	
Drawn	JK	21.11.13
Checked	PB	21.11.13

Drg. No. 15388 - 1002

Rev. A



Notes

1. Hardstandings shall be covered in topsoil and reseeded.
2. Wind Turbines and Foundations will be completely removed.
3. Access Road, Turning Areas and Associated Drainage: It is expected that the access roads will remain in situ as infrastructure for the landowner. However if it is decided at the time of decommissioning, tracks and associated drainage will be completely removed.

Notes

Please see main body of report for more detail on the notes above.

Please see Construction Environmental Management Plan for details of reinstatement of Borrow Pits and Site Compounds.

Rev.	Date	Description	by	ch'd	app
A	22.11.13	Issued For Information	JK	PB	PB

Client: Ecopower Developments Ltd

Project: Upperchurch Wind Farm

Title: Restoration Plan
Sheet 3 of 12

Malachy Walsh and Partners
Consulting Engineers
Cork | Tralee | London | Limerick

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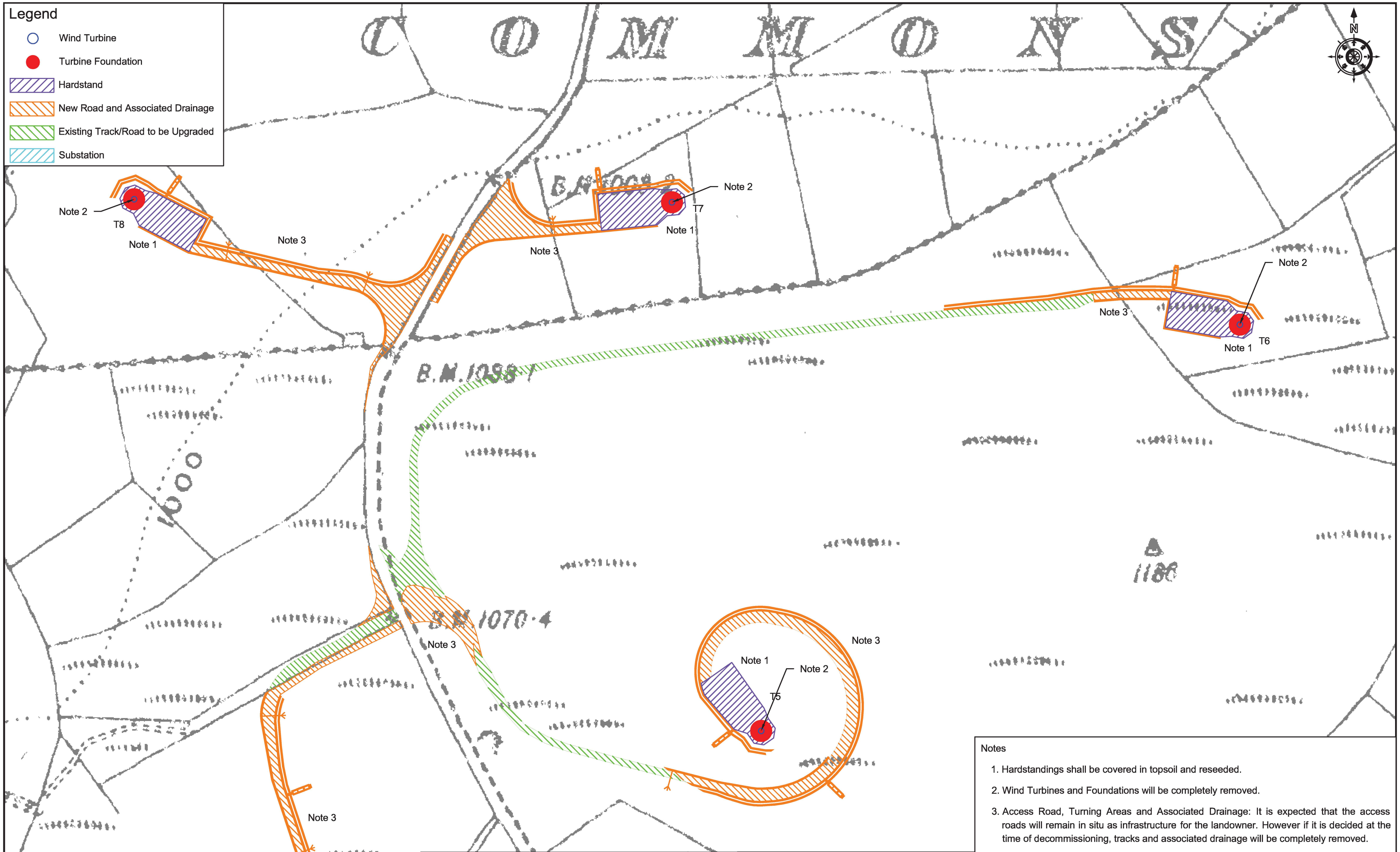
Checked	PB	21.11.13

Drg. No. 15388 - 1003

Rev. A



Notes

1. Hardstandings shall be covered in topsoil and reseeded.
2. Wind Turbines and Foundations will be completely removed.
3. Access Road, Turning Areas and Associated Drainage: It is expected that the access roads will remain in situ as infrastructure for the landowner. However if it is decided at the time of decommissioning, tracks and associated drainage will be completely removed.

Notes

Please see main body of report for more detail on the notes above.

Please see Construction Environmental Management Plan for details of reinstatement of Borrow Pits and Site Compounds.

Rev.	Date	Description	by	ch'd	app
A	22.11.13	Issued For Information	JK	PB	PB

Client: Ecopower Developments Ltd

Project: Upperchurch Wind Farm

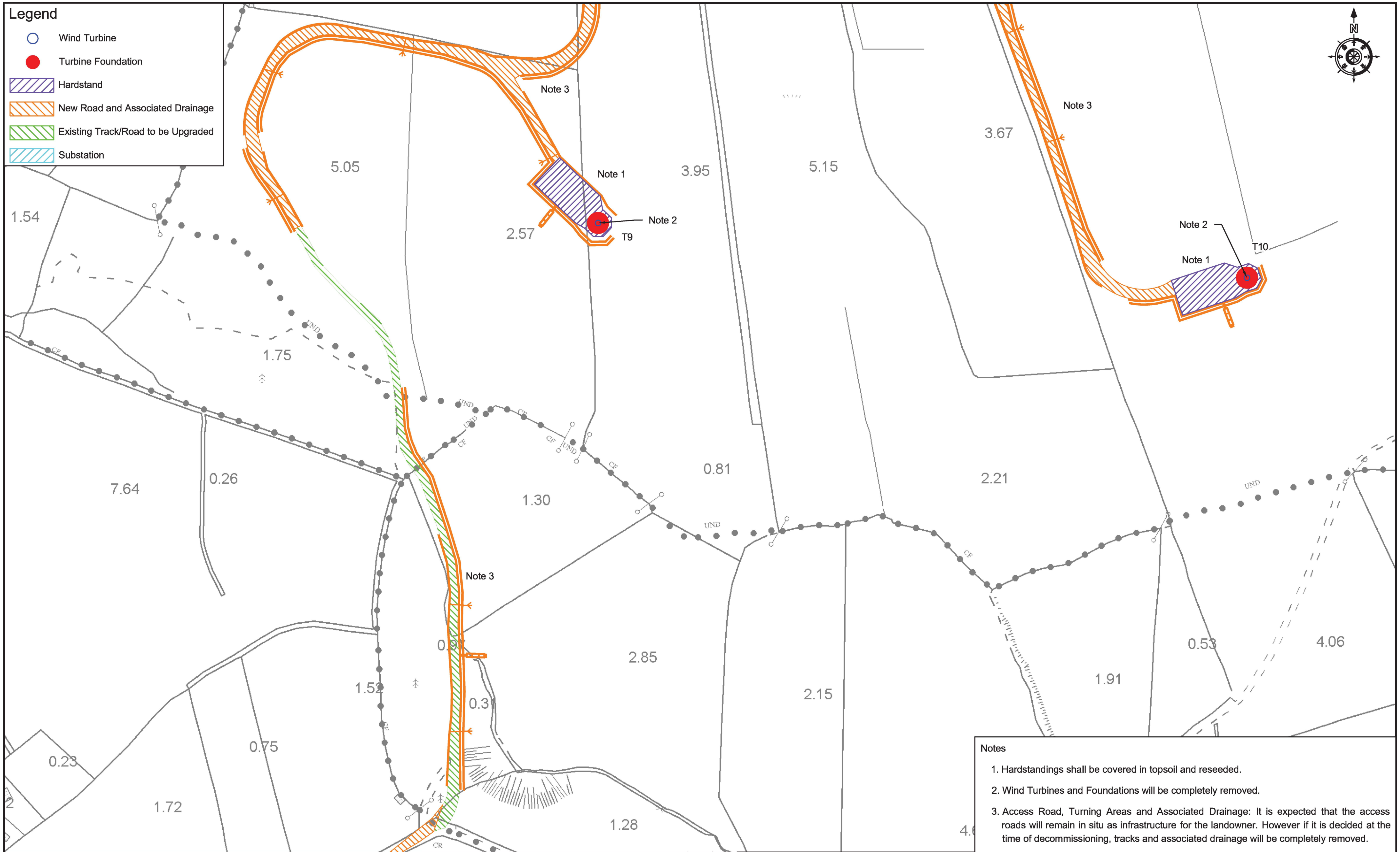
Title: Restoration Plan
Sheet 4 of 12

Malachy Walsh and Partners
Consulting Engineers
Cork | Tralee | London | Limerick

Scales (A3)	1:2,500	
Drawn	JK	21.11.13
Checked	PB	21.11.13

Drg. No. 15388 - 1004

Rev. A



Notes

1. Hardstandings shall be covered in topsoil and reseeded.
2. Wind Turbines and Foundations will be completely removed.
3. Access Road, Turning Areas and Associated Drainage: It is expected that the access roads will remain in situ as infrastructure for the landowner. However if it is decided at the time of decommissioning, tracks and associated drainage will be completely removed.

Notes

Please see main body of report for more detail on the notes above.

Please see Construction Environmental Management Plan for details of reinstatement of Borrow Pits and Site Compounds.

Rev.	Date	Description	by	ch'd	app
A	22.11.13	Issued For Information	JK	PB	PB

Client: Ecopower Developments Ltd

Project: Upperchurch Wind Farm

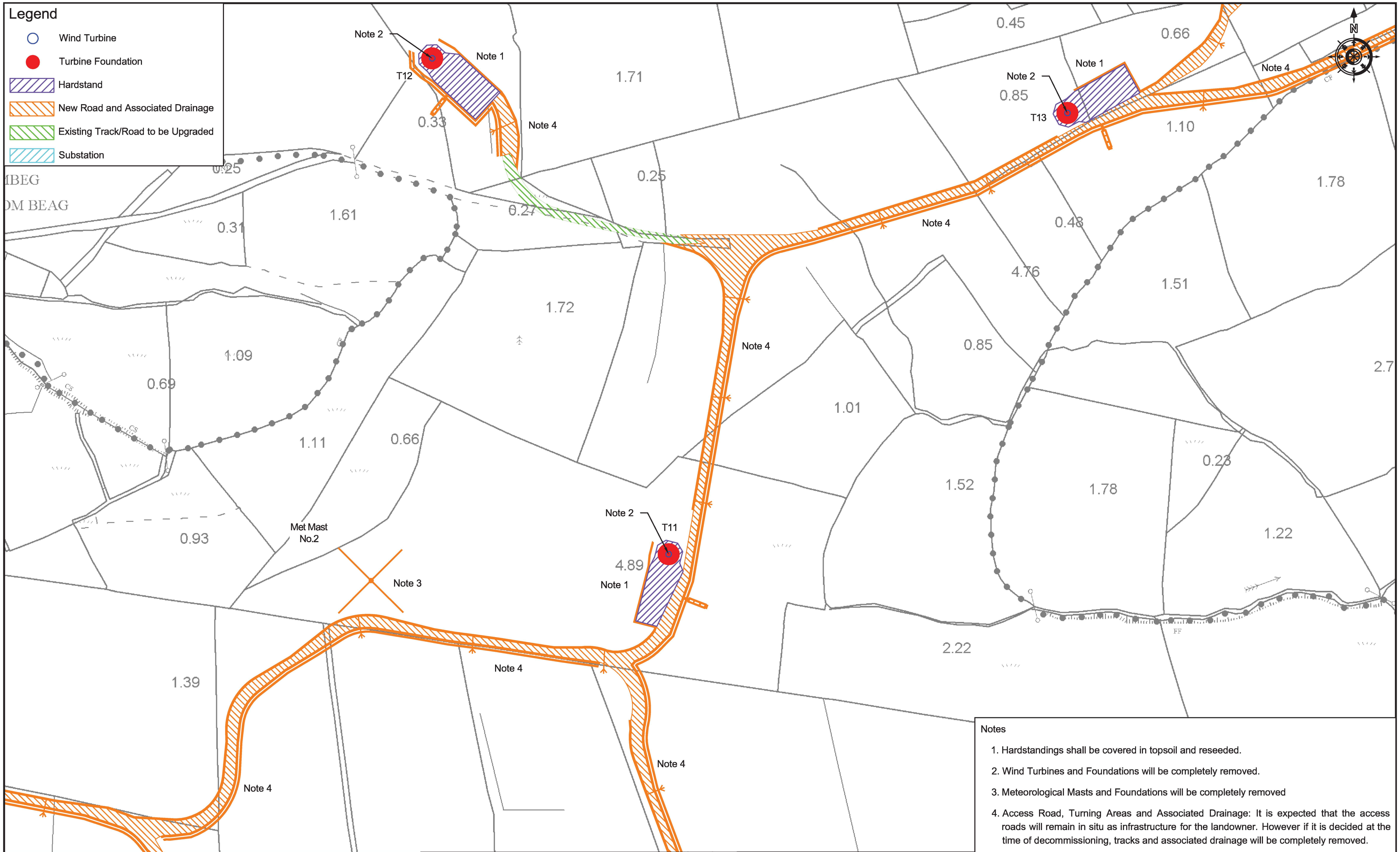
Title: Restoration Plan Sheet 5 of 12

Malachy Walsh and Partners
Consulting Engineers
Cork | Tralee | London | Limerick

Scales (A3)	1:2,500	
Drawn	JK	21.11.13
Checked	PB	21.11.13

Drg. No. 15388-1005

Rev. A



Notes

1. Hardstandings shall be covered in topsoil and reseeded.
2. Wind Turbines and Foundations will be completely removed.
3. Meteorological Masts and Foundations will be completely removed
4. Access Road, Turning Areas and Associated Drainage: It is expected that the access roads will remain in situ as infrastructure for the landowner. However if it is decided at the time of decommissioning, tracks and associated drainage will be completely removed.

Notes

Please see main body of report for more detail on the notes above.

Please see Construction Environmental Management Plan for details of reinstatement of Borrow Pits and Site Compounds.

Rev.	Date	Description	by	ch'd	app
A	22.11.13	Issued For Information	JK	PB	PB

Client: Ecopower Developments Ltd

Project: Upperchurch Wind Farm

Title: Restoration Plan
Sheet 6 of 12

Malachy Walsh and Partners
Consulting Engineers
Cork | Tralee | London | Limerick

Scales (A3)	1:2,500	
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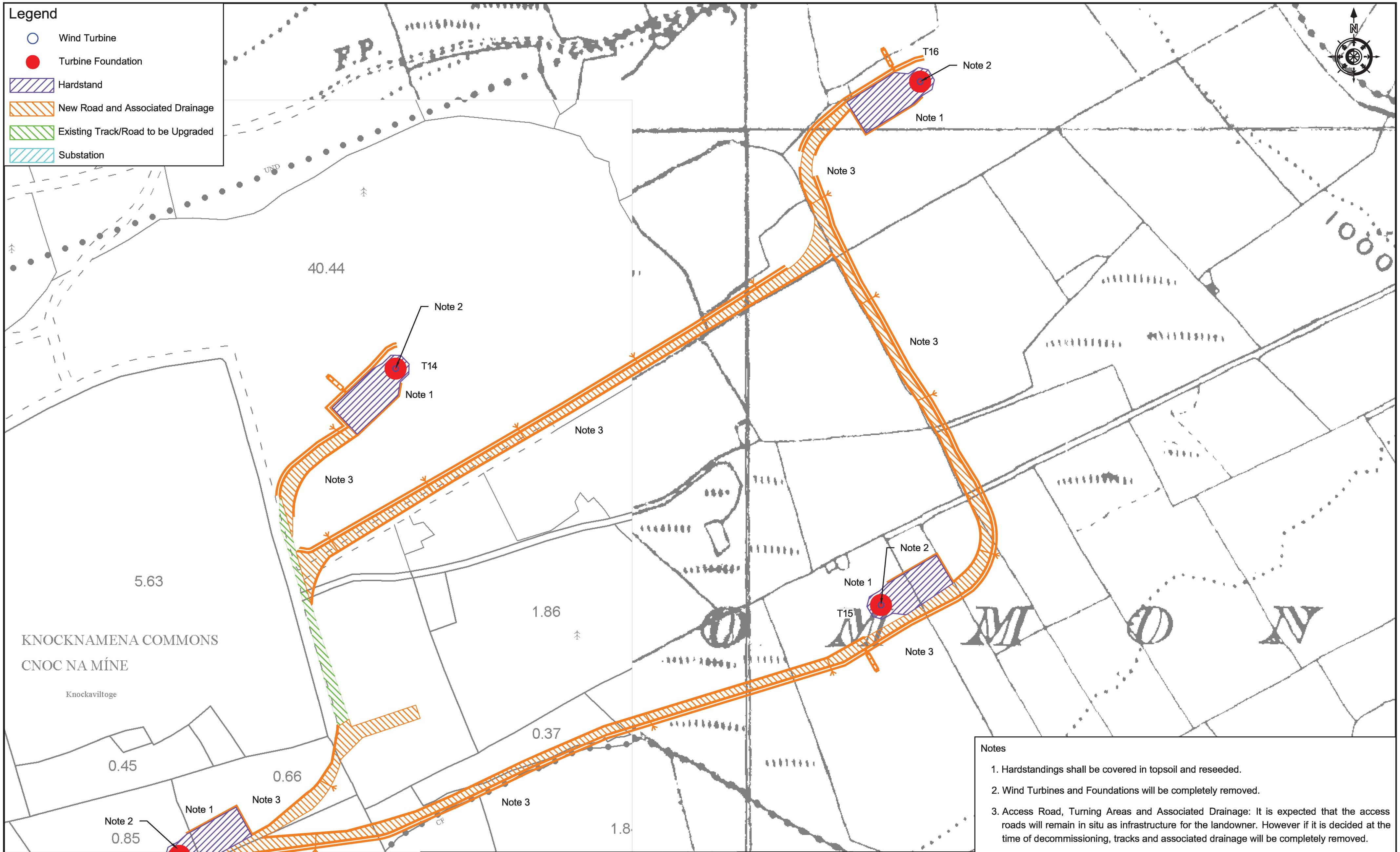
Checked	PB	21.11.13

Drg. No. 15388-1006

Rev. A

REFERENCE DOCUMENTS



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Notes

Please see main body of report for more detail on the notes above.

Please see Construction Environmental Management Plan for details of reinstatement of Borrow Pits and Site Compounds.

Rev.	Date	Description	by	ch'd	app
A	22.11.13	Issued For Information	JK	PB	PB

Client: Ecopower Developments Ltd

Project: Upperchurch Wind Farm

Title: Restoration Plan
Sheet 7 of 12

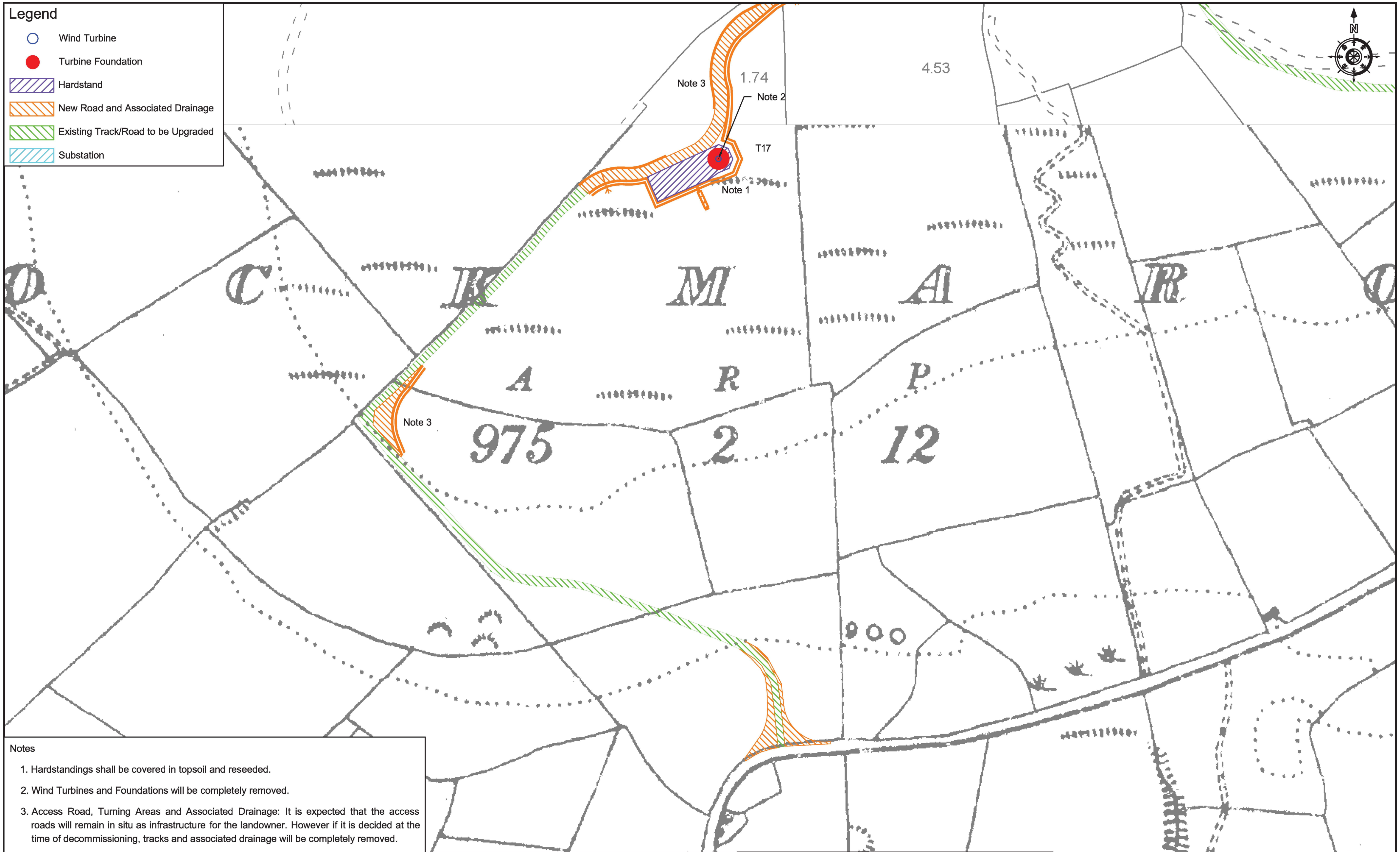
Malachy Walsh and Partners
Consulting Engineers
Cork | Tralee | London | Limerick

Scales (A3)	1:2,500	
Drawn	JK	21.11.13
Checked	PB	21.11.13

Drg. No. 15388 - 1007

Rev. A

REFERENCE DOCUMENTS



Notes

1. Hardstandings shall be covered in topsoil and reseeded.
2. Wind Turbines and Foundations will be completely removed.
3. Access Road, Turning Areas and Associated Drainage: It is expected that the access roads will remain in situ as infrastructure for the landowner. However if it is decided at the time of decommissioning, tracks and associated drainage will be completely removed.

Notes

Please see main body of report for more detail on the notes above.

Please see Construction Environmental Management Plan for details of reinstatement of Borrow Pits and Site Compounds.

Rev.	Date	Description	by	ch'd	app
A	22.11.13	Issued For Information	JK	PB	PB

Client: Ecopower Developments Ltd

Project: Upperchurch Wind Farm

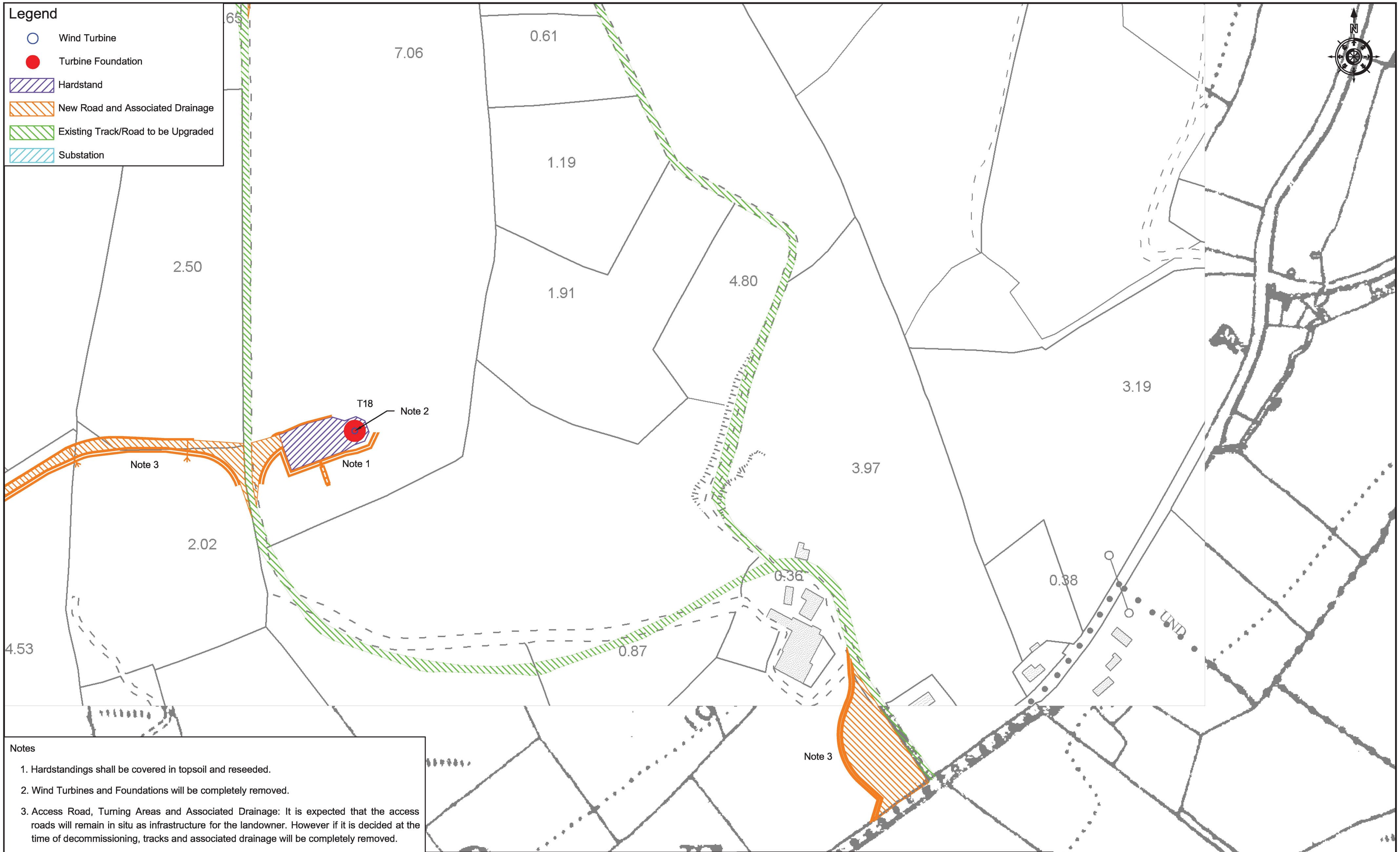
Title: Restoration Plan
Sheet 8 of 12

Malachy Walsh and Partners
Consulting Engineers
Cork | Tralee | London | Limerick

Scales (A3)	1:2,500	
Drawn	JK	21.11.13
Checked	PB	21.11.13

Drg. No. 15388-1008

Rev. A



Notes

1. Hardstandings shall be covered in topsoil and reseeded.
2. Wind Turbines and Foundations will be completely removed.
3. Access Road, Turning Areas and Associated Drainage: It is expected that the access roads will remain in situ as infrastructure for the landowner. However if it is decided at the time of decommissioning, tracks and associated drainage will be completely removed.

Notes

Please see main body of report for more detail on the notes above.

Please see Construction Environmental Management Plan for details of reinstatement of Borrow Pits and Site Compounds.

Rev.	Date	Description	by	ch'd	app
A	22.11.13	Issued For Information	JK	PB	PB

Client: Ecopower Developments Ltd

Project: Upperchurch Wind Farm

Title: Restoration Plan
Sheet 9 of 12

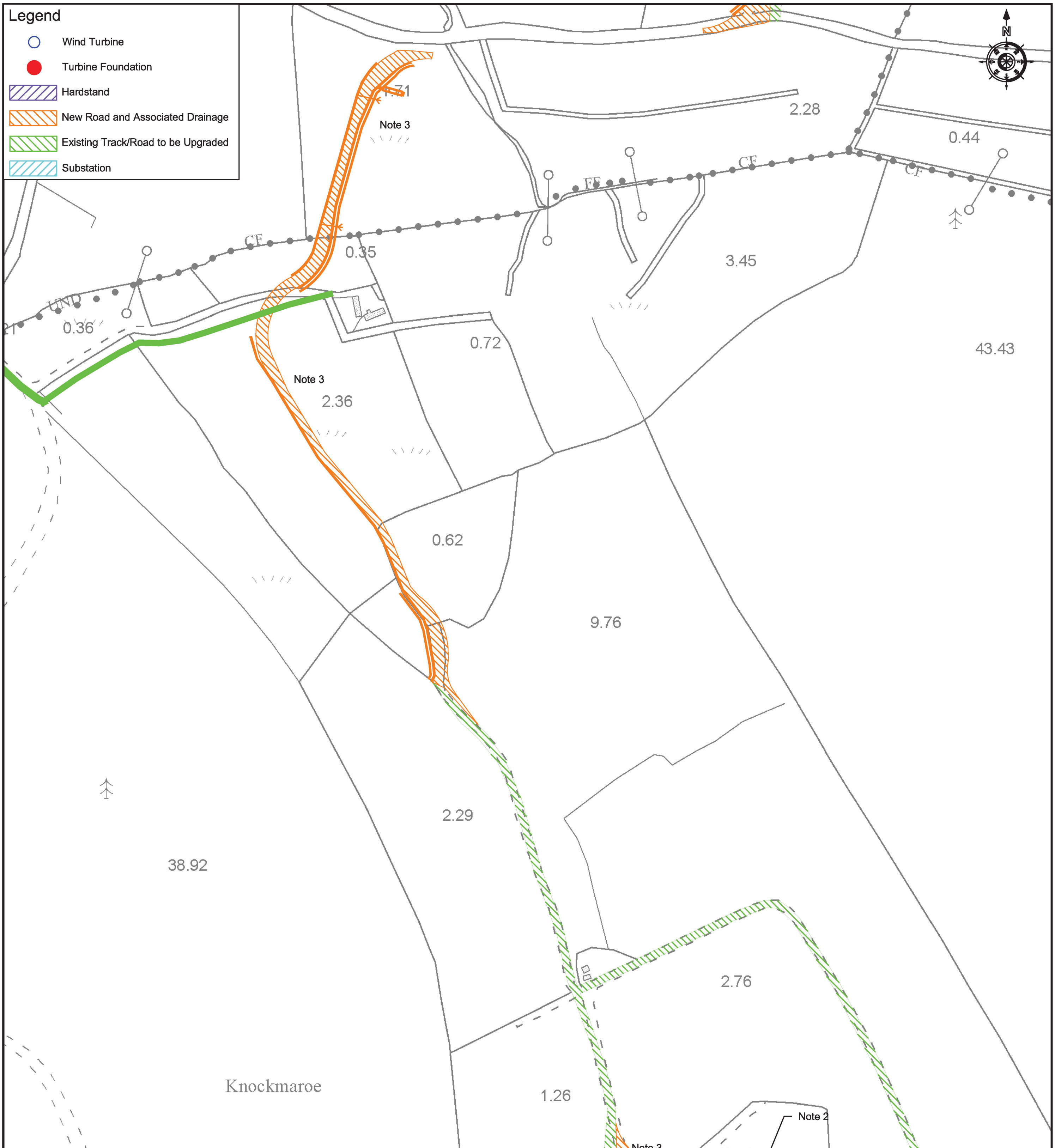
Malachy Walsh and Partners
Consulting Engineers
Cork | Tralee | London | Limerick

Scales (A3)	1:2,500	
Drawn	JK	21.11.13
Checked	PB	21.11.13

Drg. No. 15388 - 1009

Rev. A

REFERENCE DOCUMENTS



Notes

1. Hardstandings shall be covered in topsoil and reseeded.
2. Wind Turbines and Foundations will be completely removed.
3. Access Road, Turning Areas and Associated Drainage: It is expected that the access roads will remain in situ as infrastructure for the landowner. However if it is decided at the time of decommissioning, tracks and associated drainage will be completely removed.

Notes

Please see main body of report for more detail on the notes above.

Please see Construction Environmental Management Plan for details of reinstatement of Borrow Pits and Site Compounds.

Rev.	Date	Description	by	ch'd	app
A	22.11.13	Issued For Information	JK	PB	PB

Client: Ecopower Developments Ltd

Project: Upperchurch Wind Farm

Title: Restoration Plan
Sheet 10 of 12

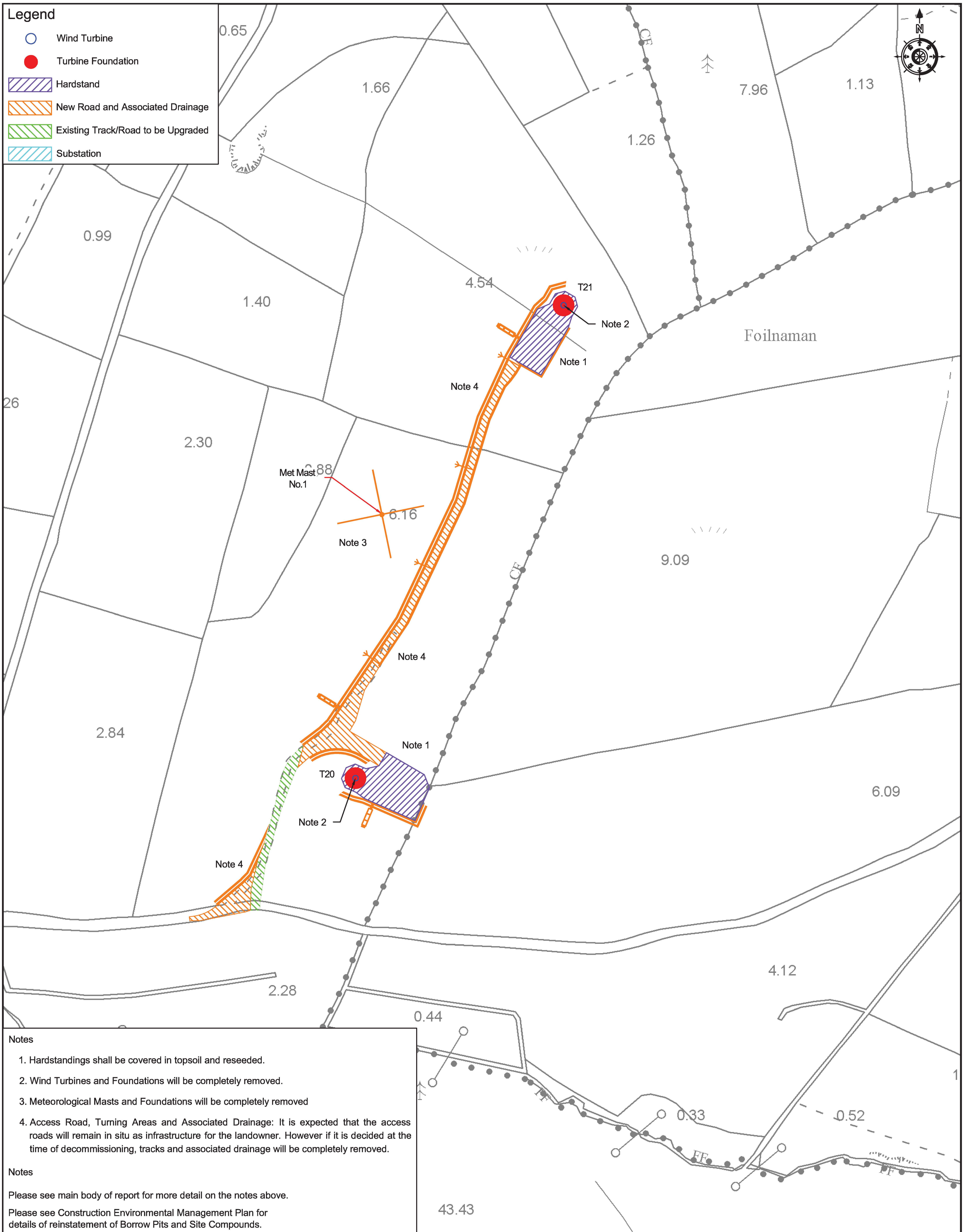
Malachy Walsh and Partners
Consulting Engineers
Cork | Tralee | London | Limerick

Scales (A3)	1:2,500	
Drawn	JK	21.11.13
Checked	PB	21.11.13

Drg. No. 15388-1010

Rev. A

REFERENCE DOCUMENTS



Legend

- Wind Turbine
- Turbine Foundation
- Hardstand
- New Road and Associated Drainage
- Existing Track/Road to be Upgraded
- Substation

Notes

1. Hardstandings shall be covered in topsoil and reseeded.
2. Wind Turbines and Foundations will be completely removed.
3. Meteorological Masts and Foundations will be completely removed
4. Access Road, Turning Areas and Associated Drainage: It is expected that the access roads will remain in situ as infrastructure for the landowner. However if it is decided at the time of decommissioning, tracks and associated drainage will be completely removed.

Notes

Please see main body of report for more detail on the notes above.

Please see Construction Environmental Management Plan for details of reinstatement of Borrow Pits and Site Compounds.

Rev.	Date	Description	by	ch'd	app
A	22.11.13	Issued For Information	JK	PB	PB

Client: Ecopower Developments Ltd

Project: Upperchurch Wind Farm

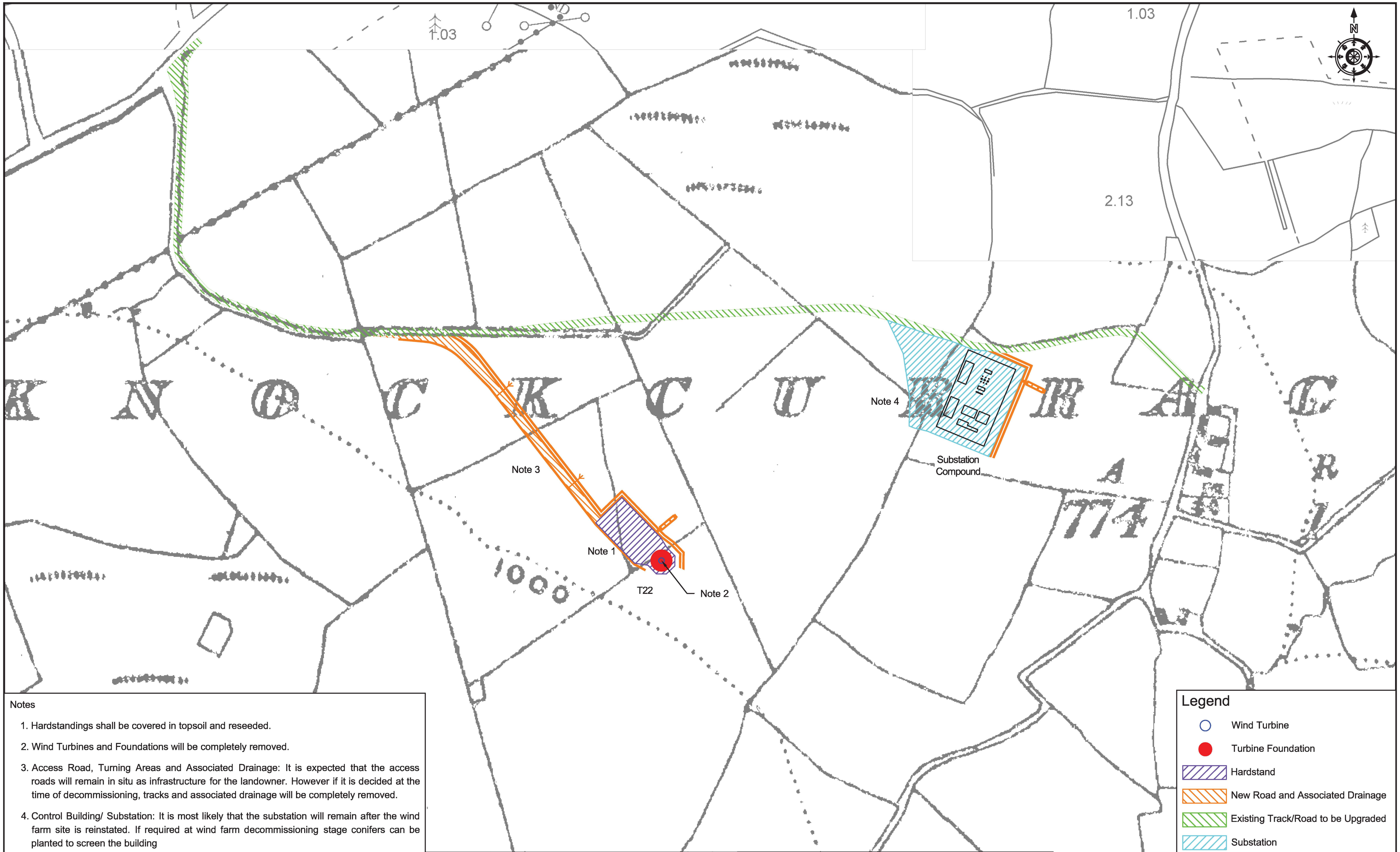
Title: Restoration Plan Sheet 11 of 12

Malachy Walsh and Partners
Consulting Engineers
Cork | Tralee | London | Limerick

Scales (A3)	1:2,500	
Drawn	JK	21.11.13
Checked	PB	21.11.13

Drg. No. 15388-1011

Rev. A



Notes

1. Hardstandings shall be covered in topsoil and reseeded.
2. Wind Turbines and Foundations will be completely removed.
3. Access Road, Turning Areas and Associated Drainage: It is expected that the access roads will remain in situ as infrastructure for the landowner. However if it is decided at the time of decommissioning, tracks and associated drainage will be completely removed.
4. Control Building/ Substation: It is most likely that the substation will remain after the wind farm site is reinstated. If required at wind farm decommissioning stage conifers can be planted to screen the building

Legend

- Wind Turbine
- Turbine Foundation
- Hardstand
- New Road and Associated Drainage
- Existing Track/Road to be Upgraded
- Substation

Notes

Please see main body of report for more detail on the notes above.

Please see Construction Environmental Management Plan for details of reinstatement of Borrow Pits and Site Compounds.

Rev.	Date	Description	by	ch'd	app
A	22.11.13	Issued For Information	JK	PB	PB

Client: Ecopower Developments Ltd

Project: Upperchurch Wind Farm

Title: Restoration Plan Sheet 12 of 12

Malachy Walsh and Partners
Consulting Engineers
Cork | Tralee | London | Limerick

Scales (A3)	1:2,500	
Drawn	JK	21.11.13
Checked	PB	21.11.13

Drg. No. 15388 - 1012

Rev. A

13 /51/0003 – response to RFI dated 28th February, 2013

Q8.*In relation to the proposed site compound please submit the following information:*

(a) design proposals in relation to the proposed site compound i.e. layout drawing: parking area, refuelling area/facilities, offices, sanitary facilities, drinking water supply etc.

(b) proposals (design details) in relation to the provision of sanitary facilities etc. facilitating maintenance personnel over the long term life of the development.

Note*: If it is intended not to provide long term facilities then a statement outlining reasons for same is required.*

The answer to Q.8 follows:

It is proposed to designate 2 No. site compounds during the construction phase of the windfarm.

8(a) Site Compound No. 1 will be the main site compound and is proposed for 170m inside of Site Entrance No. 1 (at Graniera). All construction and deliveries vehicles will access the site at Site Entrance No. 1. All vehicles will be fully clear of the public road before stopping at the compound. The compound will comprise sign-in hut, main site offices, parts storage area, employee/visitor parking, induction office, canteen(including self-contained fresh water tank and waste water tank), drying room, toilet cabin unit (includingself-contained effluent tank and water storage tank), wheel wash area with siltation pondfor wheel wash wastewater andbunded fuel storage area.

Site Compound No. 2 is proposed for an area around an unoccupied house, yard and outhouses, belonging to one of the windfarm landowners, in the centre of the site and 155m east of the windfarm sub-station compound. It is intended as a convenience area in the centre of the site. This smaller compound will comprise car parking and storage for parts. The unoccupied house will be converted to an office space, canteen and toilet facility for the windfarm construction personnel. This house already has water (ground water from a well) and sanitary facilities (septic tank).

See Figures (over).

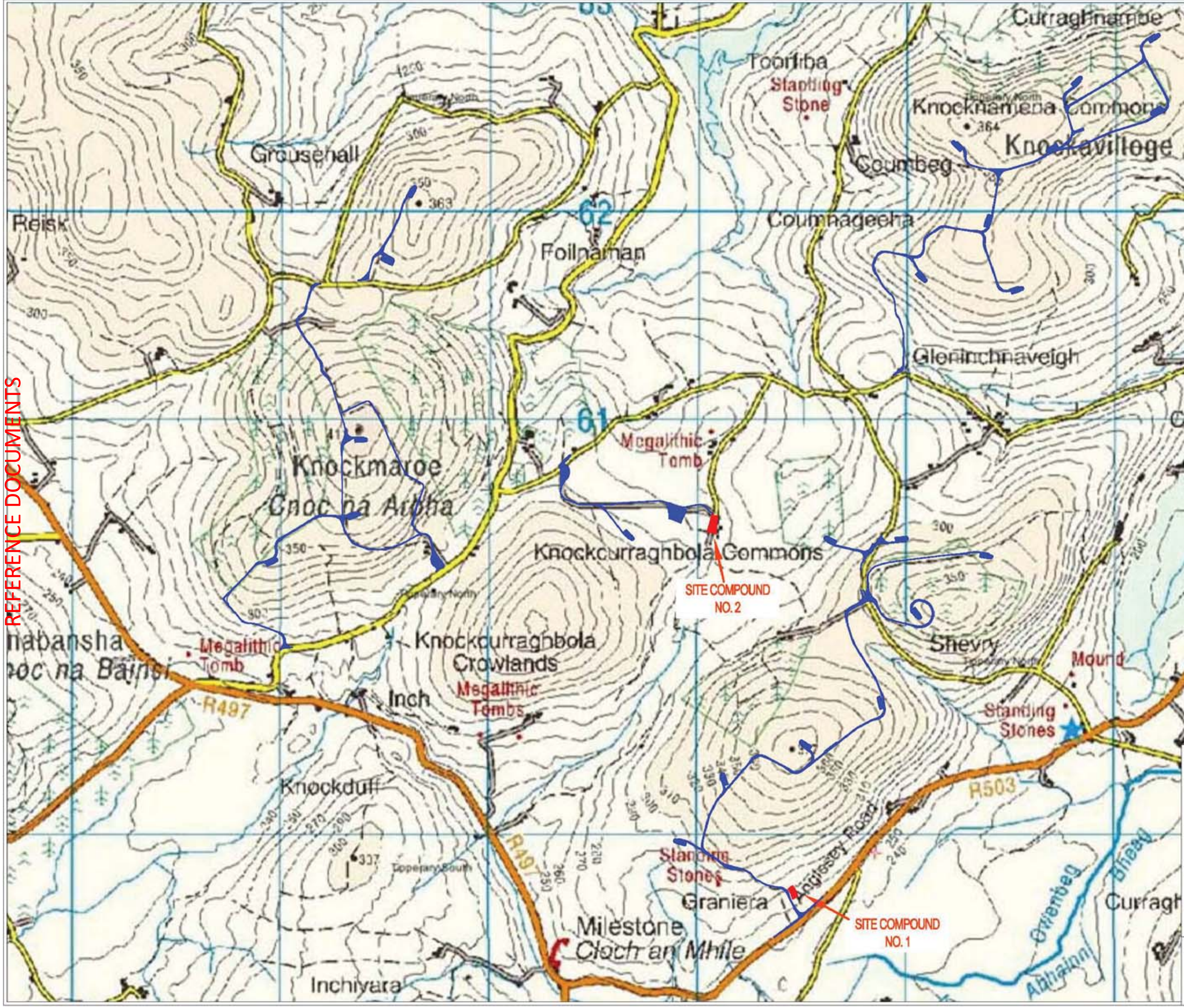
- **Figure 8 (A)** - Location of Site Compounds No. 1 and No. 2 on Discovery mapping
- **Figure 8 (B)** – Site Compound No. 1 Layout (1:500)
- **Figure 8 (C)** – Site Compound No. 2 Layout (1:500)
- **Figure 8 (D)** – Temporary Building elevations and plans (1:100) Sheet 1 of 2
- **Figure 8 (D)** – Temporary Building elevations and plans (1:100) Sheet 2 of 2

Also see Drawings No.s (in the accompanying FI Drawings Pack)

- Drg. No. UWF-PA1RFI – 02 (Site Layout Revision 2 – Sheet 1 of 4) Scale 1:2500
- Drg. No. UWF-PA1RFI – 04 (Site Layout Revision 2 – Sheet 3 of 4) Scale 1:2500
- Drg. No. UWF-PA1RFI – 06 (Site Location Revision 2) Scale 1:10560

8(b) By agreement with the owner of the unoccupied house at Site Compound No. 2 with the car parking area, parts storage area and refurbished house (which includes existing provisions for sanitary facilities) will be retained for use by the maintenance personnel during the operational phase of the development.

Letter of consent from Landowner in **Appendix 8 (E).**

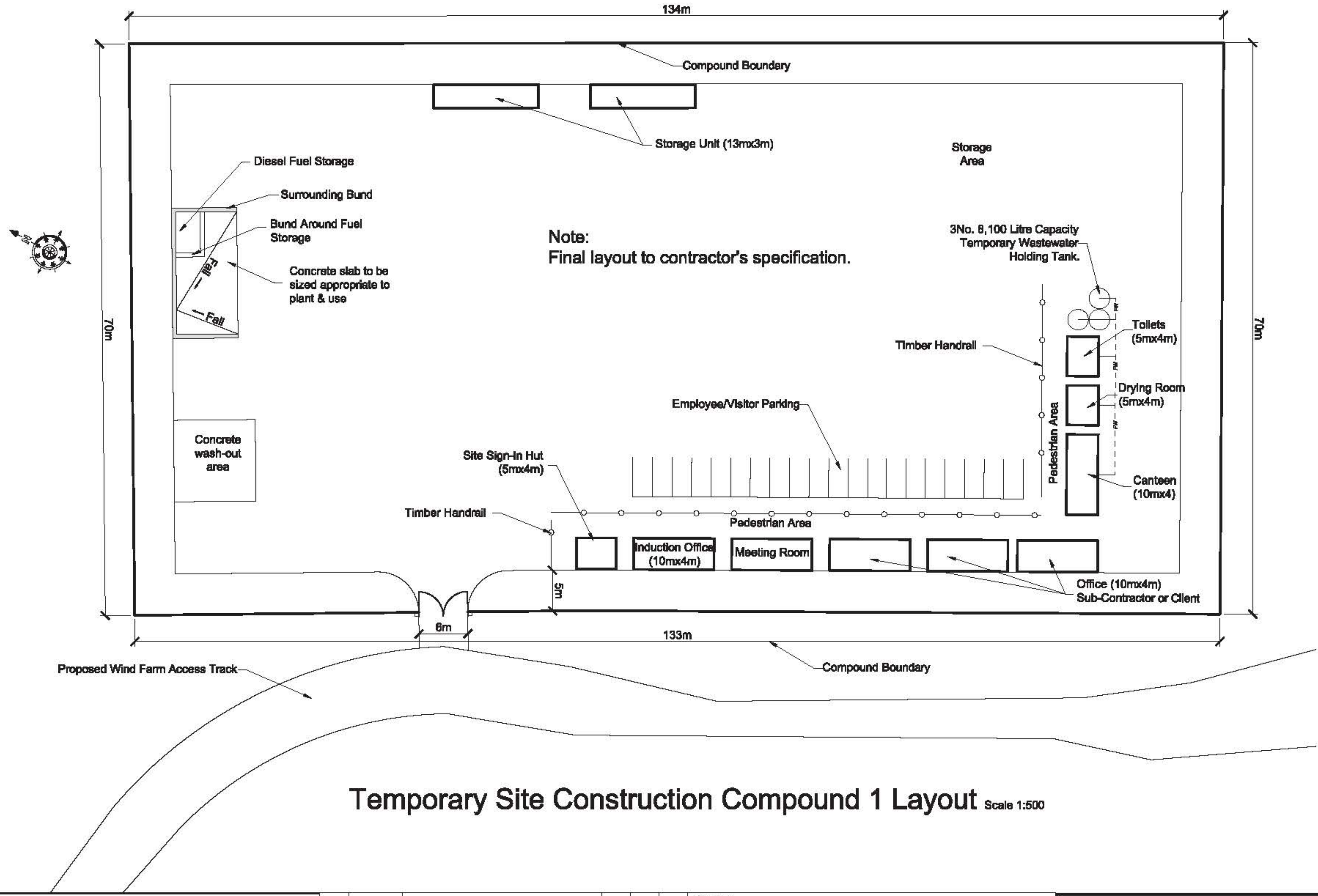


Proposed windfarm roadways shown in blue

Site Compounds shown in red

FIGURE 8 (A)
LOCATION OF SITE COMPOUNDS NO.1 AND NO.2

DRAWN BY: JACK BRETT
ECEOPOWER DEVELOPMENTS LTD
SION ROAD, KILKENNY
TELEPHONE: 056 7750140



Temporary Site Construction Compound 1 Layout
Scale 1:500

Rev.	Date	Description	by	ch'd	app
A	26.11.13	Issued For RFI	JK	TB	TB

Client: Ecopower Developments Ltd

Project: Upperchurch Wind Farm

Title: Proposed Site Compound 1 Layout

Malachy Walsh and Partners
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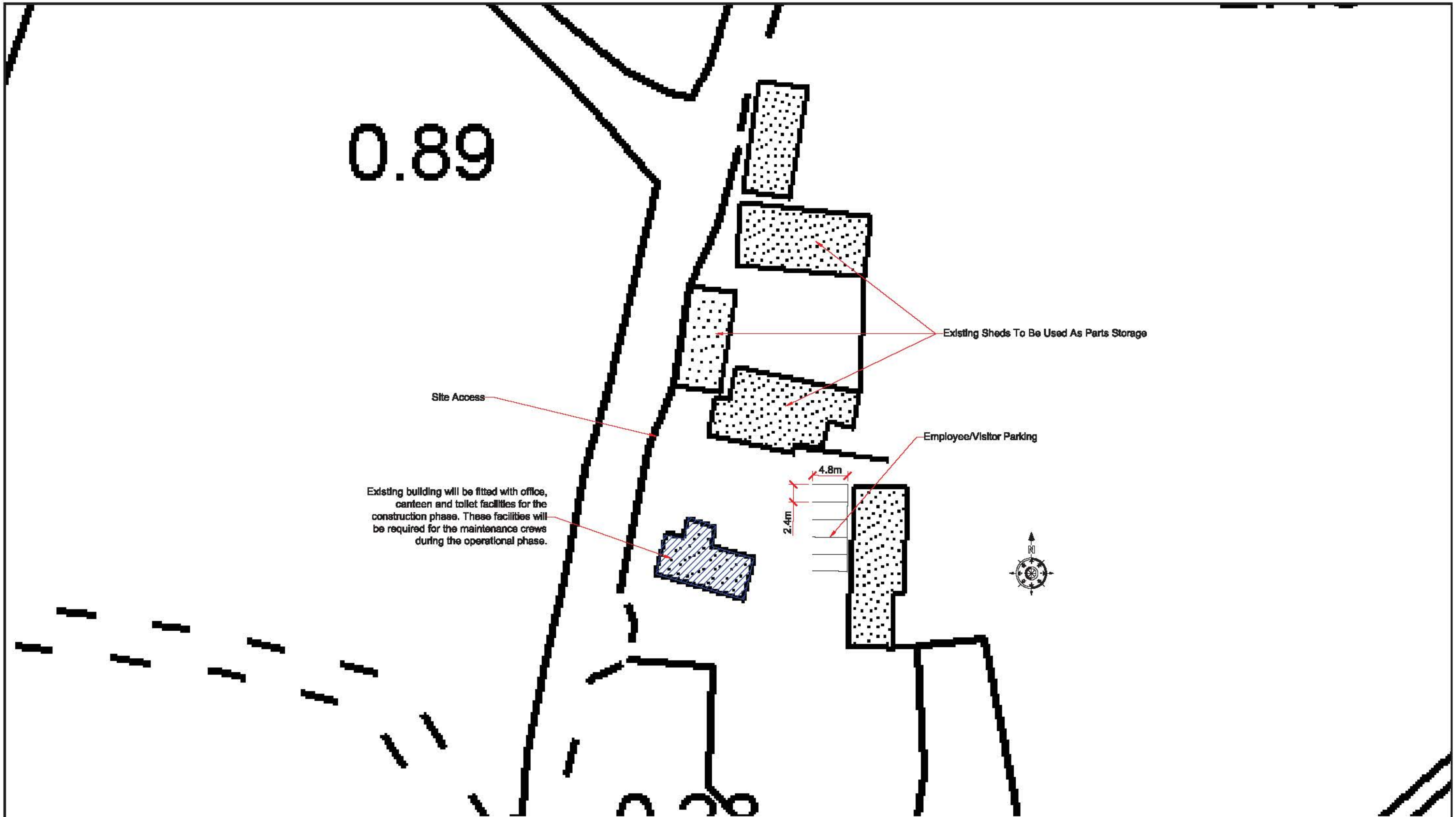
Scales (A3)	1:500	
Drawn	JK	25.11.2013
Checked	TB	25.11.2013

Drg. No. 15388 - 5007

Rev. A



Temporary Site Construction Compound 2 Layout Scale 1:500

Rev.	Date	Description	by	ch'd	app
A	26.11.13	Issued For RFI	JK	TB	TB

Client: Ecopower Developments Ltd

Project: Upperchurch Wind Farm

Title: Proposed Site Compound 2 Layout

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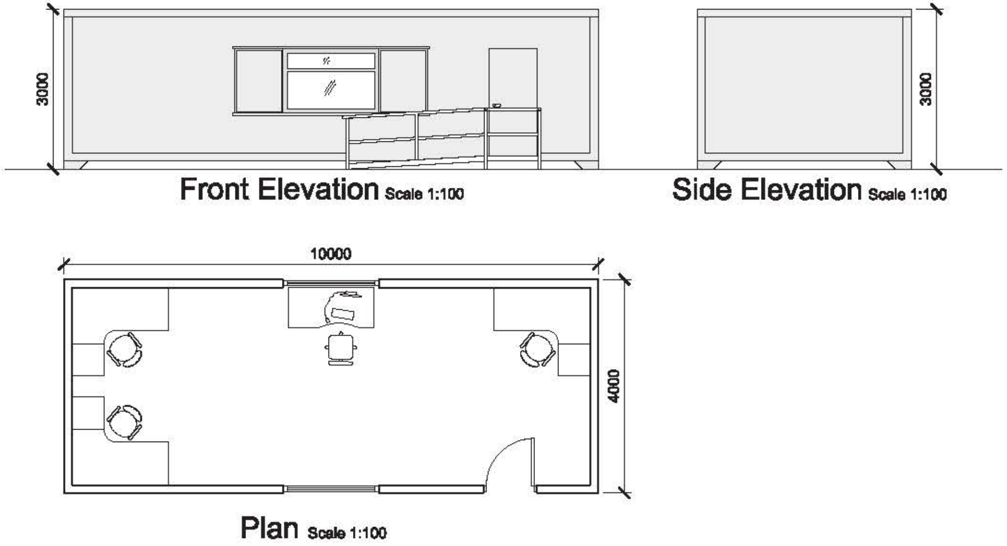
Scales (A3)	1:500		
Drawn	JK	25.11.2013	
Checked	TB	25.11.2013	

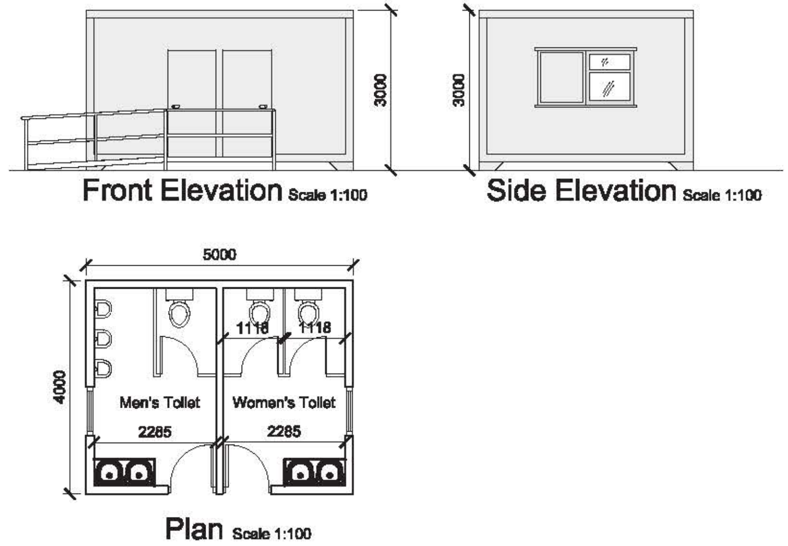
Drg. No. 15388 - 5008

Rev. A

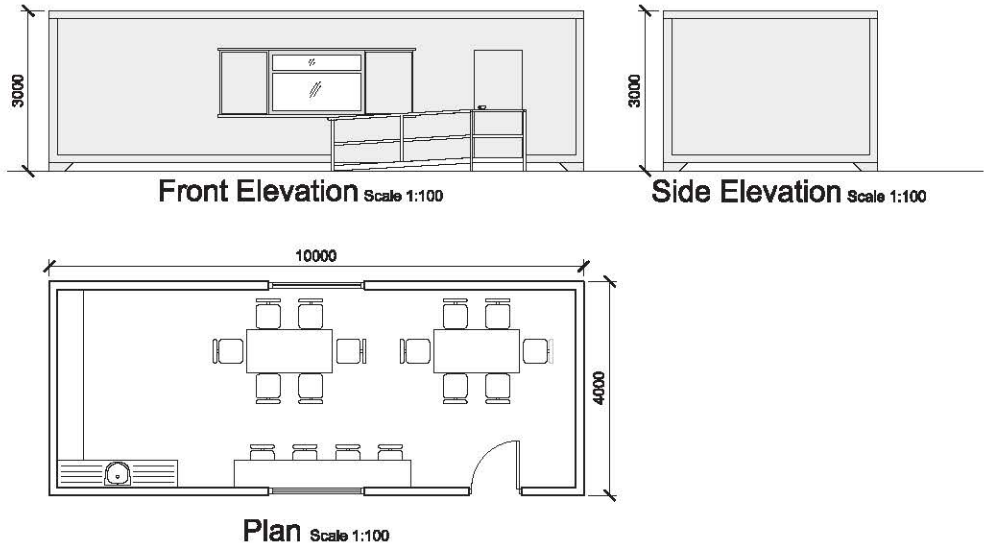
Typical Sub-Contractor or Client



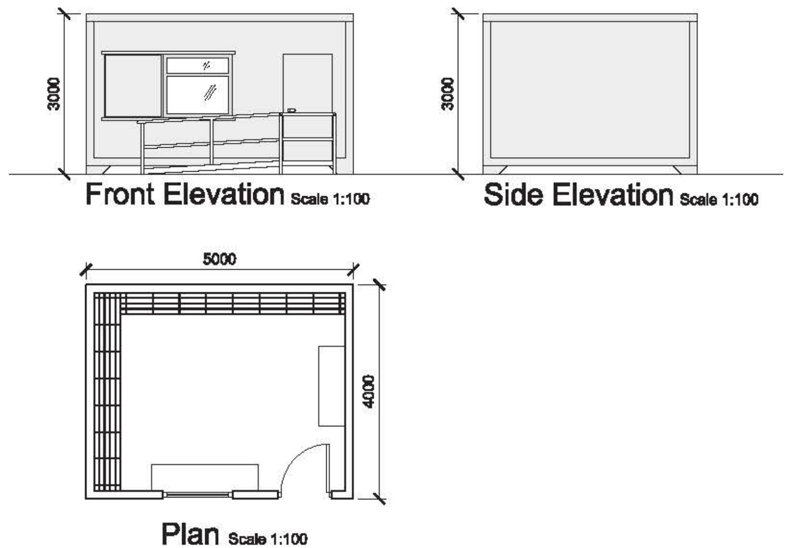
Typical Toilets Facilities



Typical Canteen Area



Typical Drying Room



Rev.	Date	Description	by	ch'd	app
A	26.11.13	Issued For RFI	JK	TB	TB

Client: Ecopower Developments Ltd

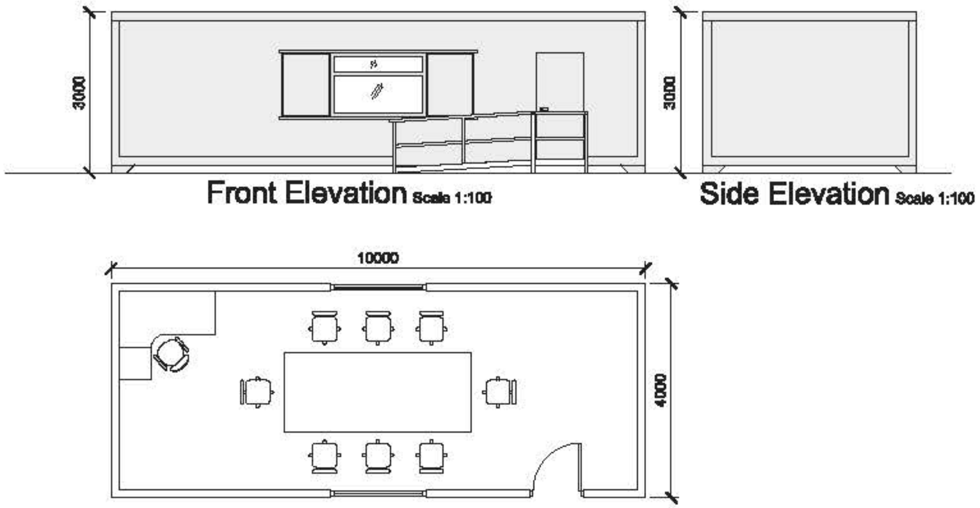
Project: Upperchurch Wind Farm

Title: Typical Temporary Building Elevations and Plans Sheet 1 of 2

Malachy Walsh and Partners
Consulting Engineers
Cork | Tralee | London | Limerick

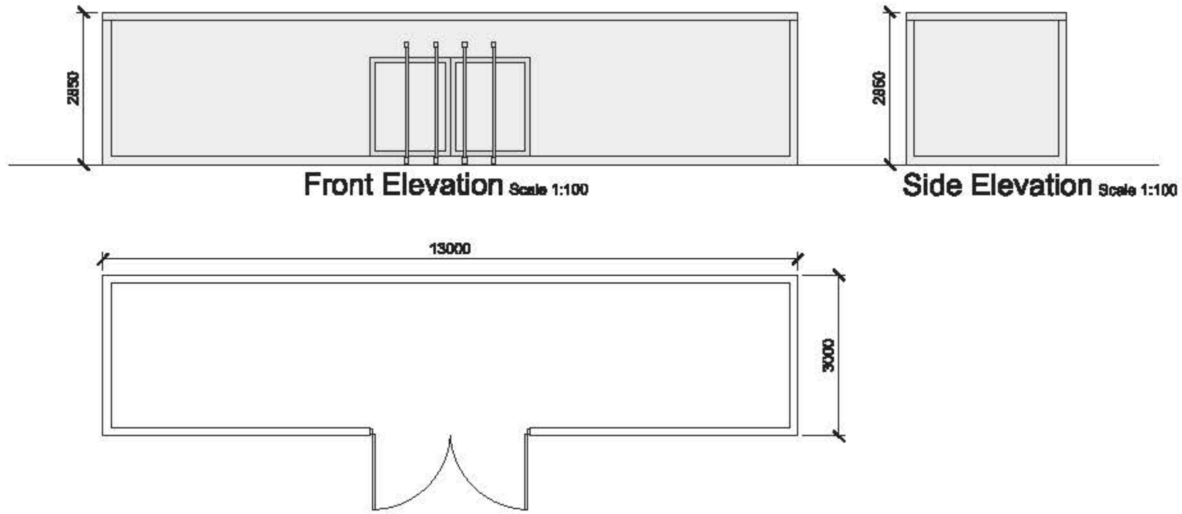
Scales (A3)	1:100		Drg. No.	Rev.
Drawn	JK	25.11.2013	15388 - 5009	A
Checked	TB	25.11.2013		

Typical Meeting Room



Typical Vandal Proof Unit To Be Used On Site

Typical Storage Unit



Rev.	Date	Description	by	ch'd	app
A	26.11.13	Issued For RFI	JK	TB	TB

Client: Ecopower Developments Ltd

Project: Upperchurch Wind Farm

Title: Typical Temporary Building Elevations and Plans Sheet 2 of 2

Malachy Walsh and Partners
Consulting Engineers
Cork | Tralee | London | Limerick

Scales (A3)	1:100	
Drawn	JK	25.11.2013
Checked	TB	25.11.2013

Drg. No. 15388 - 5010

Rev. A

APPENDIX 8 (E)

To whom it concerns,

I, Timmy McLoughlin, confirm that I am in agreement to Ecopower Developments Ltd. refurbishing my unoccupied house (House no.2 in the EIS,) to provide offices, canteen and toilet facilities for the Upperchurch windfarm personnel.

Tim McLoughlin ....

Timmy McLoughlin.

Date: 26 | 11 | 2013

REFERENCE DOCUMENTS

REFERENCE DOCUMENTS

Q9.*The visual impact assessment contained in the submitted EIS does not take account of the potential impacts that may arise from the adjoining wind farm proposed under application reference 12/51/0385. You are therefore advised to submit a revised visual impact assessment including revised photomontages.*

The answer to Q.9follows:

REVISED LANDSCAPE AND VISUAL ASSESSMENT
UPPERCHURCH WINDFARM

REFERENCE DOCUMENTS

13 /51/0003 – response to RFI dated 28th February, 2013

Further Information 13/51/0003 (22 No. wind Turbines at Upperchurch)

REVISED

LANDSCAPE AND VISUAL ASSESSMENT

UPPERCHURCH WINDFARM

MosArt Ltd., Architecture Landscape Urban Design
Block 6, Broomhall Business Park, Wicklow, Co. Wicklow, Ireland

Table of contents

9 REVISED LANDSCAPE AND VISUAL ASSESSMENT

9.1 INTRODUCTION

This chapter describes the landscape context of the proposed Upperchurch Wind Farm and assesses the likely landscape and visual impacts of the scheme on the receiving environment. Although closely linked, landscape and visual impacts are assessed separately as the effects to the physical landscape and landscape character resulting from the development form the baseline of the assessment of visual impacts from key visual receptors.

This chapter has been updated from that submitted with the initial application in order to satisfy a request for further information from the Planning Authority. It now includes a cumulative impact assessment in regards to the adjacent Milestone Wind Farm, which is also currently subject of a planning application. This updated chapter also accounts for a minor change of position (c. 100m) for turbine T22.

Landscape Impact Assessment (LIA) relates to changes in the physical landscape, brought about by the proposed development, which may alter its character and how this is experienced. This requires a detailed analysis of the individual elements and characteristics of a landscape that go together make up the overall landscape character of that area. By understanding the aspects that contribute to landscape character it is possible to make judgements in relation to its quality (integrity) and to identify key sensitivities. This, in turn, provides a measure of the ability of the landscape in question to accommodate the type and scale of change associated with the proposed development, without causing unacceptable adverse changes to its character.

Visual Impact Assessment (VIA) relates to changes in the composition of views as a result of changes to the landscape, how these are perceived and the effects on visual amenity. Such impacts are population based rather than resource based as in the case of landscape impacts. Visual impacts are measured on the basis of:

- *Visual Obstruction* (blocking of a view, be it full, partial or intermittent) or;
- *Visual Intrusion* (interruption of a view without blocking).

This landscape and visual impact assessment is based on:

- Environmental Protection Agency (EPA) publication 'Guidelines on the Information to be contained in Environmental Impact Statements (2002) and the accompanying Advice Notes on Current Practice in the Preparation of Environmental Impact Statements (2003)
- Landscape Institute and the Institute of Environmental Management and Assessment publication entitled Guidelines for Landscape and Visual Impact Assessment (2002).

- Scottish Natural Heritage (SNH) Environmental Assessment Handbook –Guidance on the Environmental Impact Assessment Process Appendix 1: Landscape and Visual Impact Assessment (2011)
- Scottish Natural Heritage (SNH) Guidance Note: Cumulative Effect of Wind Farms (2005)
- Department of Environment, Heritage and Local Government (DoEHLG) 'Wind Energy Development Guidelines' (2006)

9.1.1 Statement of Authority

This assessment report was prepared by Richard Barker, Senior Landscape Architect, MosArt Landscape Architects, Wicklow. MosArt have extensive experience at both project level and strategic planning for wind farms in Ireland. A summary of relevant experience is included below:

- Assisted the Department of Environment, Heritage and Local Government (DoEHLG) in drafting the Landscape Section of the revised Wind Energy Development Guidelines (2006);
- Responsible for the landscape section of the national attitude survey to wind farms commissioned by Sustainable Energy Ireland (2003);
- Drafted the DoEHLG Landscape and Landscape Assessment Guidelines (2000);
- Completed a wind farm strategy for Waterford County Council (2004);
- Landscape character and sensitivity classification of County Cork for wind farm planning for Cork County Council (2003);
- Involved in landscape impact assessment of over 100 on-shore wind farm projects;
- Prepared the landscape impact assessment reports for the Arklow Bank, Codling Bank and Oriel offshore wind farm projects; and
- Presented papers at numerous national conferences concerning landscape assessment for strategic planning and also for the planning and design of wind farms.

9.1.2 Description of the Proposed Development

The developer proposes to locate the wind farm in an upland area west of Upperchurch. It is proposed that this development comprises of the following main elements:

- Twenty two turbines – at a maximum hub height of 90m; a maximum rotor diameter of 90m; a maximum blade tip height of 126.6m as well as associated areas of crane hardstands and foundations;
- One permanent wind measurement mast
- One Substation and compound and associated areas of hard standing;
- Access tracks – 5m wide; and
- Underground electric cabling.

9.1.3 Assessment Methodology

Production of this Landscape and Visual Impact Assessment involved desktop studies and fieldwork comprising professional evaluation by qualified and experienced Landscape Architects. This entailed the following:

9.1.3.1 Desktop Study

- Establishing an appropriate Study Area from which to study the landscape and visual impacts of the proposed wind farm;
- Review of a Zone of Theoretical Visibility (ZTV) map, which indicates areas from which the development is potentially visible in relation to terrain within the Study Area;
- Review of relevant County Development Plans, particularly with regard to sensitive landscape and scenic view/route designations;
- Selection of potential Viewshed Reference Points (VRPs) from key visual receptors to be investigated during fieldwork for actual visibility and sensitivity;
- Preparation of an initial VRP selection map from which the visualisation consultant can prepare 'wireframe images' at each potential VRP location for use during fieldwork. Wireframe images depict the proposed wind farm within the context of a basic three dimensional view of the terrain as seen from each selected VRP location.

9.1.3.2 Fieldwork

- Recording of a description of the landscape elements and characteristics within the Study Area generally and within view from each VRP.
- Selection of a refined set of VRP's for assessment. This includes the capture of panoramic photography and grid reference coordinates for each VRP location for the visualisation specialist to prepare photomontages;

9.1.3.3 Assessment

- Description of the geographic location and landscape context of the proposed wind farm site;
- General landscape description concerning essential landscape character and salient features of the Study Area, discussed with respect to; landform and drainage; vegetation and land use; centres of population and houses; transport routes and; public amenities and facilities;
- Consideration of design guidance, the planning context and relevant landscape designations.
- Assessment of predicted landscape impacts.
- Assessment of predicted visual impacts using standard ZTV maps and cumulative ZTV maps as well photomontages prepared from selected VRP locations.
- Discussion of mitigation measures.
- Assessment of residual impacts following mitigation

9.1.4 Definition of Study Area

The Wind Energy Development Guidelines published by the Department of the Environment, Heritage and Local Government specify different radii for examining the zone of theoretical visibility of proposed wind farm projects (ZTV). The extent of this search area is influenced by turbine height, on the basis that taller turbines would be visible at greater distances, as follows:

- 15km radius for blade tips up to 100m; and
- 20km radius for blade tips greater than 100m.

In the case of this project, the blade tips are 126.6m high and, thus, the ZTV radius required is 20km from the outermost turbines of the scheme. This 20km radius, therefore, defines the extent of the Study Area for this project.

9.2 EXISTING ENVIRONMENT

9.2.1 Landscape Baseline

The landscape baseline represents the existing landscape context and is the scenario against which any changes to the landscape brought about by the proposal will be assessed. This also includes reference to any relevant landscape character appraisals and the current landscape policy context (both are generally contained within County Development Plans).

A description of the landscape context of the proposed wind farm site and wider study area is provided below under the headings of landform and drainage, vegetation and land use, centres of population and houses, transport routes and public amenities and facilities and the site context. Although this description forms part of the landscape baseline many of the landscape elements identified also relate to visual receptors i.e. places and transport routes from which viewers can potentially see the proposed development. The visual resource will be described in greater detail in section 9.2.2.

9.2.1.1 Landform and Drainage

The landform of the study area is that of rolling hills at the south eastern periphery of a contiguous upland area that consists of the Slieve Felim Mountains, the Silvermines Mountains and the Devils Bit Mountains. Relatively distinctive dome shaped hills occur to the west of the site in the heart of the ranges and the highest of these are; Keeper Hill (694m a.s.l.), Mother Mountain (543m a.s.l.) and Cooneen Hill (467m a.s.l.). The upland area is the source of a number of small watercourses that tend to run directly from the ranges then trend southwards towards the larger River Shannon system. These include; the Mulkear River, the Clare River, the Owenbeg River, the Clodiagh River, and the Nenagh River.

Image 9.1 – Rolling hills and distinctive dome shaped peaks of the central portion of the study area

Image 9.2 – flat to gently undulating landscape typical of the lowlands in the north and south of the study area

9.2.1.2 Vegetation and Land Use

The landscape of the study area is a productive rural one and this is reflected in the land cover. Within the lowland landscape in the northern and southern extents of the study area the predominant land uses are pastoral farming and tillage. Pasture remains a dominant land cover within the upland areas comprising of large geometric fields defined by broadleaf hedgerows. On higher slopes and ridges commercial conifer plantations take over as the dominant land cover. Only on the upper slopes of the tallest peaks such as Keeper Hill (generally above 500m a.s.l.) is there a natural land cover of heathland. There are some small patches of broadleaf woodland within the study area as well as narrow riparian woodlands lining the banks of the numerous watercourses.

Image 9.2 – Mixed land cover of predominantly pasture and commercial conifer plantations.

9.2.1.3 Centres of Population and Houses

The largest settlements within the study area are Nenagh at the north-western periphery and Thurles at the eastern periphery. There are a number of other modest sized settlements within the plains to the east and these include; Templemore, Borrisoleigh, Ballycahill, Holycross, Clonoulty and

Dundrum. The closest of these to the site is Borrisoleigh, which is approximately 7km to the northeast. Settlements within the upland area tend to be small and relatively dispersed. The nearest of these to the proposal site is Upperchurch approximately 2km to the southeast, whilst Kilcommon is 3km to the southwest and Hollyford is 6km to the south. There is a relatively high density of rural dwellings throughout the study area reflecting the productive nature of the landscape within both the lowland and upland portions.

9.2.1.4 Transport Routes

There are two principal transport routes that both pass through the outer fringes of the study area and these are the M7 motorway to the northwest and M8 motorway to the southeast. The N62 national secondary road links north-south between the settlements of Thurles and Templemore and is approximately 15km to the east of the proposal site at its nearest point. There are a number of regional roads that crisscross the study area and the closest of these to the proposal site is the R503 which traces a path around the southern half of the site and is within 2km of it for approximately 7km of its east – west journey through the uplands. The R497 links with the R503 from the south and is less than one kilometre to the south of the site at this intersection.

9.2.1.5 Public Amenities and Facilities

There is one waymarked walking route within the upland portion of the study area and this is the Slieve Felim Way. This winds through the heart of the Slieve Felim Mountains and is 10km to the west of the site at its nearest point. There are also four signposted loop walks in close proximity to the proposal site, which are part of the national loop walks initiative. These include the Knockalough, the Slí Éamoin an Cnoic, the Birch Hill and the Kilcommon Pilgrim Loop Walks.

Note: Approximately 2km beyond the south-eastern perimeter of the study area is the Rock of Cashel, which is one of Ireland’s premier heritage features and tourist attractions. Given the considerable separation distance (22km) and the presence of other wind energy development in closer proximity to this heritage feature, it is not deemed necessary to consider the Rock of Cashel in terms of landscape and visual impacts herein.

9.2.1.6 Site Context

This is a relatively extensive site and thus it encompasses a rolling landscape similar to that described above at a more macro level for the upland parts of the study area. The land cover of the site is that of pastoral farmland with several blocks of commercial conifer plantation. The hills encompassed within the site that will be populated by turbines are generally in the order of 350m a.s.l. The tallest is Knockmaroe at the western edge of the site, which is 411m a.s.l. In terms of terrain this is a transitional zone as the peaks immediately to the west are are generally taller than those contained within the site whilst those to the east are generally lower. The site also encompasses the headwaters catchment of the Clodiagh River which runs out of the site to the north before veering to the east.

9.2.1.7 Landscape Policy Context and Designations

9.2.1.7.1 North Tipperary County Development Plan 2010 - 2016

A landscape character assessment was undertaken for North Tipperary County Council in 2004, which formed the basis for the North Tipperary County Council Wind Capacity Strategy and Outline Landscape Strategy adopted in 2009. The role of the County Landscape Character Assessment is described in the current County Development Plan under policy ENV2: Landscape Protection:

> *'It is the policy of the Council in assessing applications for development that would impact on landscape to balance the need to protect landscape character against the requirement for socio-economic development in accordance with value assessment and sensitivity as identified in the County Landscape Character Assessment 2009.'*

The Landscape Character Assessment sets out 12 Landscape Character Areas (LCA's) and 18 generic Landscape Character Types (LCT). The proposal site is located in LCA7 'Upperchurch – Kilcommon Hills', which contains landscape character types 6 (Farmed foothills) and 16 (Enclosed valleys). In relation to landscape condition and sensitivity for LCA7 it is stated;

> *"This is a working landscape featuring pasture as the dominant landuse. It is in very good condition and indeed is highly scenic owing to the varied and interesting topography of rolling hills and valleys with vantage points that afford views. This high scenic quality renders this a significantly sensitive landscape. However, the nature of the varying topography is such that there is a capacity to accommodate development without undue deterioration in the scenic quality. The principal contrary factor in this landscape is the coniferous forestry. Its location on hilltops causes the maximum negative visual impact. In addition, single dwellings of inappropriate design which are poorly sited, reduce the scenic quality of this landscape in localised areas."*

In the subsequent Wind Capacity Strategy and Outline Landscape Strategy the following excerpt applies to wind energy development in LCA7 'Upperchurch – Kilcommon Hills';

> *"The farmed foothills in this landscape are very similar to those encountered in the Silvermines Character Area. In this regard, the capacity to absorb wind farm development is extensive and as previously discussed, some care is required in terms of achieving the right scale of development to match the scale of the receiving landscape. The design layout would broadly follow that prescribed for hilly and flat farmland according to the DoEHLG draft guidelines 2004. Some modification will be required to*

this design solution and that relates to the size of the development. An increase in scale will result in a more successful layout that will respond to this landscape pattern which is bigger in scale than that found in the farmed ridges."

9.2.1.8 South Tipperary County Development Plan (2009 – 2015)

Given the close proximity of the boundary to South Tipperary immediately to the south of the site, the wind energy policy of South Tipperary County Council is an important cross-boundary consideration. In this regard, the current Development Plan identifies the area adjacent to the site and within this upland area generally as being a *'preferred area for wind energy development'*.

9.2.2 Visual Baseline

Given the generally prominent nature of commercial wind energy developments, visual impacts tend to be a key issue for such projects. This relates both to the extent of visibility as well as the nature and degree of intrusion into views, particularly those of recognised scenic value. Only those parts of the study area that potentially afford views of the proposed wind farm are of concern to this part of the assessment. Therefore, the first part of the visual baseline is establishing a 'Zone of Theoretical Visibility' and subsequently, identifying important visual receptors from which to base the visual impact assessment.

9.2.2.1 Zone of Theoretical Visibility (ZTV)

Ecopower Developments Ltd. carried out a computer automated study of the zone of theoretical visibility (ZTV). The purpose of this exercise is to identify the 'theoretical' extent and degree of visibility of turbines. This is a theoretical exercise because it is based on topography only at 10m contour intervals and does not allow for intermittent screening provided by, for example, hedgerows, forests or buildings and does not involve the actual height of crests (but using the nearest 10m contour below). Thus the ZTV map, assuming no screening, represents a 'worst-case-scenario' with respect to viewing exposure. For the purposes of this project a radius of 20km was used for the ZTV as discussed earlier.

The following key points should be noted from the ZTV study:

- The ZTV map indicates that from within 5km of the proposal site theoretical visibility of the proposed turbines is fairly comprehensive. However, only from higher slopes within the site itself and from the opposing sides of surrounding valleys can all 22 of the proposed turbines be seen at once within this inner zone. The key receptors encompassed by the central ZTV pattern are the settlements of Upperchurch and Kilcommon, the R503 and R497 regional roads and the four signposted loop walks identified at 9.1.2.5 above. The entire length of the R503 and R497 regional roads contained within the first 5km from the site are designated as scenic routes and have theoretical visibility of some but not all of the proposed turbines.

- Between 5km and 10km away from the proposal site, theoretical visibility of the proposed wind farm falls away quickly due to terrain screening. Views from higher slopes and ridges remain, whilst from lower slopes and valleys there is either no view of turbines or views of a very limited number of them. The key receptors contained within the ZTV pattern in this concentric zone are the settlements of Borrisoleigh and Ballycahill, which lie at the interface of the upland and lowland zones to the east. The R498 regional road to the south of Borrisoleigh, which is also designated as a scenic route, falls within ZTV coverage in this zone.

- Between 10-15km away from the site extensive theoretical visibility has emerged in the lowland plains to the east of the site encompassing most of the settlements identified at 9.2.1.3 above as well as the N62 national secondary road. Theoretical visibility within the uplands to the north, south and west of the site is limited to the highest peaks and ridges. The only key receptor this coincides with is the Slieve Felim Way which is largely contained within commercial conifer forests at these elevations.

- At the outer periphery of the study area, between 15-20km from the proposal extensive theoretical visibility remains throughout the lowland landscape in the eastern quarters. This encompasses the settlements of Templemore and Thurles. Two further patches of visibility arise in the north western segment of the study area and one of these takes in the outskirts of Nenagh. Another occurs at the south-western periphery of the study area and encompasses the small settlement of Donohill.

9.2.2.2 Views of Recognised Scenic Value

Views of recognised scenic value are primarily indicated within County Development plans in the context of scenic views/routes designations, but they might also be indicated on touring maps, guide books, road side rest stops or on post cards that represent the area.

9.2.2.3 North Tipperary County Development Plan (2010 – 2016)

The North Tipperary County Development Plan identifies 15 protected views, which are all from sections of road. Those relevant to this proposal are identified below;

V11 Views north and south of the R498 from Bouladuff through Borrisoleigh to Latteragh

V12 Views north and south on sections of the R503 from Newport to Ballycahill

V13 Views east and west of the R497 from the R503 through the mountains to Dolla – including Mother Mountain to the West, Knockacreggan to the East, Cooneen Hill to the East and the Silvermines to the west

V15 Views west on the N62 north of Templemore

9.2.2.4 South Tipperary County Development Plan (2009 – 2015)

Designated scenic views from within South Tipperary are also relevant to this proposal given the close proximity of the jurisdictional boundary immediately to the south of the site. The only relevant scenic route identified within the South Tipperary County Development Plan is identified below;

V036 Views in all directions from Ironmills to Milestone Road (R497)

9.2.2.5 Limerick County Development Plan (2010 – 2016)

There are no relevant designated scenic views from the small section of County Limerick that is contained within the south-western quarter of this study area.

9.2.2.6 Identification of Viewshed Reference Points as a Basis for Assessment

The results of the ZTV analysis provide the basis for selection of Viewshed Reference Points (VRP's), which are the locations used to study the landscape and visual impact of the proposed wind farm in detail. It is not warranted to include each and every location that provides a view of this development as this would result in an unwieldy report and make it extremely difficult to draw out the key impacts arising from the project. Instead, the assessors endeavoured to select a variety of location types that would provide views of the proposed wind farm from different distances, different angles and different contexts.

The visual impact of a proposed development is assessed using up to 6 categories of receptor type as listed below;

- **Key Views (**from features of national or international importance)**;**
- **Designated Scenic Routes and Views;**
- **Local Community views;**
- **Centres of Population;**
- **Major Routes; and**
- **Amenity and heritage features;**

Where a VRP might have been initially selected for more than one reason it will be assessed according to the primary criteria for which it was chosen. The characteristics of each receptor type vary as does the way in which the view is experienced. These are described below.

9.2.2.6.1 Key Views

These VRP's are at features or locations that are significant at the national or even international level, typically in terms of heritage, recreation or tourism. They are locations that attract a significant number of viewers who are likely to be in a reflective or recreational frame of mind possibly increasing their appreciation of the landscape around them. The location of this receptor type is usually quite specific.

9.2.2.6.2 Designated Scenic Routes and Views

Due to their identification in the County Development Plan this type of VRP location represents a general policy consensus on locations of high scenic value within the Study Area. These are commonly elevated, long distance, panoramic views and may or may not be mapped from precise locations. They are more likely to be experienced by static viewers who seek out or stop to take in such vistas.

9.2.2.6.3 Local Community Views

This type of VRP represents those people that live and/or work in the locality of the wind farm, usually within a 5km radius of the site. Although the VRP's are generally located on local level roads they also represent similar views that may be available from adjacent houses. The precise location of this VRP type is not critical, however, clear elevated views are preferred, particularly when closely associated with a cluster of houses and representing their primary views. Coverage of a range of viewing angles using several VRP's is necessary in order to sample the spectrum of views that would be available from surrounding dwellings.

9.2.2.6.4 Centres of Population

VRP's are selected at centres of population primarily due to the number of viewers that are likely to experience that view. The relevance of the settlement is based on the significance of its size in terms of the Study Area or its proximity to the site. The VRP may be selected from any location within the public domain that provides a clear view either within the settlement or in close proximity to it.

9.2.2.6.5 Major Routes

These include national and regional level roads and rail lines and are relevant VRP locations due to the number of viewers potentially impacted by the proposed development. The precise location of this category of VRP is not critical and might be chosen anywhere along the route that provides clear views towards the proposal site, but with a preference towards close and/or elevated views. Major routes typically provide views experienced whilst in motion and these may be fleeting and intermittent depending on screening by intervening vegetation or buildings.

9.2.2.6.6 Amenity and Heritage Features

These views are often one and the same given that heritage locations are often important tourist and visitor destinations and amenity areas or walking routes are commonly designed to incorporate heritage features. Such locations or routes tend to be sensitive to development within the landscape as viewers are likely to be in a receptive frame of mind with respect to the landscape around them. The sensitivity of this type of visual receptor is strongly related to the number of visitors they might attract and, in the case of heritage features, whether these are discerning experts or lay tourists. Sensitivity is also heavily influenced by the experience of the viewer at a heritage site as distinct from simply the view of it. This is a complex phenomenon that is likely to be different for every site. Experiential considerations might relate to the sequential approach to a castle from the car park or the view from a hilltop monument reached after a demanding climb. It might also relate to the influence of contemporary features within a key view and whether these detract from a sense of past times. It must also be noted that the sensitivity rating attributed to a heritage feature for the purposes of a landscape and visual assessment is not synonymous with its importance to the Archaeological or Architectural Heritage record.

Table 9-1 Outline Description of Selected Viewshed Reference Points (VRPs)

VRP No.	*Location*	*Direction of view*
CP1	Toomyvara	SE
CP2	Borrisoleigh	SW
CP3	Upperchurch	W
CP4	Thurles	W
CP5	Holycross	NW
LC1	Local road at Garranakilka	S
LC2	Kilcommon Village	E
MR1	Nenagh	SE
MR2	R501 Borrisoleigh - Templemore Road	SW
MR3	N62 Thurles -Templemore Road	SW
MR4	R660 at Boherlahan	NW
DR1	Curreeny Road	NE
DR2	Anglesey Road at Loughbrack	NE
DR3	Anglesey Road at Milestone	N
DR4	R503 at Ruan	NW
DR5	Anglesey Road at Rossoulty	NW
DR6	R498 at The Ragg/Inch	W
AV1	Slí Éamoin an Cnoic	W
AV2	Ballyboy lookout point	W
AV3	Knockalough looped walk	NW
AV4	Birch Hill looped walk	W

9.3 LIKELY SIGNIFICANT IMPACTS

9.3.1 Landscape Impact

9.3.1.1 Assessment Criteria

When assessing the potential impacts on the landscape resulting from a wind farm development, the following criteria are considered:

- landscape character, value and sensitivity
- Magnitude of likely impacts; and
- Significance of landscape effects

The sensitivity of the landscape to change is the degree to which a particular landscape receptor (Landscape Character Area (LCA) or feature) can accommodate changes or new features without unacceptable detrimental effects to its essential characteristics. Landscape Value and Sensitivity is classified using the following criteria;

Table 9-2 Landscape Value and Sensitivity

Sensitivity	Description
Very High	Areas where the landscape character exhibits a very low capacity for change in the form of development. Examples of which are high value landscapes, protected at an international or national level (World Heritage Site/National Park), where the principal management objectives are likely to be protection of the existing character.
High	Areas where the landscape character exhibits a low capacity for change in the form of development. Examples of which are high value landscapes, protected at a national or regional level (Area of Outstanding Natural Beauty), where the principal management objectives are likely to be considered conservation of the existing character.
Medium	Areas where the landscape character exhibits some capacity and scope for development. Examples of which are landscapes which have a designation of protection at a county level or at non-designated local level where there is evidence of local value and use
Low	Areas where the landscape character exhibits a higher capacity for change from development. Typically this would include lower value, non-designated landscapes that may also have some elements or features of recognisable quality, where landscape management objectives include, enhancement, repair and restoration.
Negligible	Areas of landscape character that include derelict, mining, industrial land or are part of the urban fringe where there would be a reasonable capacity to embrace change or the capacity to include the development proposals. Management objectives in such areas could be focused on change, creation of landscape improvements and/or restoration to realise a higher landscape value.

The magnitude of a predicted landscape impact is a product of the scale, extent or degree of change that is likely to be experienced as a result of the proposed development. The magnitude takes into account whether there is a direct physical impact resulting from the loss of landscape components and/or a change that extends beyond the proposal site boundary that may have an effect on the landscape character of the area.

Table 9-3 Magnitude of Landscape Impacts

Magnitude of Impact	Description
Very High	Change that would be large in extent and scale with the loss of critically important landscape elements and features, that may also involve the introduction of new uncharacteristic elements or features that contribute to an overall change of the landscape in terms of character, value and quality.
High	Change that would be more limited in extent and scale with the loss of important landscape elements and features, that may also involve the introduction of new uncharacteristic elements or features that contribute to an overall change of the landscape in terms of character, value and quality.
Medium	Changes that are modest in extent and scale involving the loss of landscape characteristics or elements that may also involve the introduction of new uncharacteristic elements or features that would lead to changes in landscape character, and quality.
Low	Changes affecting small areas of landscape character and quality, together with the loss of some less characteristic landscape elements or the addition of new features or elements.
Negligible	Changes affecting small or very restricted areas of landscape character. This may include the limited loss of some elements or the addition of some new features or elements that are characteristic of the existing landscape or are hardly perceivable.

The significance of a landscape impact is based on a balance between the sensitivity of the landscape receptor and the magnitude of the impact. The significance of landscape impacts is arrived at using the following matrix;

Table 9-4 Landscape Impact Significance Matrix

	Sensitivity of Receptor				
Scale/Magnitude	*Very High*	*High*	*Medium*	*Low*	*Negligible*
Very High	Profound	Profound-major	Major	Moderate	Minor
High	Profound-major	Major	Major-moderate	Moderate-minor	Minor-negligible
Medium	Major	Major-moderate	Moderate	Minor	Negligible
Low	Moderate	Moderate-minor	Minor	Minor-negligible	Negligible
Negligible	Minor	Minor-negligible	Negligible	Negligible	Negligible

Note that potential beneficial landscape impacts are not accounted for in the tables and matrix above. In the rare instances that this might occur, perhaps by facilitating the rehabilitation of a degraded landscape, the benefits will be discussed in the assessment and the significance of impact would default to the lowest end of the range (negligible).

9.3.1.2 Landscape Character, Value and Sensitivity

Effects on landscape character will be considered at both the localised scale of the site and its immediately surrounding landscape as well as the broader scale of the study area.

In the near vicinity of the proposal site (within approximately 5km) the landscape comprises of steeply rolling hills and valleys with a mixed land cover of pastoral grazing and commercial forests. The existing Glenough wind farm also occurs just to the southwest. This landscape is also influenced by the R503 and R497 regional roads, a network of local roads and small settlements such as Upperchurch, Milestone and Kilcommon, which give it an anthropogenic character. Nonetheless, this character is that of remote rural uplands.

The landscape character of the wider study area (beyond approximately 5km) is very similar to that described above, particularly within the upland areas to the north, south and west. Forest plantations begin to dominate grazing land as the predominant land use within the heart of the ranges to the west and several wind farms also occur in this area.

The landscape character changes markedly as the hills give way to the flat lowland plains fairly abruptly to the northwest and southeast. The plains are characterised by a higher intensity of rural and built development as well as a higher settlement density. This is centred on evenly dispersed, modest scale settlements, which act as rural service centres. The major transport corridors of the M7 and M8 motorways influence the landscape character at the north-western and south-eastern fringes of the study area respectively. The mountains ranges that occupy the heart of the study area act as a distinctive undulating backdrop to the plains giving these otherwise unremarkable rural lowlands something of a sense of place. Wind turbines that can be seen above the ridgeline also contribute to the character of this backdrop. Overall it is considered that the landscape character of the lowland plains is a strongly anthropogenic one of intensive agriculture.

Due to the reasons outlined above, and particularly the presence of existing wind farms, the landscape sensitivity of the site and its immediate surrounds as well as the wider study area is deemed to be **low**.

9.3.1.3 Magnitude of Landscape Effects

The physical landscape as well as the character of the site and its immediate surrounds is affected by the proposed turbines as well as ancillary development such as access and circulation roads, areas of hard standing for the turbines, the permanent meteorological mast and the substation. By contrast, for the wider landscape of the study area, landscape impacts relate almost exclusively to the influence of the proposed turbines on landscape character.

It is considered that the proposed wind farm development will have only a minor physical impact on landscape components within the site as none of the proposed development features (turbines, substation, anemometer mast) have a significant 'footprint'. The topography of the site will remain unaltered with excavation being limited to establishment of some additional tracks and areas of hard standing for the turbines. Such excavation will tie into the existing contours and will be the minimum required for safe working. Any temporary stockpiles of material will be re-graded to marry into existing site levels. Similarly, the land cover of the site will only be interrupted as necessary to create tracks and areas of hard standing for the turbines. It is estimated that 4.35ha of existing conifer plantation will need to be clear-felled in order to construct the wind farm. The current pastoral farming regime will continue below the wind turbines without significant disruption following the construction phase.

The principal landscape impact will be the change in character of the immediate area due to the introduction of large scale structures with moving components. These will be a prominent landscape feature within the local landscape as would be the case for a commercial scale wind farm placed into almost any landscape context. However, the turbines will not represent a new and unfamiliar feature even in this localised area as the 14 turbine Glenough Wind Farm occurs only 3.2km away to the south of the proposal site. There are also two wind farms currently under construction in the near vicinity of the proposal including the 15 turbine Garracummer scheme (3.5km to the southwest) and the 2 turbine Falleen development (2.8km to the south). Therefore, the proposal represents a further intensification of wind energy development, which has considerably less effect on the landscape character than an initial introduction of turbines would have. Indeed, wind energy development is emerging as one of the defining land uses in the central study area irrespective of the proposed development.

The height of the proposed turbines and the overall scale of the wind farm, although relatively substantial, is not considered excessive in this landscape context due to the scale of the terrain and the relatively broad land use patterns in the vicinity. This is reflected in the North Tipperary 'Wind Capacity and Outline Landscape Strategy', which seeks a broad scale of wind energy development in this Landscape Character Area to reflect the nature of the landscape (see 9.2.1.7.1 above).

Although the wind farm represents a slightly increased sense of human intervention and level of built development than currently exists on the site or in the immediate area, it will not detract significantly from the relatively remote, rural character. This is on the basis that wind farms are regularly located in such areas and have become somewhat synonymous with remote rural locations. This perception is also aided by the fact that a generally low level of site activity occurs during the operational phase of a wind farm development.

Site activity will be at its greatest during the construction phase due to the operation of machinery on site and movement of heavy vehicles to and from site. This phase will have a more significant impact on the character of the site, but it is a temporary impact that will cease upon completion of the scheme (6-8 months).

It is important to note that in terms of duration, this wind farm proposal represents a long term, but not permanent impact on the landscape. The lifespan of the project is 25 years, after which time it will be dismantled and the landscape reinstated to prevailing conditions. Nonetheless, this is a significant period of time and it might be argued that if the development remains viable an application could be made to extend its lifecycle or an alternative development proposed on the basis of an established use on this site. Subsequent use of the site is difficult for anyone to predict and is not part of this assessment. Instead, the key point is that a wind farm development has a fairly 'light footprint' on the landscape in comparison to a quarry or road development, for example. Within a couple of years of decommissioning there would be little evidence that a wind farm ever existed on the site.

Within the wider landscape context there are two other existing wind farms including Curraghgraigue 9.5km to the north and Knockstanna (4 turbines) just over 8km to the south. These contribute the character of the upland landscape in which they sit and as a background feature they also influence the character of the surrounding lowland plains. Again, the proposed development represents the intensification of an established land use and it will contribute to wind energy development becoming one of the defining elements of the landscape character of the wider study area.

For the reasons outlined above, the magnitude of the landscape impact is deemed to be **low.**

In accordance with the significance matrix, a 'low' sensitivity judgement coupled with an impact magnitude of 'low' results in a **Minor-negligible** significance of landscape impact.

9.3.2 Visual Impact

As with the landscape impact, the visual impact of the proposed wind farm will be assessed as a function of sensitivity versus magnitude. In this instance the sensitivity of the visual receptor, weighed against the magnitude of the visual effect.

9.3.2.1 Sensitivity of Visual Receptors

Unlike landscape sensitivity, the sensitivity of visual receptors has an anthropocentric basis. It considers factors such as the perceived quality and values associated with the view, the landscape context of the viewer, the likely activity they are engaged in and whether this heightens their awareness of the surrounding landscape. A list of the factors considered by MosArt in estimating the level of sensitivity for a particular visual receptor is outlined below and used in table 9-6 to establish visual receptor sensitivity at each VRP:

1. **Recognised scenic value of the view** (County Development Plan designations, guidebooks, touring maps, postcards etc). These represent a consensus in terms of which scenic views and routes within an area are strongly valued by the population because in the case of County Developments Plans, at least, a public consultation process is required;

2. **Views from within highly sensitive landscape areas**. Again, highly sensitive landscape designations are usually part of a county's Landscape Character Assessment, which is then incorporated with the County Development Plan and is therefore subject to the public consultation process. Viewers within such areas are likely to be highly attuned to the landscape around them;

3. **Primary views from dwellings**. A proposed development might be seen from anywhere within a particular residential property with varying degrees of sensitivity. Therefore, this category is reserved for those instances in which the design of dwellings or housing estates, has been influenced by the desire to take in a particular view. This might involve the use of a slope or the specific orientation of a house and/or its internal social rooms and exterior spaces;

4. **Intensity of use, popularity**. This relates to the number of viewers likely to experience a view on a regular basis and whether this is significant at county or regional scale;

5. **Connection with the landscape**. This considers whether or not receptors are likely to be highly attuned to views of the landscape i.e. commuters hurriedly driving on busy national route versus hill walkers directly engaged with the landscape enjoying changing sequential views over it;

6. **Provision of elevated panoramic views**. This relates to the extent of the view on offer and the tendency for receptors to become more attuned to the surrounding landscape at locations that afford broad vistas.

7. **Sense of remoteness and/or tranquillity.** Receptors taking in a remote and tranquil scene, which is likely to be fairly static, are likely to be more receptive to changes in the view than those taking in the view of a busy street scene, for example;

8. **Degree of perceived naturalness**. Where a view is valued for the sense of naturalness of the surrounding landscape it is likely to be highly sensitive to visual intrusion by distinctly manmade features;

9. **Presence of striking or noteworthy features.** A view might be strongly valued because it contains a distinctive and memorable landscape feature such as a promontory headland, lough or castle;

10. **Historical, cultural and / or spiritual significance.** Such attributes may be evident or sensed by receptors at certain viewing locations, which may attract visitors for the purposes of contemplation or reflection heightening the sense of their surroundings;

11. **Rarity or uniqueness of the view**. This might include the noteworthy representativeness of a certain landscape type and considers whether the receptor could take in similar views anywhere in the broader region or the country;

12. **Integrity of the landscape character**. This looks at the condition and intactness of the landscape in view and whether the landscape pattern is a regular one of few strongly related components or an irregular one containing a variety of disparate components;

13. **Sense of place**. This considers whether there is special sense of wholeness and harmony at the viewing location; and

14. **Sense of awe**. This considers whether the view inspires an overwhelming sense of scale or the power of nature.

Those locations which are deemed to satisfy many of the above criteria are likely to be in the higher order of magnitude in terms of sensitivity and vice versa. No relative importance is inferred by the order of listing in the table 9-5 below. Overall sensitivity may be a result of a number of these factors or, alternatively, a strong association with one or two in particular.

Table 9-5 Analysis of Visual Receptor Sensitivity at Viewshed Reference Points

Assessment Criteria	CP1	CP2	CP3	CP4	CP5	LC1	LC2	MR1	MR2	MR3	MR4	DR1	DR2	DR3	DR4	DR5	DR6	AV1	AV2	AV3	AV4
Recognised scenic value of the view	N	N	N	N	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y	N	Y	N	N
Views from within highly sensitive landscape areas	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Primary views from residences	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Intensity of use, popularity (number of viewers)	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Viewer connection with the landscape	N	N	N	N	N	Y	Y	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Provision of vast, elevated panoramic views	N	N	N	Y	N	Y	N	Y	Y	N	Y	N	Y	Y	N	N	Y	N	Y	N	Y
Sense of remoteness and/or tranquillity at the viewing location	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	Y	Y	Y	Y
Degree of perceived naturalness	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Presence of striking or noteworthy features	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Sense of Historical, cultural and / or spiritual significance	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N

Rarity or uniqueness of the view	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Integrity of the landscape character within the view	Y	Y	Y	N	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Sense of place at the viewing location	N	Y	Y	Y	Y	Y	Y	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N
Sense of awe	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	Y	N	N
Overall sensitivity assessment	**L**	**L**	**L**	**L**	**L**	**M**	**M**	**L**	**L**	**L**	**L**	**M**	**M**	**M**	**M**	**M**	**M**	**M**	**H**	**M**	**M**

Notes: **N** implies 'no', the VRP is generally not sensitive with respect to the assessment criterion, whereas **Y** implies 'yes' it is sensitive

N = Negligible; **L** = low sensitivity; **M** = medium sensitivity; **H** = high sensitivity; **VH** = very high sensitivity

REFERENCE DOCUMENTS

9.3.2.2 Visual Impact Magnitude

The magnitude of visual effects is determined on the basis of two factors; the visual presence of the proposal and its effect on visual amenity.

Visual presence is something of a quantitative measure relating to how noticeable or visually dominant the proposal is within a particular view. This is based on a number of aspects beyond simply scale in relation to distance. Some of these include the extent of the view as well as its complexity and the degree of movement experienced i.e. within a busy street scene. The backdrop against which the development is presented and its relationship with other focal points or prominent features within the view is also considered. Visual presence is essentially a measure of the relative visual dominance of the proposal within the available vista and is often expressed as such i.e. sub-dominant, co-dominant, dominant, highly dominant.

For wind energy developments a strong visual presence is not necessarily synonymous with adverse impact as might be the case for a factory, a road or electricity pylons, for which the general consensus is likely to be almost wholly negative. Instead, the 2003 SEI funded survey of 'Attitudes Towards The Development of Wind Farms in Ireland' found that *"wind farms are seen in a positive light compared to other utility-type structures that could be built on the landscape"*. Furthermore, a clear and comprehensive view of a wind farm might be preferable in many instances to a partial and confusing view of turbine components that are not so noticeable within a view. On the basis of these reasons, the visual amenity aspect of assessing impact magnitude is qualitative and considers such factors as the spatial arrangement of turbines both within the scheme and in relation to surrounding terrain and land cover. It also examines whether the development contributes positively to the existing qualities of the vista or results in distracting visual effects and disharmony.

It should be noted that as a result of this two-sided analysis, a high order visual presence can be moderated by a low level of effect on visual amenity and vice versa. Given that wind turbines do not represent significant bulk, visual impacts result almost entirely from visual 'intrusion' rather than visual 'obstruction' (the blocking of a view). The magnitude of visual impacts is classified in the following table;

Table 9-6 Magnitude of Visual Impact

Criteria	Description
Very High	The proposal intrudes into a large proportion or critical part of the available vista and is without question the most noticeable element. A high degree of visual clutter or disharmony is also generated, strongly reducing the visual amenity of the scene
High	The proposal intrudes into a significant proportion or important part of the available vista and is one of the most noticeable elements. A considerable degree of visual clutter or disharmony is also likely to be generated, appreciably reducing the visual amenity of the scene
Medium	The proposal represents a moderate intrusion into the available vista, is a readily noticeable element and/or it may generate a degree of visual clutter or disharmony, thereby reducing the visual amenity of the scene. Alternatively, it may represent a balance of higher and lower order estimates in relation to visual presence and visual amenity
Low	The proposal intrudes to a minor extent into the available vista and may not be noticed by a casual observer and/or the proposal would not have a marked effect on the visual amenity of the scene
Negligible	The proposal would be barely discernible within the available vista and/or it would not detract from, and may even enhance, the visual amenity of the scene

9.3.2.3 Visual Impact Significance

As stated above, the significance of visual impacts is a function of visual receptor sensitivity and visual impact magnitude. This relationship is expressed in the following significance matrix;

Table 9-7 Visual Impact Significance Matrix

	Sensitivity of Receptor				
Scale/Magnitude	*Very High*	*High*	*Medium*	*Low*	*Negligible*
Very High	Profound	Profound-major	Major	Moderate	Minor
High	Profound-major	Major	Major-moderate	Moderate-minor	Minor-negligible
Medium	Major	Major-moderate	Moderate	Minor	Negligible
Low	Moderate	Moderate-minor	Minor	Minor-negligible	Negligible
Negligible	Minor	Minor-negligible	Negligible	Negligible	Negligible

REFERENCE DOCUMENTS

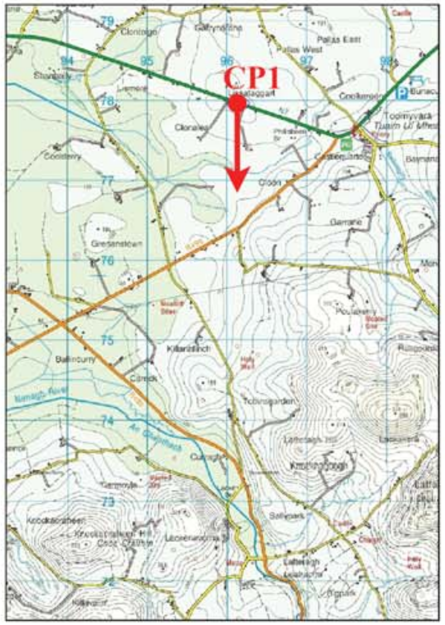
CP1: View from Toomevara

Photomontage and wireframe depiction of the proposed Upperchurch wind farm

Focal lenght: 50mm
Recommended viewing distance: 39cm

CP1

CP1: Toomevara	
CP1 Grid Reference:	E196146 N177960
Viewpoint elevation	132m
Nearest proposed Upperchurch turbine	15.2km
No. proposed Upperchurch turbine hubs visible	12
No. proposed Upperchurch turbine blade sets visible	12
Direction of view	S



Panned view showing the cumulative visual influence of the proposed Upperchurch turbines with the existing and permitted wind farms in the area in a landscape context

9.3.2.4 Estimation of Visual Impacts at VRPs

Viewshed Reference Point		Direction of View	Distance to nearest turbine:	Number of turbine hubs visible:
CP1	Toomevara	S	15.2	12

Representative of:

- An area identified on the ZTV map as having a theoretical view of 19-22 of the proposed turbines
- A settlement
- A regional road

Receptor Sensitivity **Low**

Existing View

This is a slightly elevated and fairly broad panorama that is interrupted somewhat by roadside vegetation. Across a flat pastoral landscape of large geometric fields and broadleaf hedgerows can be seen two distinctive sets of hills. The one to the left is the Devils Bit range and to the right is the northern extent of the Silvermines range. A broad saddle lies between the higher undulating ridgelines of these two linked sets of hills. Several turbines from the Curraghgraigue wind farm can be faintly seen in the base of this saddle.

Visual Impact of Upperchurch Wind Farm

Some of the proposed turbines will be just visible in the base of the low saddle between the sets of hills described above. Only the western end of the scheme can be seen above a band on intervening vegetation and these also rise above the skyline so that they are faintly seen in silhouette against the sky. At this distance the turbines are seen at a very small scale. They are also oblique to the road and within a relatively complex vista, which makes them a barely noticeable feature.

The visible turbines are seen in an unambiguous manner with a staggered linear layout and an undulating profile that complements the terrain and land cover patterns within the view. The turbines represent an extension and intensification of wind energy development in this portion of the view and are not, therefore, an unfamiliar element. Overall the magnitude of visual impact is deemed to be negligible.

Summary

Based on the assessment criteria and matrices outlined at section 9.3.2 the significance of visual impact is summarised below.

Visual Receptor Sensitivity	Visual Impact Magnitude	**Significance of Visual Impact**
Low	Negligible	**Negligible**

CP2: View from Borrisoleigh

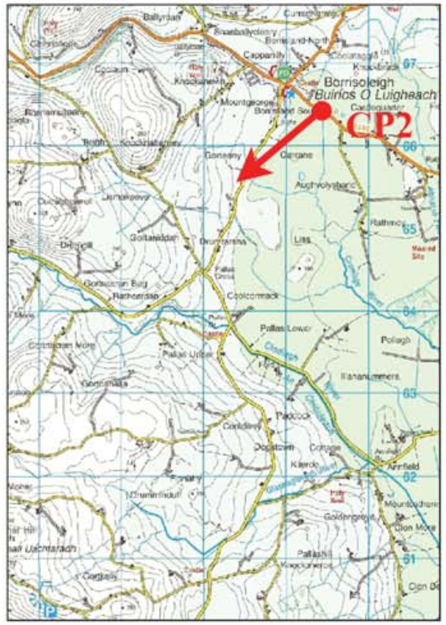
Photomontage and wireframe depiction of the proposed Upperchurch wind farm

Focal lenght: 50mm
Recommended viewing distance: 39cm

CP2

CP2: Borrisoleigh

CP2 Grid Reference:	E203435 N166415
Viewpoint elevation	100m
Nearest proposed Upperchurch turbine	7.2km
No. proposed Upperchurch turbine hubs visible	13
No. proposed Upperchurch turbine blade sets visible	14
Direction of view	SW



REFERENCE DOCUMENTS

Panned view showing the cumulative visual influence of the proposed Upperchurch turbines with the existing and permitted wind farms in the area in a landscape context

Viewshed Reference Point		Direction of View	Distance to nearest turbine:	Number of turbine hubs visible:
CP2	Borrisoleigh	SW	7.2km	13

Representative of:

- An area identified on the ZTV map as having a theoretical view of between 13 and 18 of the proposed turbines
- A centre of population
- A regional road

Receptor Sensitivity **Low**

Existing View

This is a view towards the Slieve Felim mountains from the outskirts of Borrisoleigh. The foreground of the view is transitional in character with fields and hedgerows to the left and the built environment of the village to the right. An open field defined by mature broadleaf trees lies directly in front of the viewer. These trees limit the view of the surrounding hills so that only sections of the undulating ridgeline are apparent.

Visual Impact of Upperchurch Wind Farm

The proposed turbines are seen in two dense clusters within the tops of the intervening trees and above the more distant skyline ridge. Whilst the overlapping of several of the turbines might draw attention as the blades cross over each other, the scheme is relatively camouflaged by the foreground trees. The blade sets of the turbines are seen at a modest scale from this distance and within a broad vista. The visual presence of the scheme is considered to be sub-dominant from here.

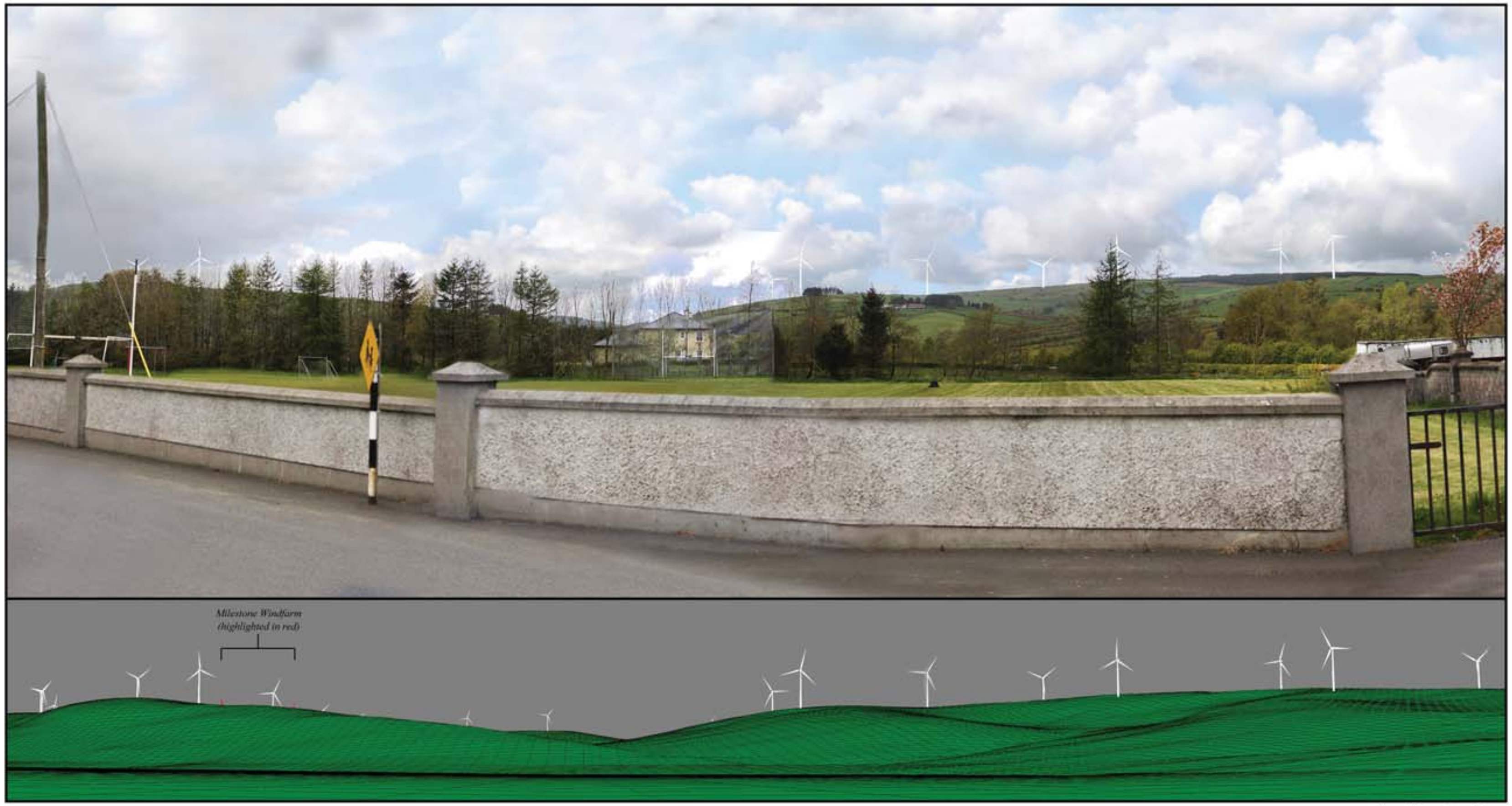
The view of the tightly clustered and overlapping turbines within the vegetated skyline is somewhat ambiguous and also generates a degree of visual clutter. These undesirable effects are moderated slightly by the low order of visual presence. On the basis of these factors the magnitude of the visual impact at CP2 is deemed to be medium.

Summary

Based on the assessment criteria and matrices outlined at section 9.3.2 the significance of visual impact is summarised below.

Visual Receptor Sensitivity	Visual Impact Magnitude	**Significance of Visual Impact**
Low	medium	**Minor**

CP3: View from Upperchurch



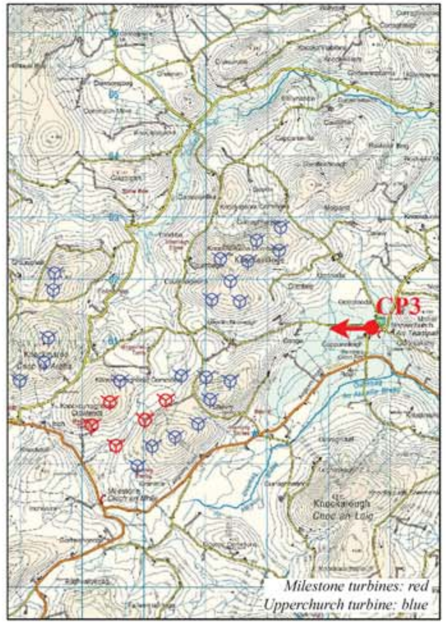
Focal Lenght: 20mm
Recommended viewing distance: 10cm

Photomontage and wireframe depiction of the proposed Upperchurch wind farm

CP3

CP3: Upperchurch

CP3 Grid Reference:	E198670 N161178
Viewpoint elevation	190m
Nearest proposed Upperchurch turbine	1.9km
No. proposed Upperchurch turbine hubs visible	16
No. proposed Upperchurch turbine blade sets visible	19
Direction of view	W



Panned view showing the cumulative visual influence of the proposed Upperchurch turbines with the existing and permitted wind farms in the area in a landscape context

Viewshed Reference Point		Direction of View	Distance to nearest turbine:	Number of turbine hubs visible:
CP3	Upperchurch	W	1.9km	16

Representative of:

- An area identified on the ZTV map as having a theoretical view of between 19 and 22 of the proposed turbines
- The closest settlement to the proposed wind farm

Receptor Sensitivity **Low**

Existing View

This is a view across a playing field from the core of Upperchurch Village. Some conifer screening at the edge of the field veils the view of the rolling hills that form a backdrop to this scene at a relatively short distance. These hills have a mixed land cover of both agriculture and silviculture. Dwellings and commercial premises can be seen to the left and right in this typical rural village street scene.

Visual Impact of Upperchurch Wind Farm

The proposed wind farm will line the ridge that contains this westerly view. The turbines are almost all fully revealed in silhouette above the skyline and the uphill view of them tends to accentuate their height. The lateral extent of the scheme is considerable when viewed from here as it occupies much of the westerly view. Even though the turbines will be a background feature of this dynamic street scene they are considered to have a dominant visual presence.

There is a relaxed linear rhythm to the spacing of the turbines and for the most part the clear view of them above the skyline makes for an unambiguous view of the scheme. However, there will be partial screening of some of the turbines by the conifers in the foreground and the blade sets will cut against the branches in perspective. This is a typical view from Upperchurch in that all of the turbines are seldom visible at once, but some will almost always be visible as part of the western backdrop of the settlement. Overall the magnitude of the visual impact is deemed to be high from Upperchurch.

Summary

Based on the assessment criteria and matrices outlined at section 9.3.2 the significance of visual impact is summarised below.

Visual Receptor Sensitivity	Visual Impact Magnitude	**Significance of Visual Impact**
Low	High	**Moderate-minor**

CP4: View from Thurles

Photomontage and wireframe depiction of the proposed Upperchurch wind farm

Focal lenght: 50mm
Recommended viewing distance: 39cm

CP4

CP4: Thurles

CP4 Grid Reference:	E210471 N159701
Viewpoint elevation	107m
Nearest proposed Upperchurch turbine	13.5km
No. proposed Upperchurch turbine hubs visible	21
No. proposed Upperchurch turbine blade sets visible	22
Direction of view	W

Panned view showing the cumulative visual influence of the proposed Upperchurch turbines with the existing and permitted wind farms in the area in a landscape context

Viewshed Reference Point		Direction of View	Distance to nearest turbine:	Number of turbine hubs visible:
CP4	Thurles	W	13.5km	21

Representative of:

- An area identified on the ZTV map as having a theoretical view of between 19 and 22 of the proposed turbines
- A significant settlement
- A regional road

Receptor Sensitivity **Low**

Existing View

This is a broad and elevated view from the western outskirts of Thurles at the top of a rise. For motorists travelling west this expansive view opens abruptly from a relatively confined urban context and the viewer becomes immediately aware the landscape ahead of them. This consists of peri-urban housing in the foreground followed by gently rolling, lowland fields in the middle ground and finally the undulating backdrop of the Slieve Felim mountains. Turbines from the Glenough wind farm can be seen above the skyline ridge.

Visual Impact of Upperchurch Wind Farm

The proposed turbines will be visible at a relatively small scale, but covering a substantial section of the visible ridgeline in the centre of the panorama afforded from here. A viewer's eye is drawn through this vista towards the distinctive skyline and as such the proposed wind farm will be a noticeable feature. The turbines rise above the skyline and will be camouflaged slightly against a backdrop of sky, especially when viewed from this distance.

The turbines have an appropriate staggered linear layout and undulating profile that reflects the underlying ridge. There are only a few minor instances of turbine overlap. Whilst the proposed wind farm represents an additional, but characteristic feature in this section of the view there is a sense that wind energy development is beginning to dominate this part of the skyline. On balance of these reasons the magnitude of the visual impact at CP3 is considered to be medium.

Summary

Based on the assessment criteria and matrices outlined at section 9.3.2 the significance of visual impact is summarised below.

Visual Receptor Sensitivity	Visual Impact Magnitude	**Significance of Visual Impact**
Low	Medium	**Minor**

CP5: View from Holycross

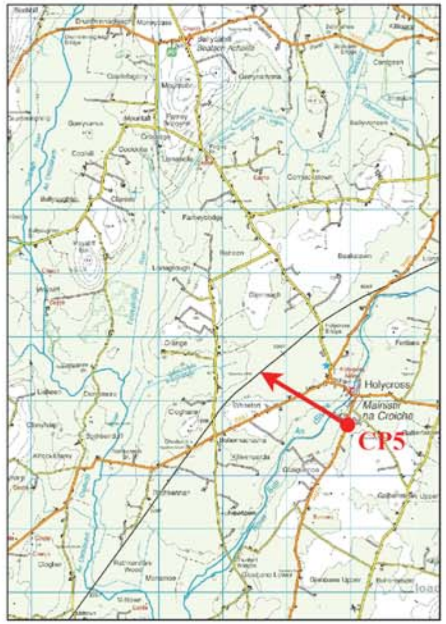
Photomontage and wireframe depiction of the proposed Upperchurch wind farm

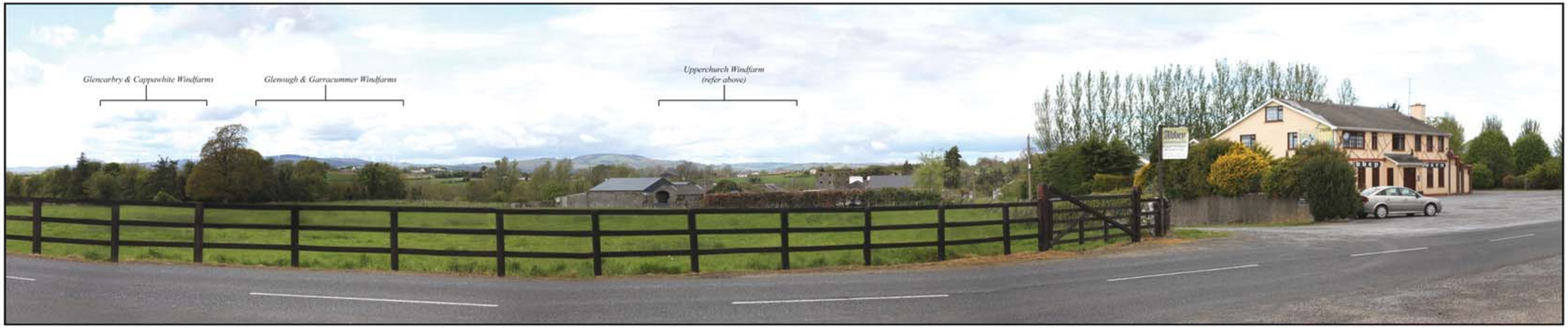
Focal lenght: 50mm
Recommended viewing distance: 39cm

CP5

CP5: Holycross

CP5 Grid Reference:	E208937 N153643
Viewpoint elevation	94m
Nearest proposed Upperchurch turbine	14.1km
No. proposed Upperchurch turbine nacelles visible	9
No. proposed Upperchurch turbine blade sets visible	9
Direction of view	NW





Panned view showing the cumulative visual influence of the proposed Upperchurch turbines with the existing and permitted wind farms in the area in a landscape context

Viewshed Reference Point		Direction of View	Distance to nearest turbine:	Number of turbine hubs visible:
CP5	Holycross	NW	14.1km	9

Representative of:

- An area identified on the ZTV map as having a theoretical view of between 7 and 12 of the proposed turbines
- A settlement
- A regional road

Receptor Sensitivity **Low**

Existing View This view takes in the rolling rural hinterland of Holycross, which comprises of fields and hedgerows as well as some riparian vegetation in the lower foreground associated with the River Suir. This vista is contained in the distance by the undulating profile of the Slieve Felim range. A number of turbines from the Glenough wind farm can be seen above the ridgeline.

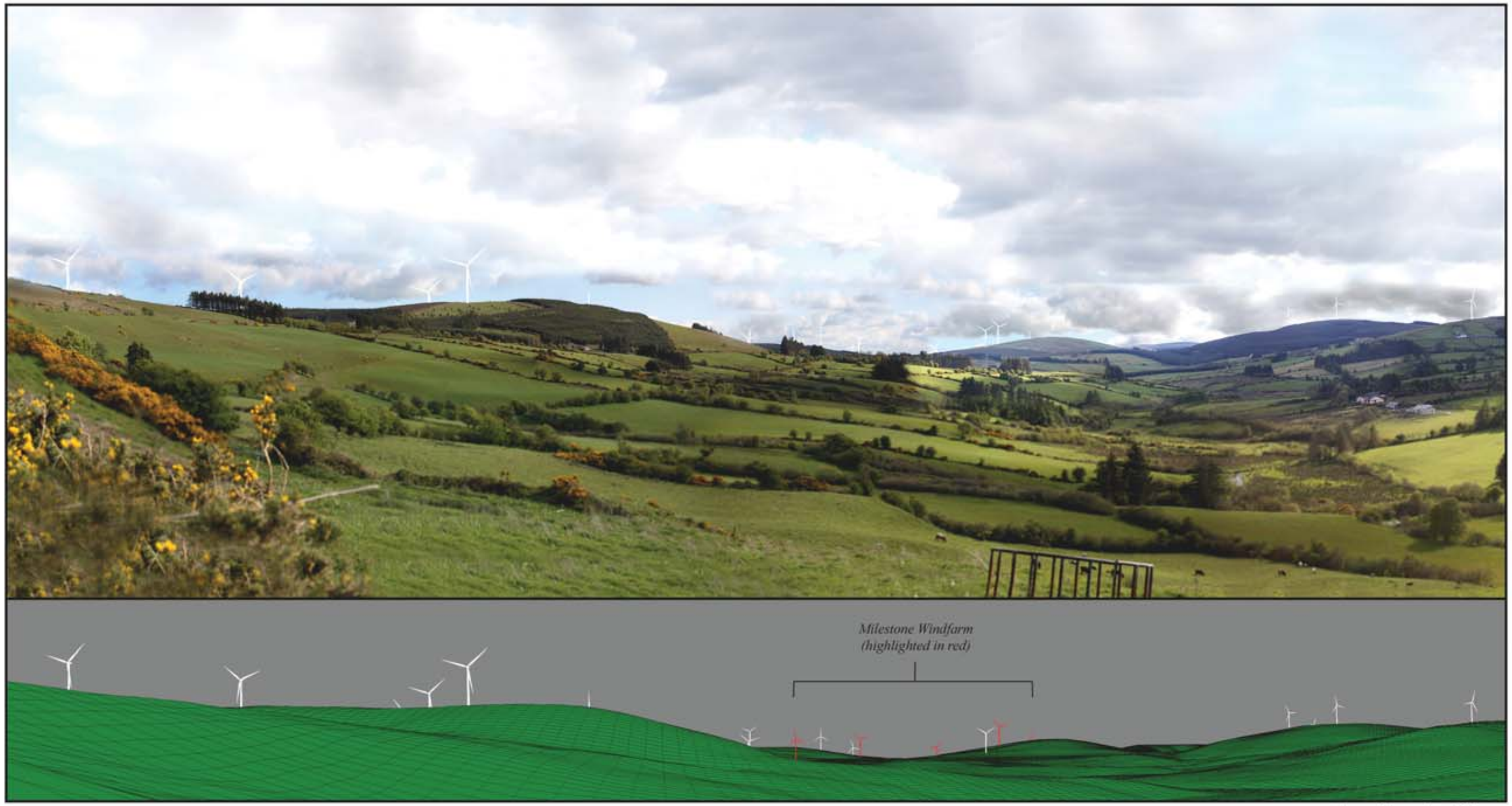
Visual Impact of Upperchurch Wind Farm Nine of the proposed turbines will be seen in silhouette above the skyline ridge, which tends to deemphasise them in comparison to a darker terrain backdrop. They are a fairly small scale but prominently located feature within this view. The visual presence of the development is considered to be sub-dominant from this location.

The visible turbines are relatively evenly spaced in what is an unambiguous view of the scheme. The profile of the development also matches that of the ridge below. One minor detraction, in an aesthetic sense, is the view of a single turbine from the substantially screened southerly cluster penetrating just above the skyline so that its blades will cut against the ridge in perspective. There is also a significant portion of the visible skyline now subject to wind farm development. This is ameliorated somewhat by the screening of half of the proposed scheme behind a hilltop. Overall the visual impact magnitude is deemed to be low.

Summary Based on the assessment criteria and matrices outlined at section 9.3.2 the significance of visual impact is summarised below.

Visual Receptor Sensitivity	Visual Impact Magnitude	**Significance of Visual Impact**
Low	Low	**Minor-negligible**

LC1: View from Garranakilka



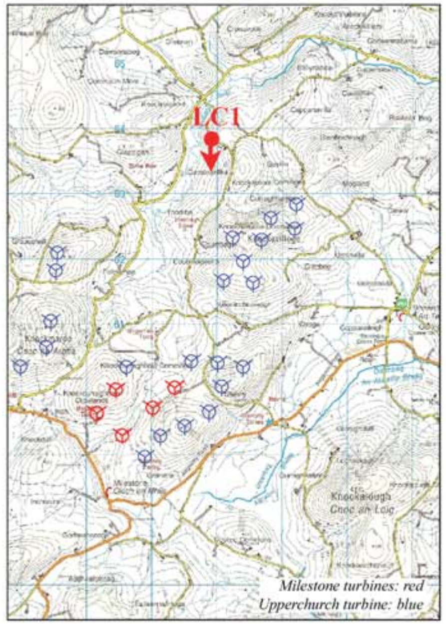
Focal Lenght: 20mm
Recommended viewing distance: 10cm

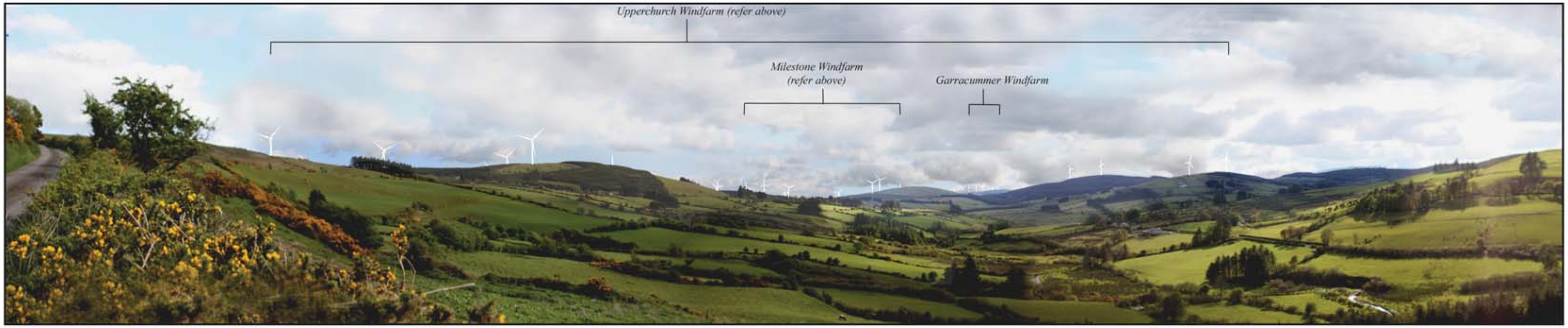
Photomontage and wireframe depiction of the proposed Upperchurch wind farm

LC1

LC1: Garranakilka

LC1 Grid Reference:	E195943 N163825
Viewpoint elevation	247m
Nearest proposed Upperchurch turbine	1.5km
No. proposed Upperchurch turbine hubs visible	12
No. proposed Upperchurch turbine blade sets visible	15
Direction of view	S





Panned view showing the cumulative visual influence of the proposed Upperchurch turbines with the existing and permitted wind farms in the area in a landscape context

REFERENCE DOCUMENTS

Viewshed Reference Point		Direction of View	Distance to nearest turbine:	Number of turbine hubs visible:
LC1	Local road at Garranakilka	S	1.5km	12

Representative of:

- An area identified on the ZTV map as having a theoretical view of between 13 and 18 of the proposed turbines
- Views from local roads and residences to the north of the site

Receptor Sensitivity **Medium**

Existing View This is an elevated but enclosed view of the upper Clodiagh Valley. The base of the valley has a strong pastoral aesthetic comprising a pattern of fields hedgerows and occasional farmsteads. On the upper slopes and ridges that contain the view there are a number of substantial sized forest plantations. The vista has a tranquil, upland, rural character.

Visual Impact of Upperchurch Wind Farm The proposed turbines are seen at a variety of scales due to the range in relative distances from the viewer. The nearest ones, at the left hand side of the view, are seen at a substantial scale, whilst those in the centre of the view are seen at a more modest scale. The wind farm wraps around the head of this valley and turbines will occupy the skyline ridges throughout the southerly aspect. The uphill nature of the view also tends to emphasise the height of the turbines. The visual presence of the scheme is considered to be dominant at this location.

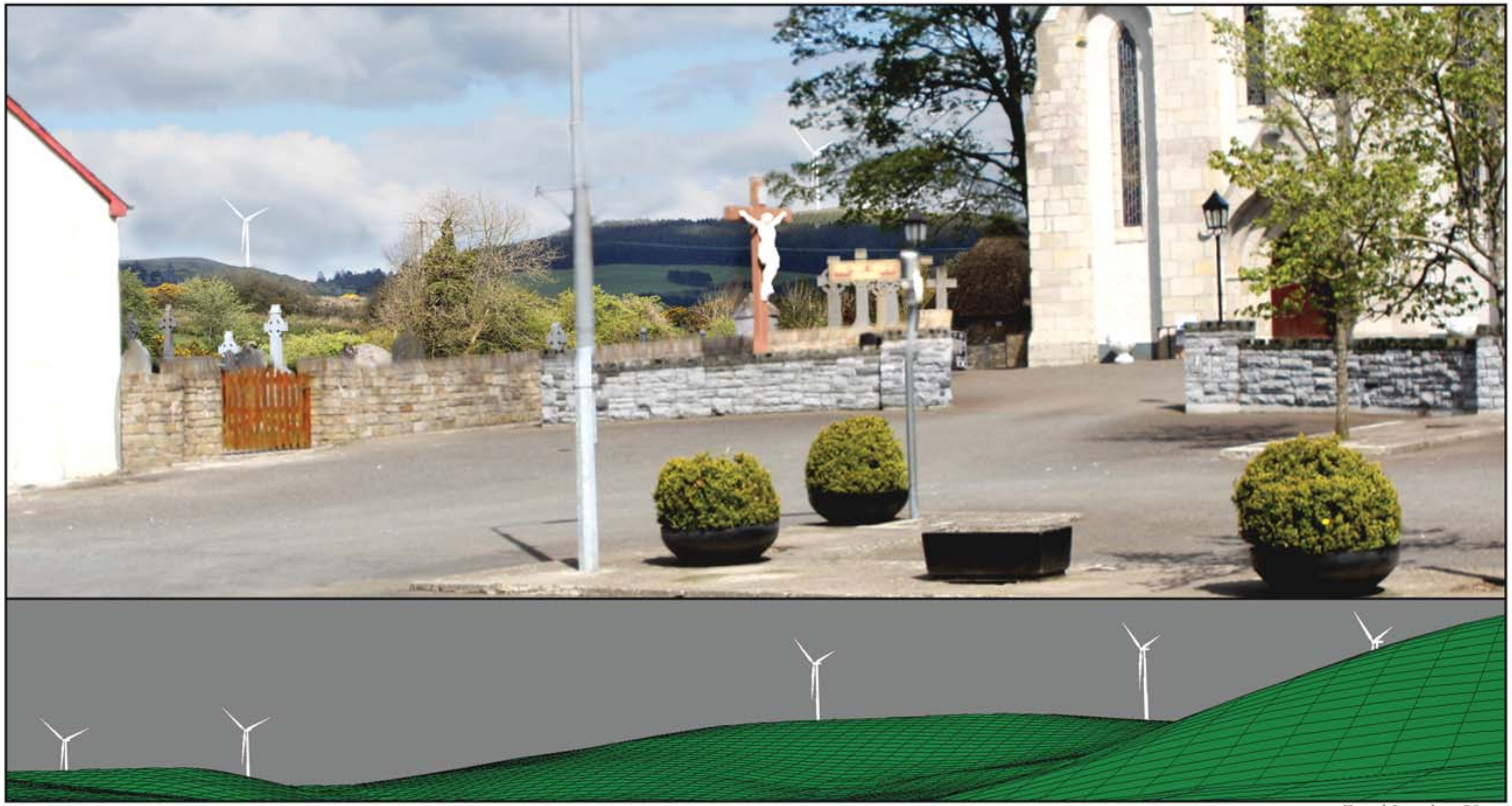
The layout of the wind farm appears extensive, but relatively dispersed from this location. Whilst there is not a strong intensity of development in any one section of the view there is a sense of being surrounded by turbines to the south. Turbines will be a new feature of this particular vista though they could not be considered an unfamiliar feature to viewers at this locality given the surrounding developments. The sense of tranquillity and remoteness in this valley will be slightly reduced by the presence of large man-made structures, but again, wind turbines are relatively synonymous with this type of upland landscape. Overall the magnitude of the visual impact at this location is deemed to be medium.

Summary Based on the assessment criteria and matrices outlined at section 9.3.2 the significance of visual impact is summarised below.

Visual Receptor Sensitivity	Visual Impact Magnitude	**Significance of Visual Impact**
Medium	Medium	**Moderate**

REFERENCE DOCUMENTS

LC2: View from Kilcommon Village



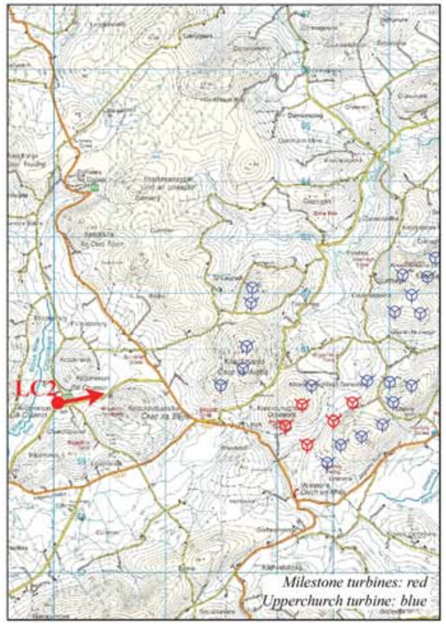
Photomontage and wireframe depiction of the proposed Upperchurch wind farm

Focal Lenght: 50mm
Recommended viewing distance: 39cm

LC2

LC2: Kilcommon Village

LC2 Grid Reference:	E190094 N160019
Viewpoint elevation	202m
Nearest proposed Upperchurch turbine	2.9km
No. proposed Upperchurch turbine hubs visible	4
No. proposed Upperchurch turbine blade sets visible	4
Direction of view	E



Panned view showing the cumulative visual influence of the proposed Upperchurch turbines with the existing and permitted wind farms in the area in a landscape context

Viewshed Reference Point		**Direction of View**	**Distance to nearest turbine:**	**Number of turbine hubs visible:**
LC2	Kilcommon Village	E	2.9km	4

Representative of:

- An area identified on the ZTV map as having a theoretical view of between 1 and 6 of the proposed turbines
- A settlement
- General views from local roads and residences a short distance to the west of the site

Receptor Sensitivity **Medium**

Existing View

This is a confined view from the centre of Kilcommon Village over the rural landscape to the west. The foreground of this vista is dominated by the settlement's church and graveyard. Beyond the edge of the settlement are steeply rolling hills cloaked in a mixture of pastoral fields and conifer plantations.

Visual Impact of Upperchurch Wind Farm

Three of the proposed turbines can be seen at a noticeable scale rising above the skyline ridges that contain this view to the east. Two of the turbines are partially obscured by buildings and by trees and headstones from the foreground graveyard and another is only visible from just below the hub behind a forested section of ridge. Because the view of the scheme is limited and it is a background element of this complex vista the visual presence is deemed to be sub-dominant.

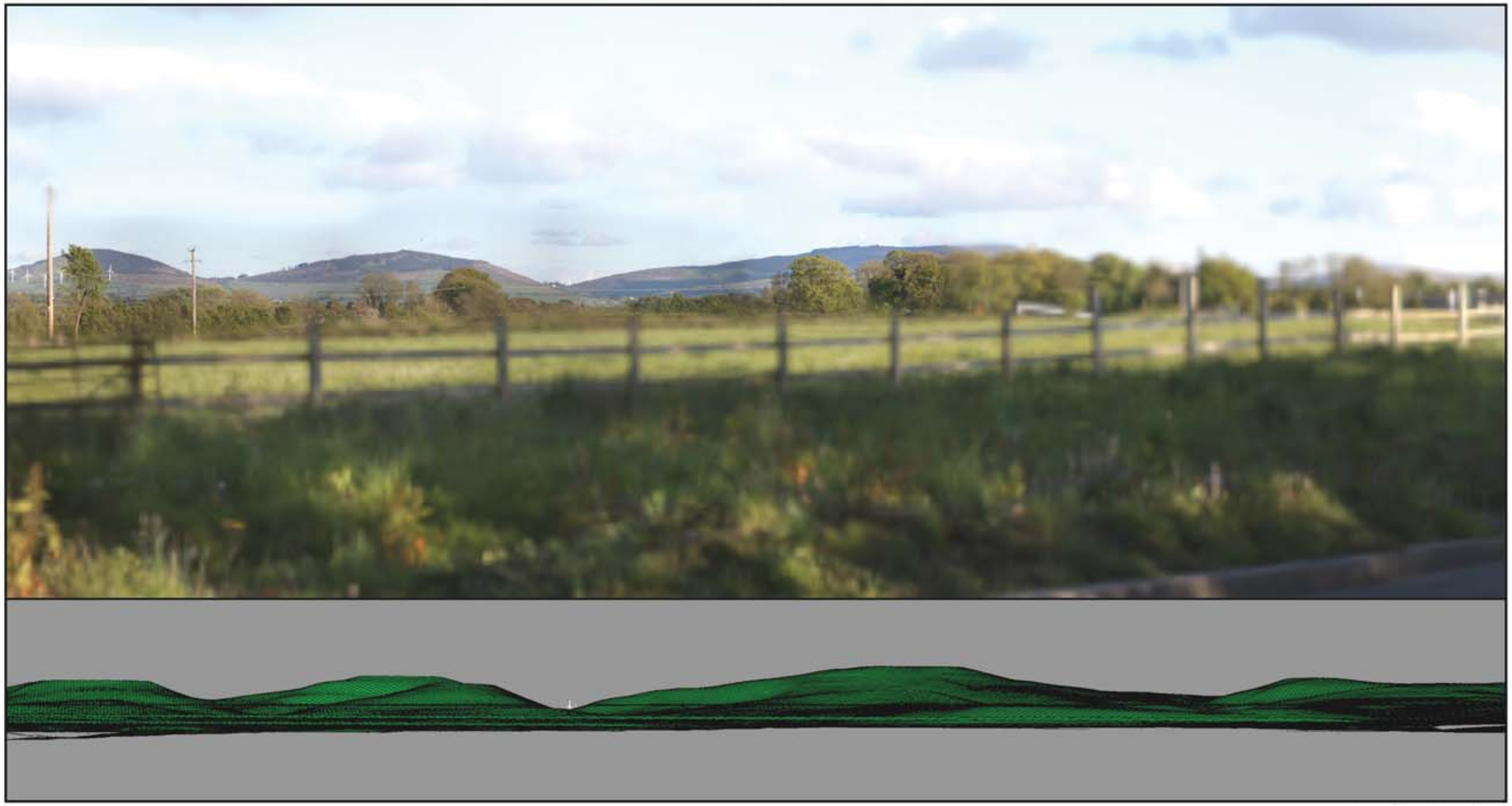
The rural context of the turbines is clearly apparent but there are some issues of turbines overlapping within intervening landscape elements that might cause a degree of visual clutter and confusion. The approach to the church affords views over the rural countryside beyond and the turbines are not an unexpected element in this scene. Overall, the visual impact magnitude is considered to be Low at LC2.

Summary

Based on the assessment criteria and matrices outlined at section 9.3.2 the significance of visual impact is summarised below.

Visual Receptor Sensitivity	Visual Impact Magnitude	**Significance of Visual Impact**
Medium	Low	**Minor**

MR1: View from Nenagh



Photomontage and wireframe depiction of the proposed Upperchurch wind farm

Focal lenght: 50mm
Recommended viewing distance: 39cm

MR1

MR1: Nenagh

MR1 Grid Reference:	E186164 N178158
Viewpoint elevation	60m
Nearest proposed Upperchurch turbine	17.7km
No. proposed Upperchurch turbine hubs visible	1
No. proposed Upperchurch turbine blade sets visible	2
Direction of view	SE

Panned view showing the cumulative visual influence of the proposed Upperchurch turbines with the existing and permitted wind farms in the area in a landscape context

Viewshed Reference Point		Direction of View	Distance to nearest turbine:	Number of turbine hubs visible:
MR1	Nenagh	SE	17.7km	1

Representative of:

- An area identified on the ZTV map as having a theoretical view of between 1 and 6 of the proposed turbines
- A significant settlement
- A regional road
- A worst case scenario view from this section of the national rail network
- Similar views from the Nenagh bypass section of theM8 motorway, which is approximately 1km closer to the site

Receptor Sensitivity **Low**

Existing View This is a slightly elevated view to the south over the hinterland of Nenagh. The land cover in view comprises of urban fringe development intersecting with pastoral farmland. Hedgerow vegetation in the middle ground limits the view of much of the lowlands beyond, but the steeply undulating form of the Silvermines range rises to form a backdrop to the vista

Visual Impact of Upperchurch Wind Farm Only the blades of two turbines from the proposed development can potentially be seen in the saddle between two of the distant hills. At this considerable distance they will be barely discernible even without taking into consideration the complex, fleeting and oblique view from this location. The visual presence is therefore deemed to be minimal.

The partial view of turbine blades cutting against the skyline is generally undesirable as it can lead to visual clutter and confusion. However given the low order of visual presence the magnitude of the visual impact is judged to be negligible from here.

Summary Based on the assessment criteria and matrices outlined at section 9.3.2 the significance of visual impact is summarised below.

Visual Receptor Sensitivity	Visual Impact Magnitude	**Significance of Visual Impact**
Low	Negligible	**Negligible**

MR2: View from Borrisoleigh - Templemore Road (R501)

Photomontage and wireframe depiction of the proposed Upperchurch wind farm

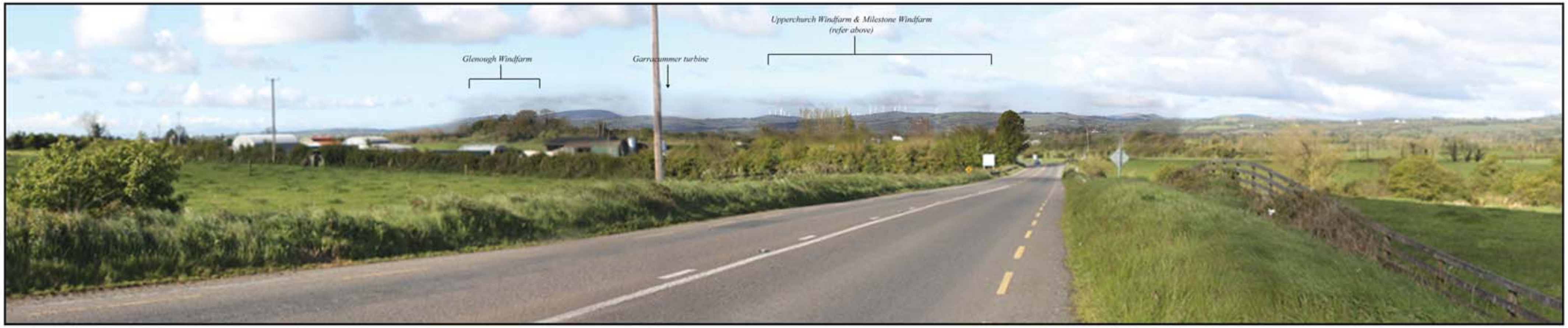
Focal lenght: 50mm
Recommended viewing distance: 39cm

MR2

MR2: Borrisoleigh - Templemore Road (R501)

MR2 Grid Reference:	E206990 N169553
Viewpoint elevation	120m
Nearest proposed Upperchurch turbine	11.9km
No. proposed Upperchurch turbine hubs visible	21
No. proposed Upperchurch turbine blade sets visible	22
Direction of view	SW

REFERENCE DOCUMENTS



Panned view showing the cumulative visual influence of the proposed Upperchurch turbines with the existing and permitted wind farms in the area in a landscape context

Viewshed Reference Point		Direction of View	Distance to nearest turbine:	Number of turbine hubs visible:
MR2	R501 Borrisoleigh - Templemore Road	SW	11.9km	21

Representative of:

- An area identified on the ZTV map as having a theoretical view of between 19 and 22 of the proposed turbines
- A regional road
- General views from the outer northeast of the study area

Receptor Sensitivity **Low**

Existing View

This is a broad panoramic vista from a slightly elevated location within the lowland context of the eastern study area. The view encompasses a mildly undulating rural landscape of fields and hedgerows that gives way to the steeper upland landscape of the Slieve Felim range in the distance. This comprises of a series of ridges and peaks that are stacked in perspective to form an undulating skyline.

Visual Impact of Upperchurch Wind Farm

The proposed wind farm is almost entirely visible in silhouette above the skyline ridge except for the partial screening of several turbines at the northern end of the scheme. The turbines are seen at a noticeable scale from this distance in a prominent part of the vista especially due to the almost direct alignment with the road. Although the lateral extent of the development is considerable it occupies only a small proportion of the skyline that is visible from this location. The visual presence of the wind farm is considered to be sub-dominant in this vista.

The profile of the development appropriately mimics that of the underlying ridge and despite the density of turbines in this staggered linear layout there are only a couple of minor instances of turbine overlap. Several of the blade sets will undesirably rotate against the skyline in perspective, but this will be only a minor detraction from the view of the development, which is otherwise unambiguous from here. The development represents an extension and intensification of wind energy development within this view and not a new and unfamiliar feature. Nonetheless, it increases the proportion of developed to undeveloped skyline ridge within the vista. On the basis of these reasons the visual impact magnitude is deemed to be medium at MR2.

Summary

Based on the assessment criteria and matrices outlined at section 9.3.2 the significance of visual impact is summarised below.

Visual Receptor Sensitivity	Visual Impact Magnitude	**Significance of Visual Impact**
Low	Medium	**Minor**

MR3: View from Thurles - Templemore Road (N62)

Photomontage and wireframe depiction of the proposed Upperchurch wind farm

Focal lenght: 50mm
Recommended viewing distance: 39cm

MR3

MR3: Thurles - Templemore Road (N62)

MR3 Grid Reference:	E210804 N165225
Viewpoint elevation	103m
Nearest proposed Upperchurch turbine	13.8km
No. proposed Upperchurch turbine hubs visible	17
No. proposed Upperchurch turbine blade sets visible	17
Direction of view	W

REFERENCE DOCUMENTS

Panned view showing the cumulative visual influence of the proposed Upperchurch turbines with the existing and permitted wind farms in the area in a landscape context

Viewshed Reference Point		Direction of View	Distance to nearest turbine:	Number of turbine hubs visible:
MR3	N62 Thurles -Templemore Road	SW	13.6km	17

Representative of:

- An area identified on the ZTV map as having a theoretical view of between 19 and 22 of the proposed turbines
- A national secondary road
- General views from the outer eastern section of the study area

Receptor Sensitivity **Low**

Existing View

This is a broad horizontal vista from within the lowland context of the eastern study area. A view of some sections of the Slieve Felim ridgeline can be seen just above foreground hedgerows that define a large grassed field. This is a fairly typical rural view over a gently undulating, productive landscape.

Visual Impact of Upperchurch Wind Farm

The proposed wind farm can be seen at a fairly small scale at this distance rising above the distant skyline. Approximately one third of the turbines at the northern end and one third at the southern end of the scheme are visible, whilst those at the centre are screened from view by intervening vegetation. The turbines are oblique to the road and may not be noticed by the casual observer passing along this route. The visual presence of the development is in the order of minimal to sub-dominant.

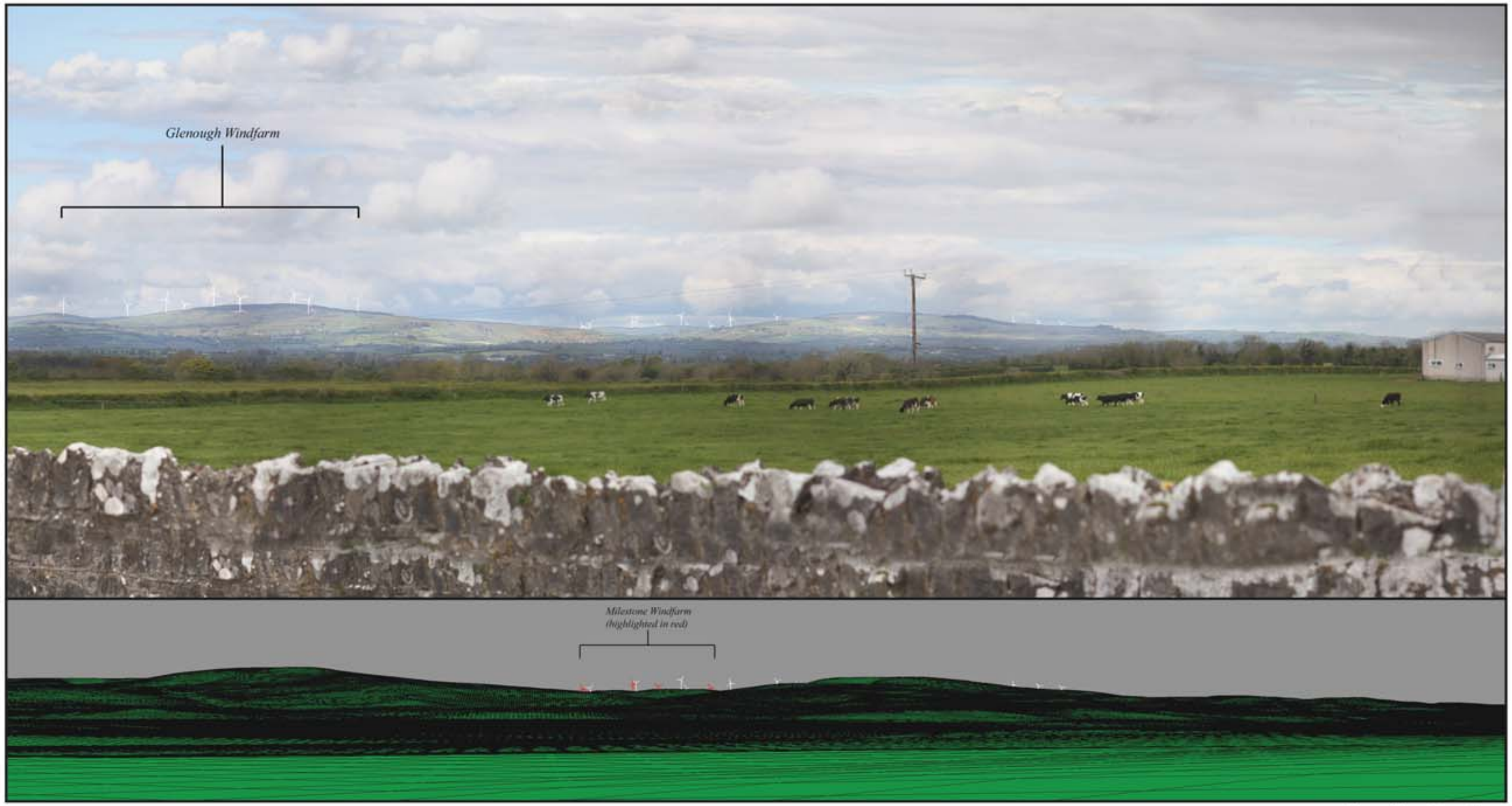
The proposed turbines are seen in a staggered linear arrangement that rises and falls in accordance with the ridgeline. There will be a minor visual distraction caused by several blade sets rotating within the middle ground tree line but this is likely to be barely noticeable giving the distances involved and the fleeting nature of the view. Overall the visual impact magnitude is deemed to be low from here.

Summary

Based on the assessment criteria and matrices outlined at section 9.3.2 the significance of visual impact is summarised below.

Visual Receptor Sensitivity	Visual Impact Magnitude	**Significance of Visual Impact**
Low	Low	**Minor-negligible**

MR4: View from Boherlahan (R660)



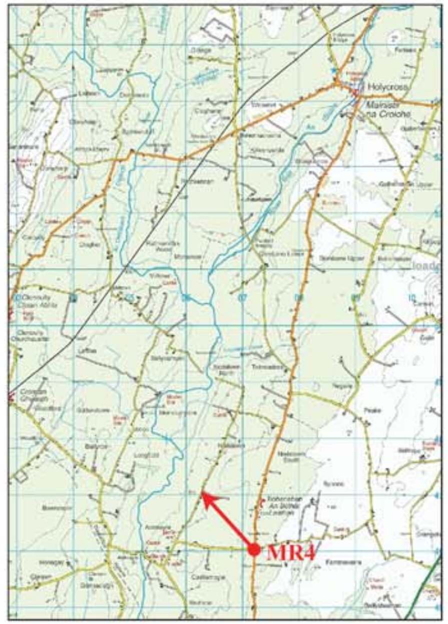
Photomontage and wireframe depiction of the proposed Upperchurch wind farm

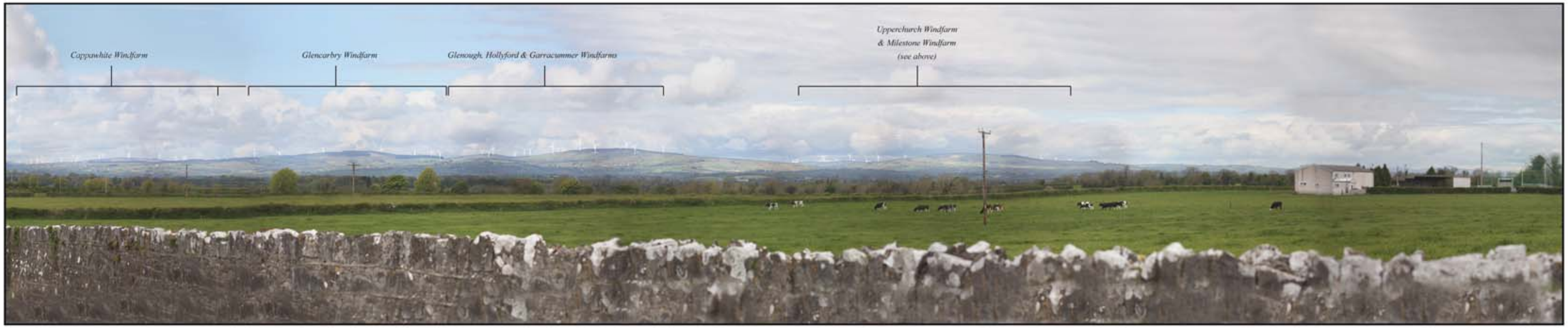
Focal lenght: 50mm
Recommended viewing distance: 39cm

MR4

MR4: Boherlahan (R660)

MR4 Grid Reference:	E207191 N146050
Viewpoint elevation	94m
Nearest proposed Upperchurch turbine	17.7km
No. proposed Upperchurch turbine hubs visible	9
No. proposed Upperchurch turbine blade sets visible	9
Direction of view	NW





Panned view showing the cumulative visual influence of the proposed Upperchurch turbines with the existing and permitted wind farms in the area in a landscape context

Viewshed Reference Point		Direction of View	Distance to nearest turbine:	Number of turbine hubs visible:
MR4	R660 at Boherlahan	NW	17.7km	9

Representative of:
- An area identified on the ZTV map as having a theoretical view of between 7 and 12 of the proposed turbines
- A regional road
- A small settlement

Receptor Sensitivity **Low**

Existing View This is a westerly view towards the Slieve Felim Mountains from the small settlement of Boherlahan that lines the R660. The intervening landscape is predominantly rural comprising of gently rolling fields and hedgerows, but with some buildings associated with the settlement visible to the right-hand side in the foreground. The turbines of the Glenough Wind Farm can be seen above the undulating skyline ridge.

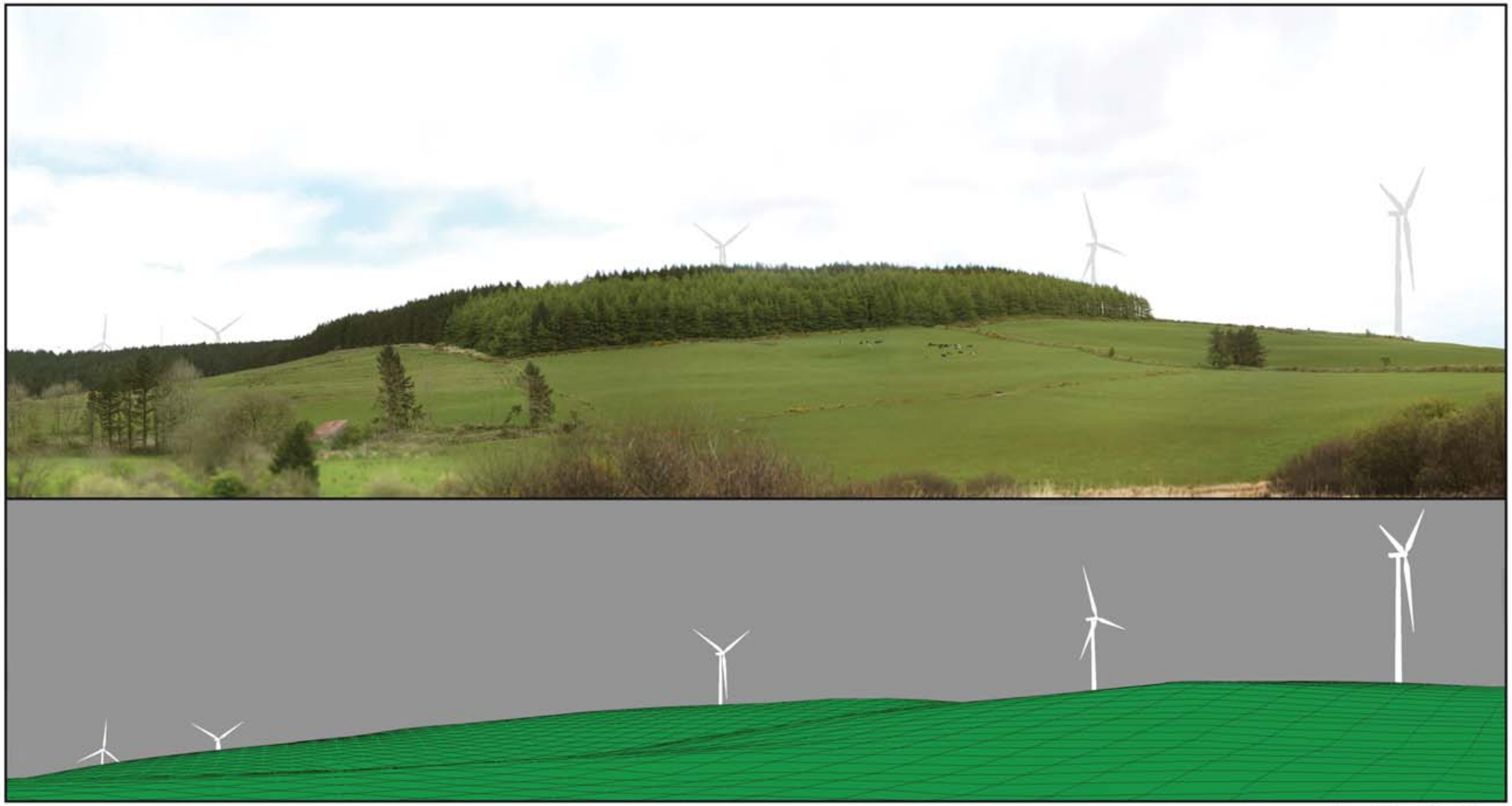
Visual Impact of Upperchurch Wind Farm The proposed wind farm is partly screened from view by a peak in the skyline ridge so that 6 turbines are almost fully revealed to the left hand side of it with only 3 blade sets seen to the right. The turbines are seen at a noticeable scale from this distance although they are less prominent than the adjacent Glenough turbines. Whilst the proposed turbines are likely to have a sub-dominant visual presence in their own right, when viewed in conjunction with the Glenough turbines the collective developments are considered to be co-dominant.

The 6 turbines at the southern end of the scheme have a fairly even spacing with only one instance of a turbine cutting against the skyline ridge, whereas all three of the visible turbines at the northern end of the scheme will generate this effect. Due to the screening of the central turbines by the intervening hilltop, the two clusters may be perceived as separate developments. Any visual confusion caused by this relationship is balanced by the fact that the prominent section of the ridgeline remains undeveloped. This is an important consideration in this instance as the proportion of developed to undeveloped skyline in this section of the view will be fairly even as a result of the proposal. On the basis of these reasons the magnitude of the visual impact is considered to be medium.

Summary Based on the assessment criteria and matrices outlined at section 9.3.2 the significance of visual impact is summarised below.

Visual Receptor Sensitivity	Visual Impact Magnitude	**Significance of Visual Impact**
Low	Medium	**Minor**

DR1: View from the Dolla Road (R497)



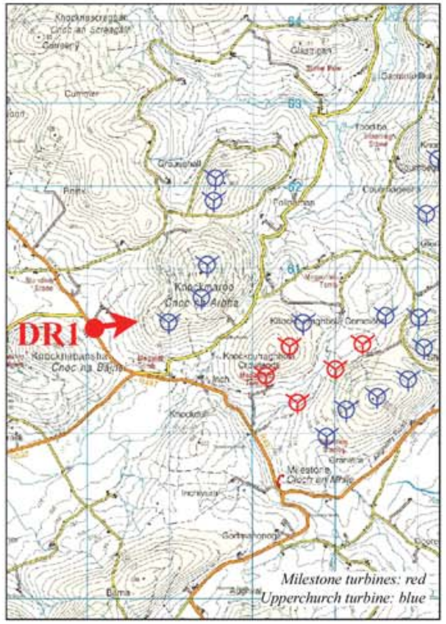
Focal lenght: 40mm
Recommended viewing distance: 21cm

Photomontage and wireframe depiction of the proposed Upperchurch wind farm

DR1

DR1: Dolla Road (R497)

DR1 Grid Reference:	E192092 N160232
Viewpoint elevation	240m
Nearest proposed Upperchurch turbine	0.9km
No. proposed Upperchurch turbine hubs visible	5
No. proposed Upperchurch turbine blade sets visible	5
Direction of view	E



REFERENCE DOCUMENTS

Panned view showing the cumulative visual influence of the proposed Upperchurch turbines with the existing and permitted wind farms in the area in a landscape context

Viewshed Reference Point		Direction of View	Distance to nearest turbine:	Number of turbine hubs visible:
DR1	Dolla Road (R497) near Anglesey Road Junction	E	0.9	5

Representative of:

- An area identified on the ZTV map as having a theoretical view of between 1 and 6 of the proposed turbines
- A designated scenic route
- A regional road

Receptor Sensitivity **Medium**

Existing View

This is a short distance uphill view over a relatively steep slope comprising of marshland at the base, pastoral farmland on the mid-slope and a forested crest. There is a thick band of marshy scrub adjacent to the road, which limits extended views from much of this section of the route.

Visual Impact of Upperchurch Wind Farm

Several of the proposed turbines rise just above the near, forested ridgeline, but due to the close proximity and the uphill nature of the view they are seen at a substantial scale. The most that can be seen of any of the turbines is a full blade set and this occurs in only one instance. For the remaining visible turbines only the hubs and blades can be seen. Given the close proximity, the proposal is considered to have a co-dominant visual presence from here.

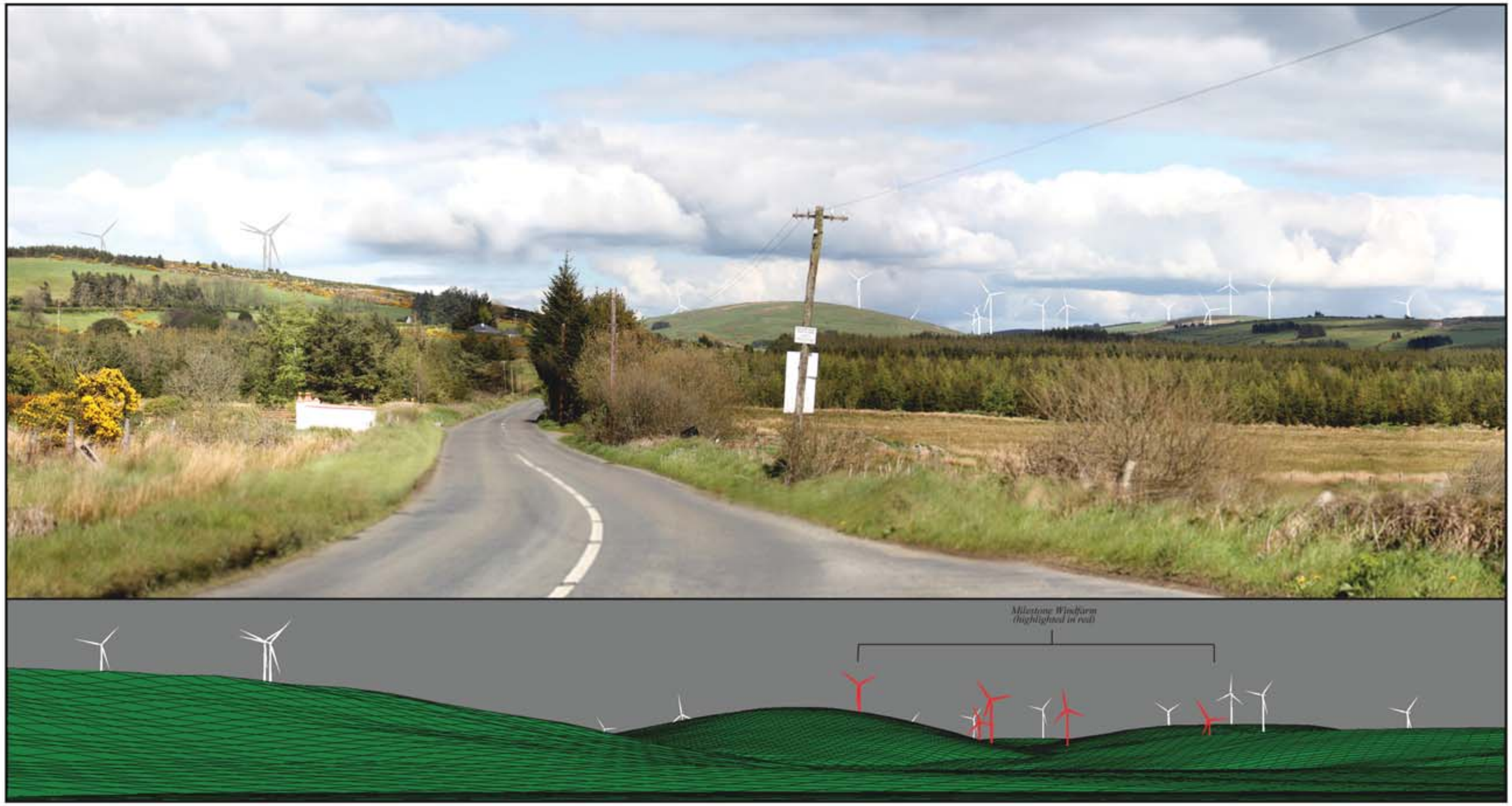
Aesthetically speaking this is not an ideal viewing scenario, with partial views of turbines cutting against a near skyline ridge. This can cause a degree of visual clutter and confusion as well as generating eye catching motion. These effects are moderated somewhat by the limited view of only a small proportion of the proposed turbines. This is also an anthropogenic vista in an area where turbines are a familiar feature. On balance the magnitude of the visual impact is deemed to be medium.

Summary

Based on the assessment criteria and matrices outlined at section 9.3.2 the significance of visual impact is summarised below.

Visual Receptor Sensitivity	Visual Impact Magnitude	**Significance of Visual Impact**
Medium	Medium	**Moderate**

DR2: View from Anglesey Road at Loughbrack



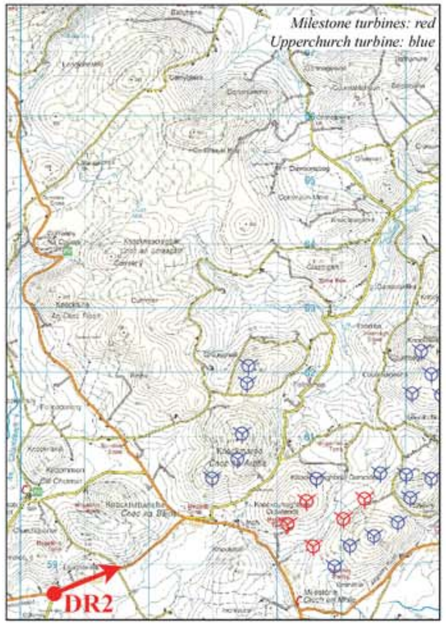
Photomontage and wireframe depiction of the proposed Upperchurch wind farm

Focal Lenght: 50mm
Recommended viewing distance: 39cm

DR2

DR2: Anglesey Road at Loughbrack

DR2 Grid Reference:	E190521 N158532
Viewpoint elevation	220m
Nearest proposed Upperchurch turbine	3.0km
No. proposed Upperchurch turbine hubs visible	11
No. proposed Upperchurch turbine blade sets visible	12
Direction of view	NE



Panned view showing the cumulative visual influence of the proposed Upperchurch turbines with the existing and permitted wind farms in the area in a landscape context

Viewshed Reference Point		Direction of View	Distance to nearest turbine:	Number of turbine hubs visible:
DR2	Anglesey Road at Loughbrack	NE	3km	11

Representative of:

- An area identified on the ZTV map as having a theoretical view of between 13 and 18 of the proposed turbines
- A designated scenic route
- Views from local roads and residences

Receptor Sensitivity **Medium**

Existing View

This is a northerly view from within the upland context of the study area. The terrain in the foreground is flat and boggy and has a land cover of rough pasture and scrub as well as extensive conifer plantations. Better quality pasture occurs on the series of rolling hills that contain the vista at a relatively short distance.

Visual Impact of Upperchurch Wind Farm

Approximately half of the proposed turbines will rise above three different hills that make up the skyline to the northeast. The nearest and largest scale turbines can be seen in a cluster of three to the left of the road alignment. The remaining turbines are seen at a slightly more modest scale. The scheme occupies a wide portion of the northerly vista and it is considered to have a dominant visual presence.

Aside from one instance of turbine overlap and a couple of blades cutting against the skyline, the scheme is unambiguously displayed from here. The extensive nature of the scheme within the view is balanced by its dispersal and, therefore, a low degree of intensity. Nonetheless there is some sense of being surrounded by turbines, at least in this northern aspect. On the basis of these reasons the magnitude of the visual impact id deemed to be medium.

Summary

Based on the assessment criteria and matrices outlined at section 9.3.2 the significance of visual impact is summarised below.

Visual Receptor Sensitivity	Visual Impact Magnitude	**Significance of Visual Impact**
Medium	Medium	**Moderate**

DR3: View from Anglesey Road near Milestone

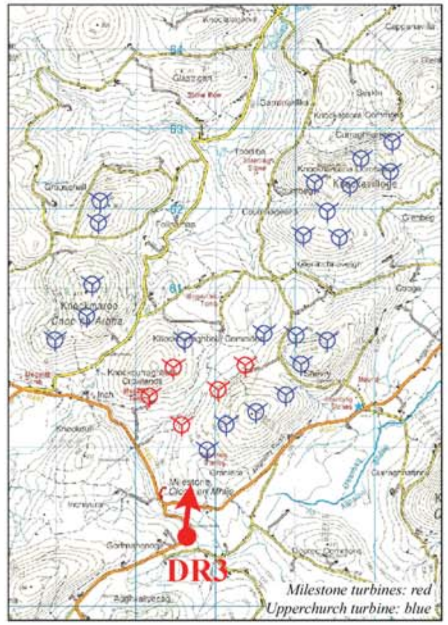
Focal lenght: 30mm
Recommended viewing distance: 39cm

Photomontage and wireframe depiction of the proposed Upperchurch wind farm

DR3

DR3: Anglesey Road near Milestone

DR3 Grid Reference:	E194669 N157872
Viewpoint elevation	250m
Nearest proposed Upperchurch turbine	1.1km
No. proposed Upperchurch turbine hubs visible	9
No. proposed Upperchurch turbine blade sets visible	10
Direction of view	N



Panned view showing the cumulative visual influence of the proposed Upperchurch turbines with the existing and permitted wind farms in the area in a landscape context

Viewshed Reference Point		Direction of View	Distance to nearest turbine:	Number of turbine hubs visible:
DR3	Anglesey Road at Milestone	N	1.1km	9

Representative of:

- An area identified on the ZTV map as having a theoretical view of between 7 and 12 of the proposed turbines
- A designated scenic route
- A regional road
- Views from local residences

Receptor Sensitivity **Medium**

Existing View

This is a relatively contained vista over the rolling landscape at the centre of the study area. In the lower foreground, the flat base of the valley is in rough pasture reflecting the boggy nature of the soil. On the more free draining slopes above are large pastoral fields divided by scrubby hedgerows.

Visual Impact of Upperchurch Wind Farm

Only five of the proposed turbines can be seen clearly from here rising above the undulating ridgeline, whilst several others are substantially screened by the ridge or intervening vegetation. The nearest turbines, which are almost fully revealed, are seen at a significant scale, but there is a considerable scale differential to those that are seen further in the distance. The turbines will be the most noticeable singular element in this vista and as such they are considered to have a dominant visual presence.

The scale differential between the nearest and furthest of the turbines creates a striking sense of perspective that contributes to the picturesque qualities of this vista. It also reveals the extensive nature of this scheme, but as with other close views, this is countered by the limited number of visible turbines and the apparent low intensity of the development. There are a couple of instances of turbines blades cutting against the ridgeline and foreground vegetation. However, these are fairly minor issues in the context of what is otherwise an uncomplicated view of the scheme. Overall the magnitude of the visual impact is considered to be medium.

Summary

Based on the assessment criteria and matrices outlined at section 9.3.2 the significance of visual impact is summarised below.

Visual Receptor Sensitivity	Visual Impact Magnitude	**Significance of Visual Impact**
Medium	Medium	**Moderate**

DR4: View from the Anglesey Road at Ruan

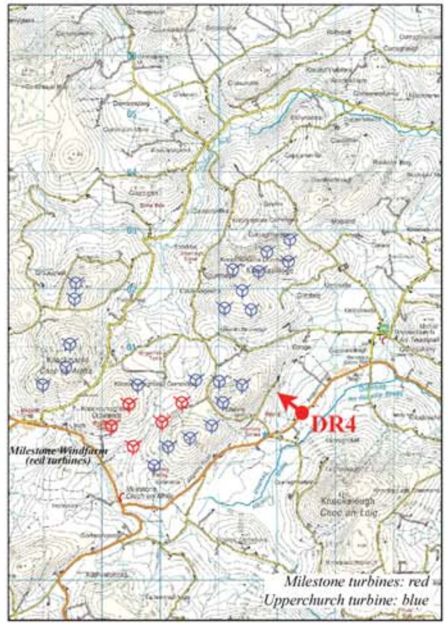
Photomontage and wireframe depiction of the proposed Upperchurch wind farm

Focal lenght: 15mm
Recommended viewing distance: 8cm

DR4

DR4: Anglesey Road at Ruan

DR4 Grid Reference:	E197436 N159843
Viewpoint elevation	206m
Nearest proposed Upperchurch turbine	1.1km
No. proposed Upperchurch turbine hubs visible	12
No. proposed Upperchurch turbine blade sets visible	13
Direction of view	W - NW



REFERENCE DOCUMENTS

Panned view showing the cumulative visual influence of the proposed Upperchurch turbines with the existing and permitted wind farms in the area in a landscape context

Viewshed Reference Point		Direction of View	Distance to nearest turbine:	Number of turbine hubs visible:
DR4	Anglesey Road at Ruan	NW	1.1km	12

Representative of:

- An area identified on the ZTV map as having a theoretical view of between 13 and 18 of the proposed turbines
- A designated scenic route
- A regional road
- Views from local residences

Receptor Sensitivity **Medium**

Existing View

This is a somewhat confined view from within the rolling upland context of the central study area. The foreground roadside context of a dwelling and nearby hedgerow limits the view over the landscape beyond until a steep ridge emerges to contain the vista at a modest distance. The slopes below the ridge are clad in pastoral fields and sporadic hedgerows as well as small stands of conifers and patches of scrubby vegetation.

Visual Impact of Upperchurch Wind Farm

Five of the proposed turbines from the southern cluster of the scheme can be seen rising at a prominent scale above the near ridgeline at the left hand side of the view. A similar number from the northern cluster can be seen at a slightly greater distance to the right hand side of the view. The scheme would be immediately noticeable from this section of the road and it is likely to have a dominant visual presence in the context of this relatively confined vista.

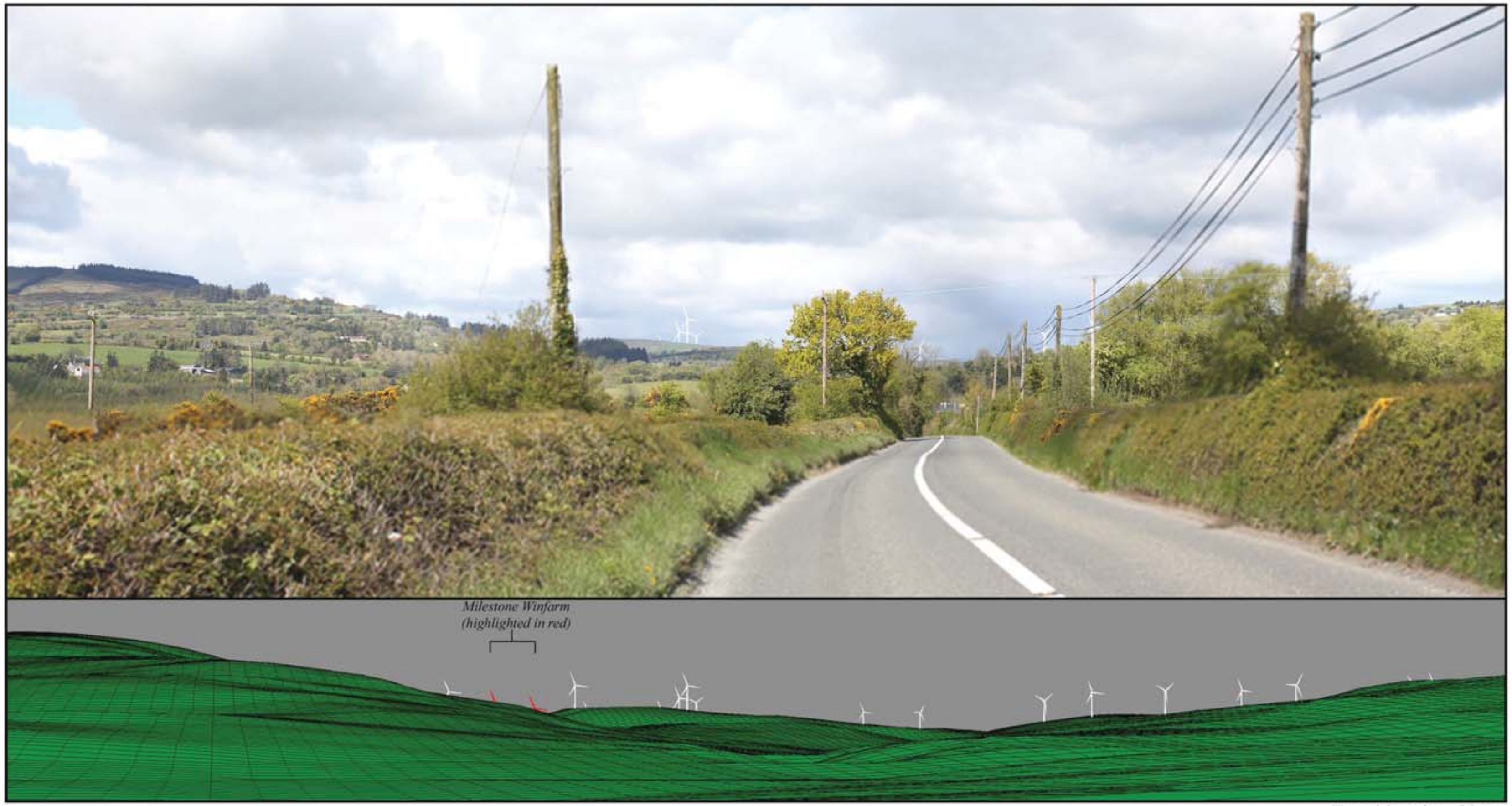
The scheme is perceived to have a fairly modest extent from here due to the view of only a limited number of turbines. These are seen in a simple arrangement above the crown of the hill, but with some turbines overlapping or blades sets cutting against the skyline in perspective. The character of this vista is strongly anthropogenic and turbines are a familiar element in the local area. For these reasons the magnitude of the visual impact is judged to me medium.

Summary

Based on the assessment criteria and matrices outlined at section 9.3.2 the significance of visual impact is summarised below.

Visual Receptor Sensitivity	Visual Impact Magnitude	**Significance of Visual Impact**
Medium	Medium	**Moderate**

DR5: View from the Anglesey Road at Rossoulty



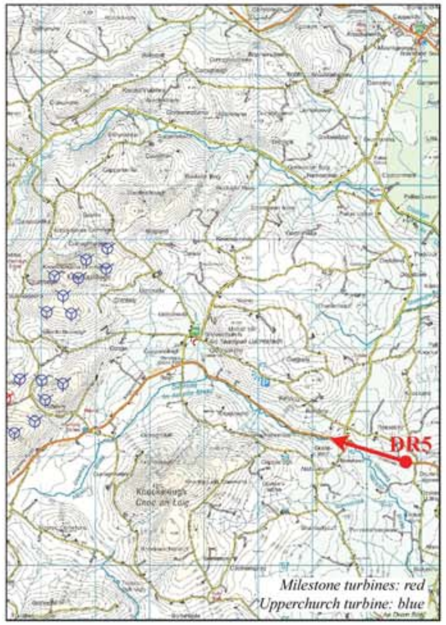
Focal lenght: 50mm
Recommended viewing distance: 39cm

Photomontage and wireframe depiction of the proposed Upperchurch wind farm

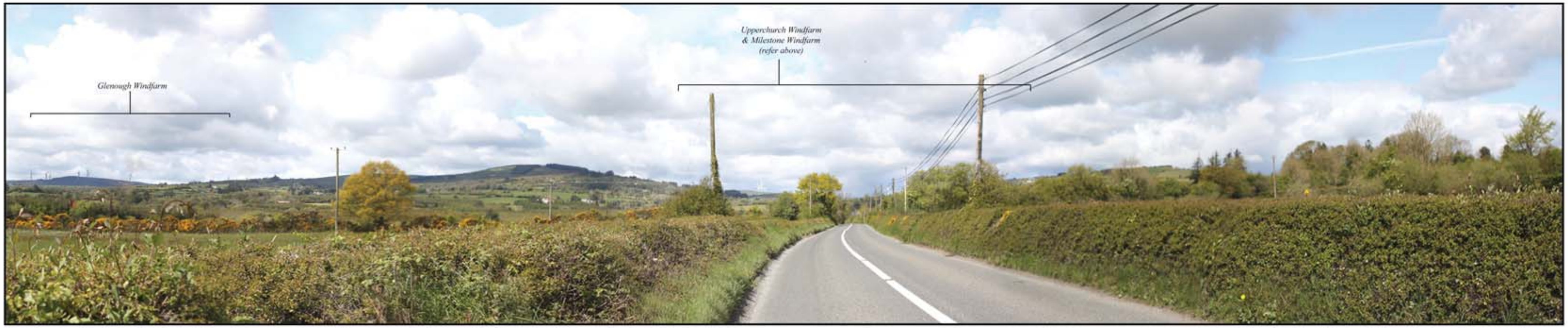
DR5

DR5: Anglesey Road at Rossoulty

DR5 Grid Reference:	E202740 N158906
Viewpoint elevation	141m
Nearest proposed Upperchurch turbine	6.5km
No. proposed Upperchurch turbine hubs visible	13
No. proposed Upperchurch turbine blade sets visible	17
Direction of view	W



REFERENCE DOCUMENTS



Panned view showing the cumulative visual influence of the proposed Upperchurch turbines with the existing and permitted wind farms in the area in a landscape context

Viewshed Reference Point		Direction of View	Distance to nearest turbine:	Number of turbine hubs visible:
DR5	Anglesey Road at Rossoulty	W	6.5km	13

Representative of:

- An area identified on the ZTV map as having a theoretical view of between 13 and 18 of the proposed turbines
- A designated scenic route
- A regional road

Receptor Sensitivity **Medium**

Existing View

This is a relatively broad vista, particularly to the south, from the R503 as it enters the foothills of the Slieve Felim range. The slopes of these hills are cloaked in a combination of fields and hedgerows, patches of broadleaf woodland and blocks of commercial conifer forest at higher levels. The Glenough Wind farm can be clearly seen further along the ridge to the south.

Visual Impact of Upperchurch Wind Farm

Only three of the proposed turbines are clearly visible from this point rising above the skyline ridge in a tight cluster just to the left hand side of the road alignment. A number of other turbines can also be seen with closer scrutiny to the left and right of the road, but these are substantially screened by the ridge and/or foreground vegetation. The visual presence of the scheme is considered to be in the order of sub-dominant to co-dominant.

This is not an optimal view of the scheme in anaesthetic sense as there is a reasonable level of visual ambiguity generated. This relates to the partial view of the scheme with turbines cutting against intervening landscape elements or overlapping each other. In the context of the anthropogenic landscape character and the presence of other turbines within the view, there is little change to the nature of the vista. For these reasons the magnitude of the visual impact is deemed to be medium at DR5.

Summary

Based on the assessment criteria and matrices outlined at section 9.3.2 the significance of visual impact is summarised below.

Visual Receptor Sensitivity	Visual Impact Magnitude	**Significance of Visual Impact**
Medium	Medium	**Moderate**

DR6: View from the The Ragg/Inch on the R498 Borrisoleigh Road

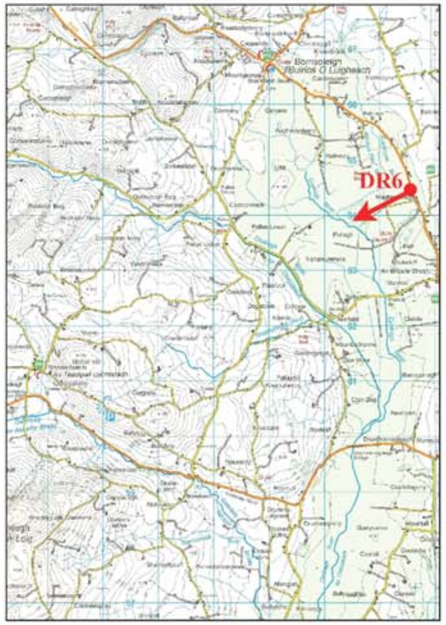
Photomontage and wireframe depiction of the proposed Upperchurch wind farm

Focal lenght: 50mm
Recommended viewing distance: 39cm

DR6

DR6: The Ragg/Inch (R498)

DR6 Grid Reference:	E205586 N164444
Viewpoint elevation	90m
Nearest proposed Upperchurch turbine	8.5km
No. proposed Upperchurch turbine hubs visible	13
No. proposed Upperchurch turbine blade sets visible	15
Direction of view	SW



REFERENCE DOCUMENTS

Panned view showing the cumulative visual influence of the proposed Upperchurch turbines with the existing and permitted wind farms in the area in a landscape context

Viewshed Reference Point		Direction of View	Distance to nearest turbine:	Number of turbine hubs visible:
DR6	R492 at The Ragg/Inch	SW	8.5	13

Representative of:

- An area identified on the ZTV map as having a theoretical view of between 13 and 18 of the proposed turbines
- A designated scenic route
- A regional road

Receptor Sensitivity **Medium**

Existing View This is a westerly vista towards the Slieve Felim range from within the rural lowland context in the eastern portion of the study area. The landscape in view comprises of flat to gently rolling farmland in the foreground surrounding several dwellings. Above the tops of the foreground vegetation rises the Slieve Felim foothills and these have a clearly defined, pastoral field pattern with conifer forests at upper levels. Several turbines from the Glenough Wind Farm can be seen above the ridge to the south.

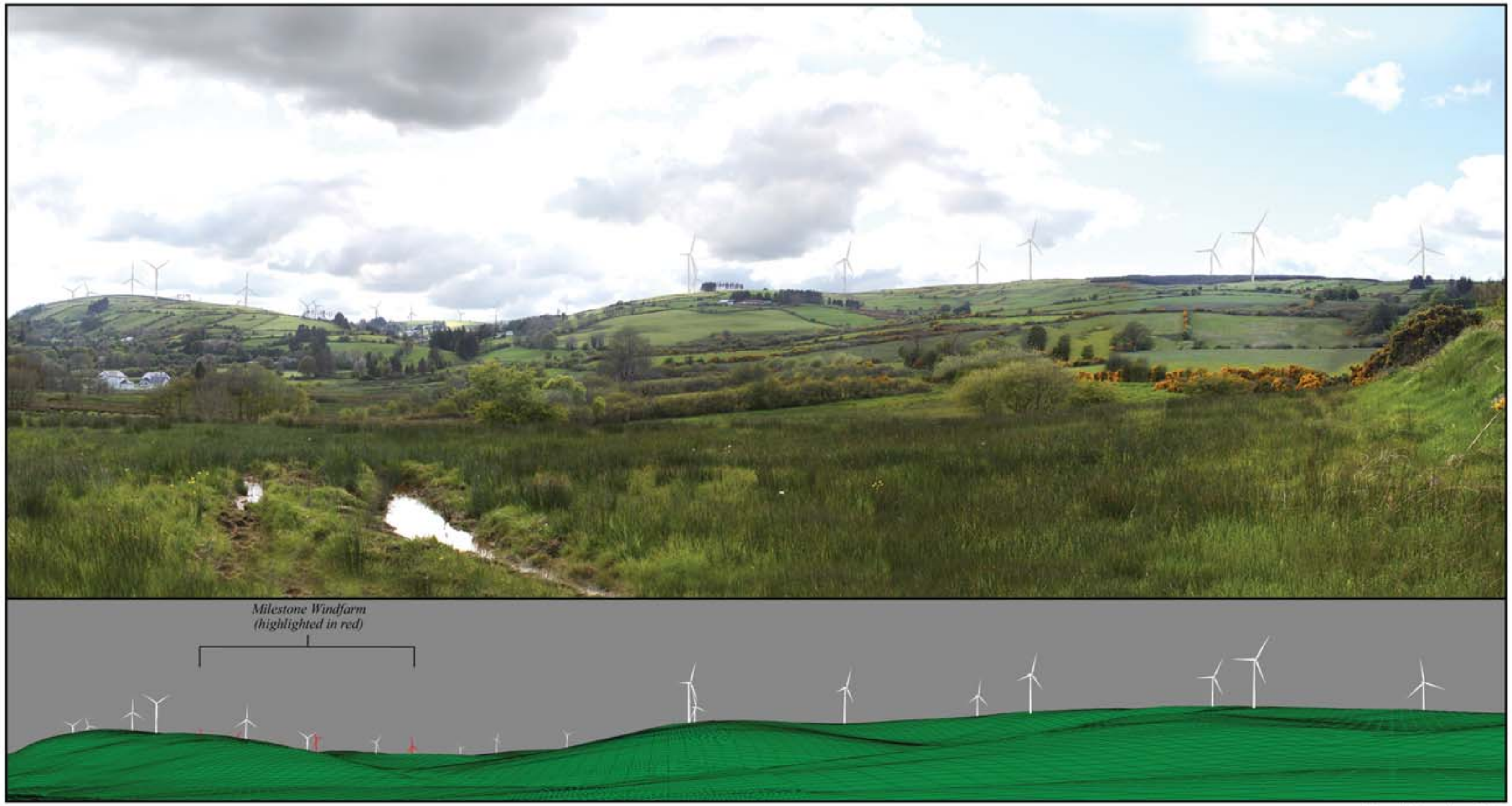
Visual Impact of Upperchurch Wind Farm The proposed turbines are seen at a noticeable scale from this distance although only those at the northern end of the scheme rise fully above the skyline ridge. Only blade sets and blade tips of several of the turbines that comprise the southern cluster penetrate above the ridge. The visual presence of the scheme is deemed to be sub-dominant within the context of this vista.

The turbines from the northern cluster of the scheme are well revealed with a staggered linear layout that avoids instances of overlapping and with a collective profile that compliments the underlying terrain. The partial view of the southern cluster of turbines is less satisfactory in an aesthetic sense with blade sets cutting against the skyline ridge in perspective. However, this cluster is far less noticeable than the northern cluster. The proposed turbines are a familiar element within this anthropogenic vista and for these reasons the magnitude of the visual impact is judged to be low.

Summary Based on the assessment criteria and matrices outlined at section 9.3.2 the significance of visual impact is summarised below.

Visual Receptor Sensitivity	Visual Impact Magnitude	**Significance of Visual Impact**
Medium	low	**Minor**

AV1: View from Slí Éamoin an Chnoic



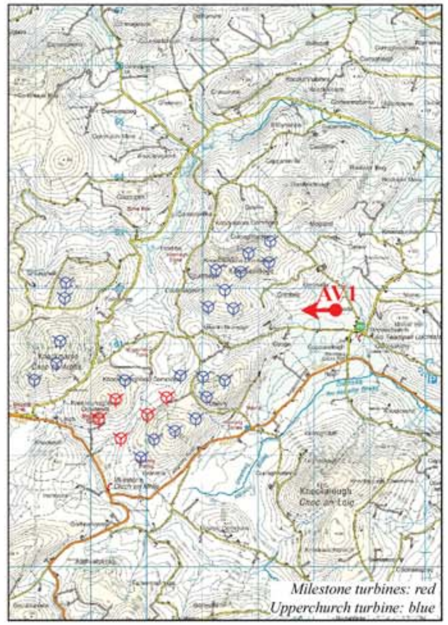
Photomontage and wireframe depiction of the proposed Upperchurch wind farm

Focal lenght: 20mm
Recommended viewing distance: 10cm

AV1

AV1: Slí Éamoin an Chnoic

AV1 Grid Reference:	E198380 N161584
Viewpoint elevation	200m
Nearest proposed Upperchurch turbine	1.5km
No. proposed Upperchurch turbine hubs visible	18
No. proposed Upperchurch turbine blade sets visible	18
Direction of view	W



REFERENCE DOCUMENTS

Panned view showing the cumulative visual influence of the proposed Upperchurch turbines with the existing and permitted wind farms in the area in a landscape context

Viewshed Reference Point		Direction of View	Distance to nearest turbine:	Number of turbine hubs visible:
AV1	Slí Éamoin an Cnoic	W	1.5km	18

Representative of:

- An area identified on the ZTV map as having a theoretical view of between 13 and 18 of the proposed turbines
- A signposted local loop walk – part of the national looped walk network
- Views from local residences

Receptor Sensitivity **Medium**

Existing View

This is an enclosed vista to the west from a point on the Slí Éamoin an Cnoic. The rolling upland landscape in view has a rich and varied land cover ranging from a flat marshy field in the foreground to pastoral fields and hedgerows on sloping ground and conifer plantations on some hilltops. The vista has a remote rural character.

Visual Impact of Upperchurch Wind Farm

The proposed turbines are seen at a significant scale from this short viewing distance and the uphill nature of the view accentuates their height. The lateral extent of the scheme is also considerable within this relatively contained vista. For these reasons the scheme is considered to have a dominant visual presence at this location.

The turbines have a clear and simple arrangement when viewed from here. The majority are fully revealed above the skyline ridge in a legible linear rhythm and the profile of the scheme compliments that of the ridgeline. There is also a picturesque sense of perspective generated in the varying scale between the nearest and furthest turbines. The extent of the scheme is somewhat dominant in relation to the contained vista and the finer grain of the land use patterns below. On balance of these reasons the magnitude of the visual impact is deemed to be high.

Summary

Based on the assessment criteria and matrices outlined at section 9.3.2 the significance of visual impact is summarised below.

Visual Receptor Sensitivity	Visual Impact Magnitude	**Significance of Visual Impact**
Medium	High	**Major-moderate**

AV2: View from Ballyboy Lookout

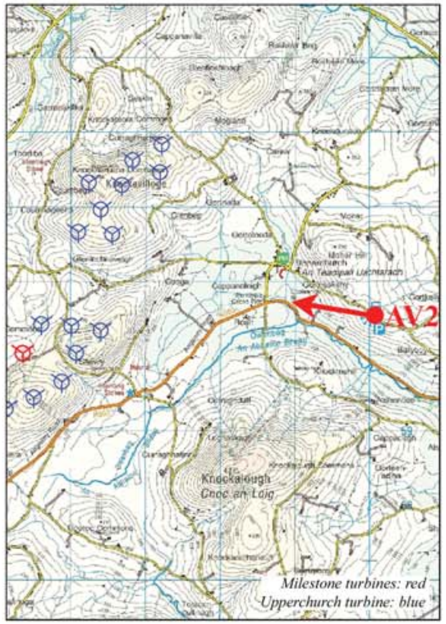
Photomontage and wireframe depiction of the proposed Upperchurch wind farm

Focal Lenght: 35mm
Recommended viewing distance: 18cm

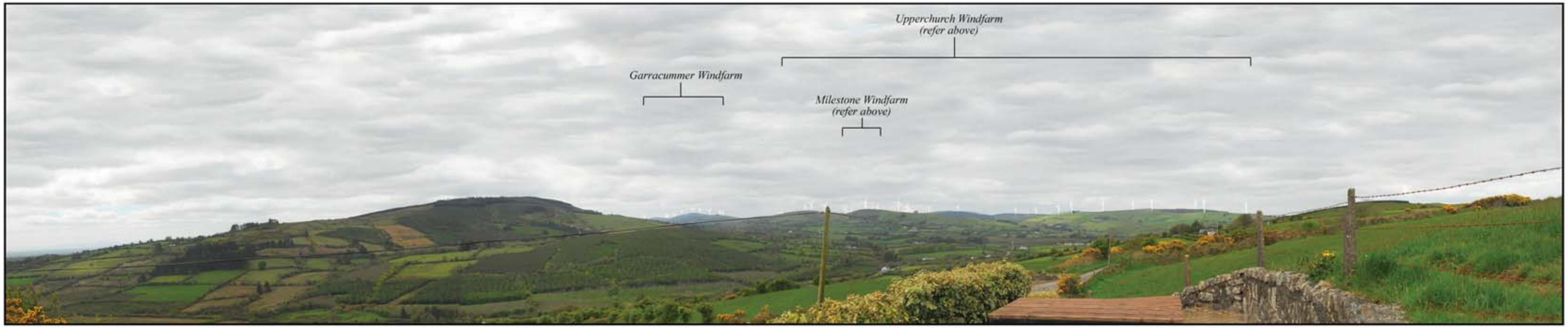
AV2

AV2: Ballyboy Lookout

AV2 Grid Reference:	E200070 N160488
Viewpoint elevation	261m
Nearest proposed Upperchurch turbine	3.5km
No. proposed Upperchurch turbine hubs visible	22
No. proposed Upperchurch turbine blade sets visible	22
Direction of view	W



REFERENCE DOCUMENTS



Panned view showing the cumulative visual influence of the proposed Upperchurch turbines with the existing and permitted wind farms in the area in a landscape context

Viewshed Reference Point		Direction of View	Distance to nearest turbine:	Number of turbine hubs visible:
AV2	Ballyboy lookout point	W	3.5km	22

Representative of:

- An area identified on the ZTV map as having a theoretical view of between 19 and 22 of the proposed turbines
- A locally recognised and signposted lookout point

Receptor Sensitivity **High**

Existing View

This is a broadly panoramic and highly elevated lookout point that affords views over the upland context of the Slieve Felim range to the west and the lowland plains to the east. Almost the entire landscape in view is in productive use as either agriculture or silviculture. Even so, there is a reasonable level of complexity within the view and this lookout provides an idyllic and tranquil location to take it in.

Visual Impact of Upperchurch Wind Farm

A view of all of the proposed turbines is afforded from this elevated viewpoint and the scheme occupies a significant section of the view to the west. However, in the context of the full panorama this is a fairly small proportion of the vista. The turbines are seen at a reasonable scale from this distance, but it is the extent of the scheme that draws attention. In the context of this vista the proposed wind farm is deemed to be co-dominant in terms of visual presence.

Aesthetically speaking the turbines are well displayed from here in an uncomplicated manner. Nearly all of the turbines are fully visible in silhouette above the skyline with a staggered linear layout that accords with both the terrain and land cover patterns in the vicinity. There is, however, a noticeable contrast in scale between the overall extent of the scheme and the more intricate nature of the surrounding land cover pattern. This gives a minor sense of visual ambivalence. Turbines are a characteristic feature of this general area and the only effect on the character of the view is an increased intensity of built development. On the basis of these reasons the proposed wind farm is considered to generate a medium visual impact magnitude.

Summary

Based on the assessment criteria and matrices outlined at section 9.3.2 the significance of visual impact is summarised below.

Visual Receptor Sensitivity	Visual Impact Magnitude	**Significance of Visual Impact**
High	Medium	**Major-moderate**

AV3: View from Knockalough Looped Walk

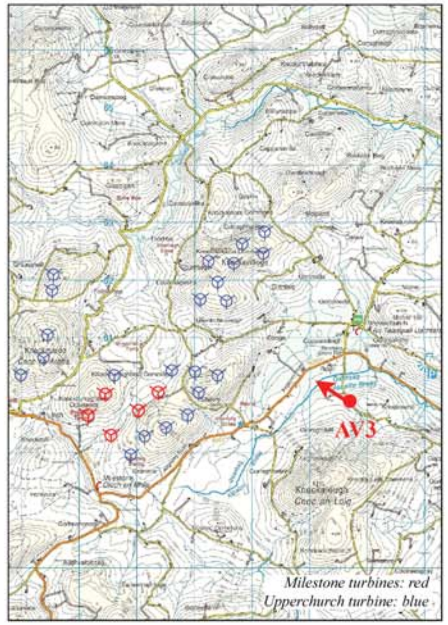
Photomontage and wireframe depiction of the proposed Upperchurch wind farm

Focal lenght: 25mm
Recommended viewing distance: 13cm

AV3

AV3: Knockalough Looped Walk

AV3 Grid Reference:	E198689 N159873
Viewpoint elevation	214m
Nearest proposed Upperchurch turbine	2.3km
No. proposed Upperchurch turbine hubs visible	14
No. proposed Upperchurch turbine blade sets visible	15
Direction of view	NW



REFERENCE DOCUMENTS

Panned view showing the cumulative visual influence of the proposed Upperchurch turbines with the existing and permitted wind farms in the area in a landscape context

Viewshed Reference Point		Direction of View	Distance to nearest turbine:	Number of turbine hubs visible:
AV3	Knockalough looped walk	NW	2.3km	14

Representative of:

- An area identified on the ZTV map as having a theoretical view of between 13 and 18 of the proposed turbines
- A signposted local loop walk – part of the national looped walk network
- Views from local roads and residences

Receptor Sensitivity **Medium**

Existing View

This is a panoramic vista to the northwest from an elevated local road. The view afforded crosses an upland valley and is contained at a modest distance by the opposing ridgeline. The land cover in the valley consists of a combination of grazing land and conifer plantations with some small patches of broadleaf woodland.

Visual Impact of Upperchurch Wind Farm

The proposed wind farm will occupy the majority of the ridgeline on the opposite side of the valley and at this short distance the visible turbines are seen at a considerable scale. The turbines will be the most prominent singular feature in the view and thus, their visual presence is deemed to be dominant.

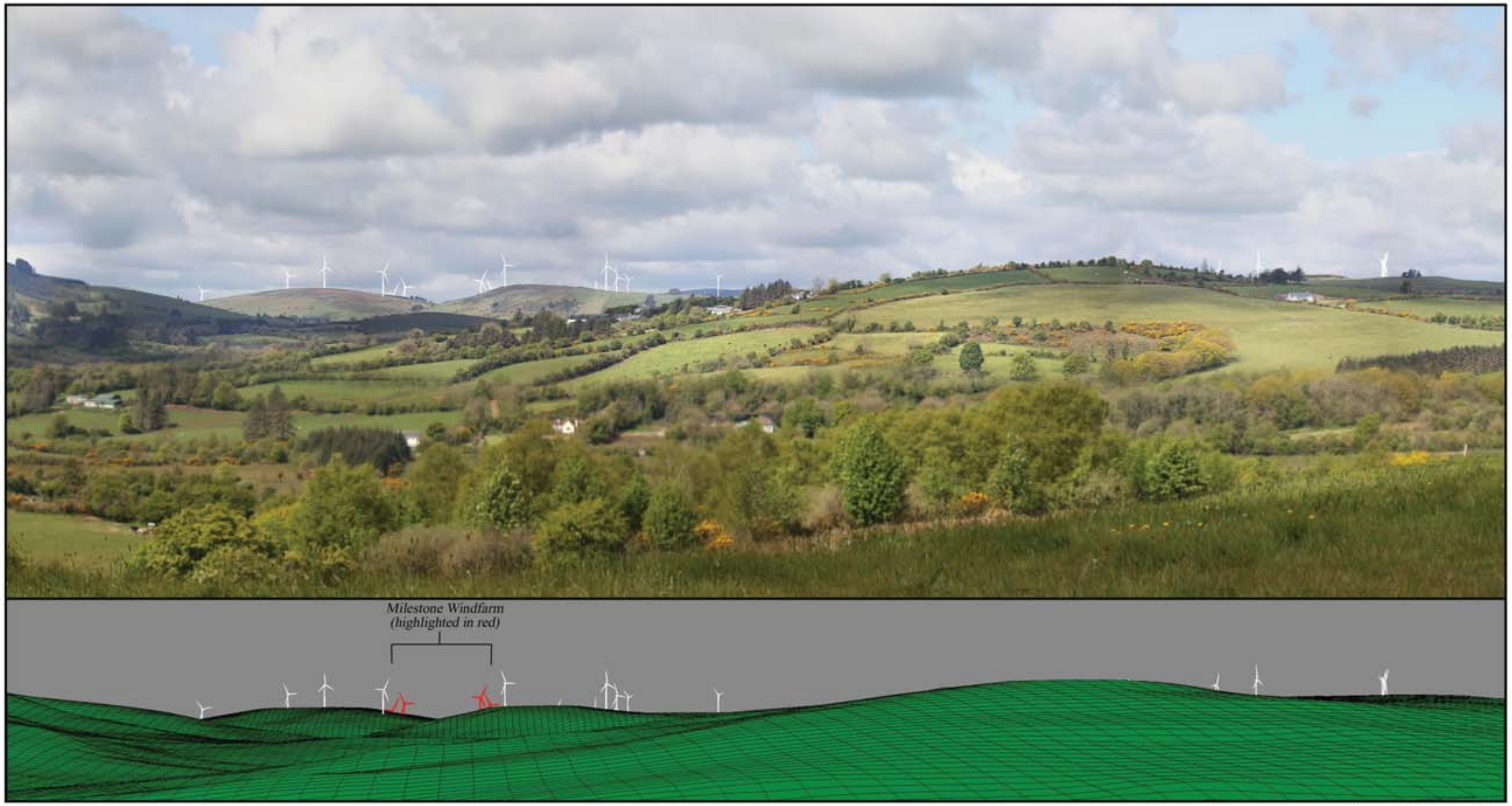
The line of turbines that tops the ridge is evenly and generously spaced and the profile of the scheme undulates in accordance with the terrain. This is diluted slightly by a more ambiguous and distracting view of the more distant turbines cutting against the skyline ridge in perspective. The considerable extent of the scheme is also considered to be somewhat dominant in the context of this vista. The character of this anthropogenic rural vista is not unduly influenced by the presence of wind turbines, which are relatively synonymous with this type of upland landscape, particularly in the vicinity. Overall, the magnitude of the visual impact is judged to be medium.

Summary

Based on the assessment criteria and matrices outlined at section 9.3.2 the significance of visual impact is summarised below.

Visual Receptor Sensitivity	Visual Impact Magnitude	**Significance of Visual Impact**
Medium	Medium	**Moderate**

AV4: View from Birch Hill Looped Walk



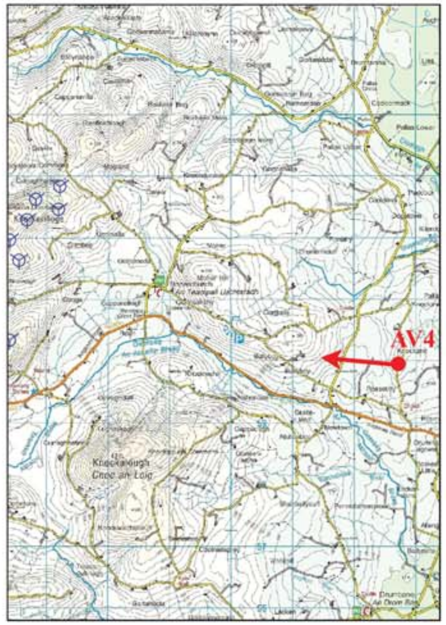
Photomontage and wireframe depiction of the proposed Upperchurch wind farm

Focal Lenght: 50mm
Recommended viewing distance: 39cm

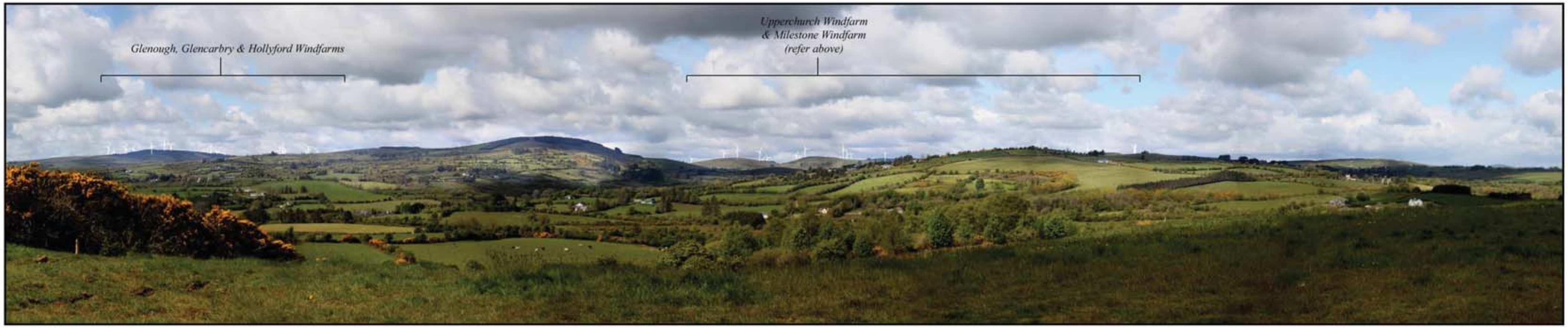
AV4

AV4: Birch Hill Looped Walk

AV4 Grid Reference:	E202710 N159897
Viewpoint elevation	200m
Nearest proposed Upperchurch turbine	6.1km
No. proposed Upperchurch turbine hubs visible	13
No. proposed Upperchurch turbine blade sets visible	16
Direction of view	W



REFERENCE DOCUMENTS



Panned view showing the cumulative visual influence of the proposed Upperchurch turbines with the existing and permitted wind farms in the area in a landscape context

Viewshed Reference Point		Direction of View	Distance to nearest turbine:	Number of turbine hubs visible:
AV4	Birch Hill looped walk	W	6.1km	13

Representative of:

- An area identified on the ZTV map as having a theoretical view of between 19 and 22 of the proposed turbines
- A signposted local loop walk – part of the national looped walk network
- Views from local roads and residences

Receptor Sensitivity **Medium**

Existing View

This is a broad and elevated vista to the west from a high point of the Birch Hill Looped Walk. The rolling upland landscape in view has a land cover that comprises a rich texture of pastoral fields and hedgerows as well as patches of woodland and geometric blocks of conifer plantation. The vista has a remote rural character.

Visual Impact of Upperchurch Wind Farm

Just over half of the proposed turbines will rise above undulating sections of the skyline ridge in two clusters divided by an intervening hilltop. The turbines are seen at a reasonable scale from here and despite the discontinuity, the lateral extent of the scheme is also considerable. In the context of this broad and rich vista the wind farm is deemed to have a co-dominant visual presence.

The proposed turbines are relatively well displayed form here with most of them rising fully in silhouette above the skyline ridge and the profile of the scheme rising and falling in sympathy with the underlying terrain. There are a couple of instance of turbine overlap or blade sets rotating against the skyline in perspective. Overall, the magnitude of the visual impact is deemed to be medium.

Summary

Based on the assessment criteria and matrices outlined at section 9.3.2 the significance of visual impact is summarised below.

Visual Receptor Sensitivity	Visual Impact Magnitude	**Significance of Visual Impact**
Medium	Medium	**Moderate**

9.3.3 Cumulative Impacts

The Scottish Natural Heritage (SNH) Guidelines relating to the Cumulative Effects of Wind Farms (2005) identify that cumulative impacts on visual amenity consist of combined visibility and sequential effects.

> *'Combined visibility occurs where the observer is able to see two or more developments from one viewpoint. Combined visibility may either be in combination (where several wind farms are within the observer's arc of vision at the same time) or in succession (where the observer has to turn to see the various wind farms).*
>
> *Sequential effects occur when the observer has to move to another viewpoint to see different developments. The occurrence of sequential effects may range from frequently sequential (the features appear regularly and with short time lapses between, depending on speed of travel and distance between the viewpoints) to occasionally sequential (long time lapses between appearances, because the observer is moving very slowly and / or the there are large distances between the viewpoints.)'*

Cumulative impacts of wind farms tend to be adverse rather than positive as they relate to the addition of moving manmade structures into a landscape and viewing context that already contains such development. Based on guidance contained within the SNH Guidelines relating to the Cumulative Effects of Wind Farms (2005) and the DoEHLG Wind Energy Guidelines (2006) cumulative impacts can be experienced in a variety of ways. In terms of landscape character, additional wind energy developments might contribute to an increasing sense of proliferation. A new wind farm might also contribute to a sense of being surrounded by turbines with little relief from the view of them. The term 'skylining' is used in the SNH Guidelines to describe the effect where *"an existing windfarm is already prominent on a skyline the introduction of additional structures along the horizon may result in development that is proportionally dominant. The proportion of developed to non-developed skyline is therefore an important landscape consideration"*.

In terms of visual amenity, there is a range of ways in which an additional wind farm might generate visual conflict and disharmony in relation to other wind energy developments. Some of the most common include visual tension caused by disparate extent, scale or layout of neighbouring developments. A sense of visual ambivalence might also be caused by adjacent developments traversing different landscape types. Turbines from a proposed wind farm that are seen stacked in perspective against the turbines of nearer or further developments tend to cause visual clutter and confusion. Such effects are exacerbated when, for example, the more distant turbines are larger than the nearer ones and the sense of distance is also distorted. Table 9.8 below provides criteria for assessing the magnitude of cumulative impacts.

Table 9-8 Magnitude of cumulative impact

Magnitude of Impact	Description
Very High	• The proposed wind farm will strongly contribute to wind energy development being the defining element of the surrounding landscape. • It will strongly contribute to a sense of wind farm proliferation and being surrounded by wind energy development. • Strongly adverse visual effects will be generated by the proposed turbines in relation to other turbines.
High	• The proposed wind farm will contribute significantly to wind energy development being a defining element of the surrounding landscape. • It will contribute to a significant sense of wind farm proliferation and being surrounded by wind energy development. • Significant adverse visual effects will be generated by the proposed turbines in relation to other turbines.
Medium	• The proposed wind farm will contribute to wind energy development being a characteristic element of the surrounding landscape. • It will contribute to a sense of wind farm accumulation and dissemination. • Adverse visual effects might be generated by the proposed turbines in relation to other turbines.
Low	• The proposed wind farm will be one of only a few wind farms in the surrounding area and will viewed in isolation from most receptors. • It might contribute wind farm development becoming a familiar feature within the study area. • The design characteristics of the proposed wind farm accord with other schemes within the surrounding landscape and adverse visual effects are not likely to occur in relation to these.
Negligible	• The proposed wind farm will most often be viewed in isolation or occasionally in conjunction with other distant wind energy developments. • Wind energy development will remain an uncommon landscape feature. • No adverse visual effects will be generated by the proposed turbines in relation to other turbines.

9.3.3.1 Cumulative Baseline

There are 4 operational wind farms and 3 wind farms currently under construction within the study area. There are also 3 other permitted wind farm developments and these are all outlined in table 9-9 below.

Table 9-9 Existing, permitted and proposed wind farms within the study area

Wind farm Name	Turbine No.	Distance and direction from proposal site	Status
Knockastanna, Co Limerick	4	8.1km S	Operating
Mienvee	1	9km SW	Operating
Garracummer	15	3.5km SW	In Construction
Falleennafinoga	2	5.5km S	In Construction
Hollyford	3	5.5km S	Permitted
Glencarbry	9	6.3 S	In Construction
Glenough	14	3.2 S	Operating
Cappagh White	18	8.5km S	Permitted
Curraghgraigue	6	9.5km N	Operating
Knockmeale	2	8.2km NW	Permitted
*Milestone	5	0.5km SW	Proposed

*Note: MosArt would not normally include proposed wind farms in the assessment of cumulative impacts as there is a high degree of uncertainty as to whether a proposed scheme will obtain planning permission and go on to be constructed. Thus, cumulative impacts could be overemphasised and confusion caused. In this instance, however, the proposed Milestone Wind Farm was applied for at the same time as the proposed Upperchurch Wind Farm and the two developments form a combined cluster of turbines. In accordance with a request from North Tipperary County Council the proposed Milestone Wind Farm is included within the cumulative assessment below.

9.3.3.2 Department of Environment, Heritage and Local Government (DoEHLG) 'Wind Energy Development Guidelines' (2006)

The above guidelines provide direction on wind farm siting and design criteria for a number of different landscape types. This proposal site is considered to be contained within the 'Hilly and Flat Farmland' landscape type and the guidance with respect to cumulative impact in such areas is;

> *"It is important that wind energy development is never perceived to visually dominate. However, given that these landscapes comprise hedgerows and often hills, and that views across the landscape will likely be intermittent and partially obscured, visibility of two or more wind energy developments is usually acceptable".*

9.3.3.3 Cumulative Zone of Theoretical Visibility

Given that the proposed Upperchurch and Milestone Wind Farms are contained within a singular grouping it is considered prudent to combine these developments for the production of a cumulative ZTV. This will provide a more useful understanding of cumulative impacts for the wider study area. The resultant cumulative ZTV maps indicate that;

- Despite the high density of turbines from the various existing and permitted wind farms in this part of the Slieve Felim uplands, intervisibility between them and the proposed Upperchurch and Milestone Wind Farms is surprisingly limited within the rolling upland context. This is particularly true beyond 5km of the proposal sites.

- Extensive visibility of the proposed Upperchurch and Milestone Wind Farms in conjunction with multiple other wind farms emerges within the lowlands to the east and south beyond where the foothills of the range no longer screen the primary ridgelines from view (approximately 5km east of the R661 alignment).

- There is a relatively small proportion of the landscape that will afford views of only the proposed Upperchurch and Milestone Wind Farms and no other schemes. These areas all occur either within the confines of the development or to the northeast within approximately 8km. Notwithstanding, this is still a notable proportion of the study area given the density of development in this general upland area. Again, this reflects the absorption capacity of the rolling upland context.

The following table identifies the characteristics of the cumulative view of wind farms from each of the VRP's used earlier in the assessment of the visual impacts of the proposed scheme in its own right.

Table 9-10 Cumulative view of existing and consented wind farms from VRP's

VRP Ref.	**No. of other wind farms potentially in view**	**Nearer or further than proposal**	**Combined view** (within a single viewing arc)	**Succession view** (within a series of viewing arcs from the same location)	**Sequential view** (view of different developments moving along a linear receptor)
CP1	1	nearer	yes	no	no
CP2	0	-	-	-	-
CP3	2	1 at a similar distance and 1 further	yes	yes	no
CP4	4	2 at a similar distance and 2 further	yes	no	no
CP5	4	1 at a similar distance and 3 further	yes	yes	no
LC1	2	1 at a similar distance and 1 further	no	yes	yes
LC2	0	-	-	-	-

MR1	2	nearer	yes	no	no
MR2	4	1 at a similar distance and 3 further	yes	yes	no
MR3	3	2 at a similar distance and 1 further	yes	no	yes
MR4	6	4 at a similar distance and 2 further	yes	yes	yes
DR1	0				
DR2	2	1 nearer and 1 at a similar distance	yes	yes	no
DR3	2	1 nearer and 1 at a similar distance	yes	yes	no
DR4	1	at a similar distance	yes	no	no
DR5	3	2 at a similar distance and 1 further	yes	yes	yes
DR6	4	2 at a similar distance and 2 further	yes	yes	no
AV1	3	2 further and 1 at a similar distance	yes	no	no
AV2	3	2 further and 1 at a similar distance	yes	no	no
AV3	1	-At a similar distance	yes	no	no
AV4	4	2 at a similar distance and 2 further	yes	yes	no

9.3.3.4 Cumulative Impact Assessment

As can be seen from table 9-10 above, cumulative effects relating to the proposed Upperchurch Wind Farm follow several patterns, which are analysed below.

From locations within the central upland spine of the study area, where the landscape is steeply undulating, there is generally less opportunity to see other wind energy developments in conjunction with the proposal except from elevated locations. Obviously, this does not apply to the proposed Milestone Wind Farm, which lies within the southern cluster of Upperchurch turbines. However, in cumulative impact terms these developments will be perceived as a singular development. Importantly, most sensitive receptors in the local area, such as roads and settlements, are contained within the base of valleys. Receptors at higher elevations that are afforded potential views of multiple developments tend to be local walking routes, elevated farmsteads and lookout points. Overall it is considered that the central upland zone of the study area has a high capacity to absorb multiple and expansive wind energy developments. Currently the number of existing and permitted schemes in this area combine to make wind energy development a familiar element in this productive rural landscape, but without a significant sense of proliferation or being surrounded by turbines.

From the lowland context, particularly to the southeast, a different scenario occurs regarding cumulative effects. Whilst the foothills of the Slieve Felim upland spine tend to screen close views of multiple wind energy developments, from distances beyond approximately 5km of the base of these hills a more comprehensive view of the primary ridgeline is afforded. This in turn allows for clear, but distant views of the turbines that rise above the skyline ridge. There are a number of settlements and major routes contained within this zone that are afforded such views. Perhaps the best example of this effect is the view from MR4 at Boherlahan, where combined and succession views of the proposal in conjunction with up to 6 other schemes are afforded. This route is also subject to sequential views of different wind farms as the viewer travels along it. The key issue here is not so much the manner in which multiple schemes are viewed but the effect of 'skylining' where the proportion of developed skyline can begin to dominate the proportion of undeveloped skyline. The proposed development will noticeably contribute to this effect at MR4. It should be noted that MR4 represents a worst case scenario in this regard as the adjacent section of ridgeline is subject to the highest level of turbine accumulation within the upland spine. Clear views of significant sections of the Slieve Felim range are also often screened by foreground vegetation from within the wider lowland context.

From the lowland plains to the northwest of the Slieve Felim uplands there is less opportunity to see multiple wind farm developments. This is due to most of the existing and permitted wind farms being located closer to the south-eastern edge of the upland spine. The steeply undulating Silvermines Mountains that run along the northwestern edge of the upland zone also tend to screen views of the landscape and, therefore, the wind farms beyond.

In terms of effects on visual amenity, most of the existing and permitted wind farms in this area are seen as discreet clusters of turbines from within the Slieve Felim Mountains. Alternatively, from the south-eastern lowlands they are seen as separate linear sequences along the Slieve Felim skyline ridge. Consequently, there are few instances in which the turbines of separate schemes are seen to overlap in perspective causing visual stacking and/or confusion of scale. Within broad views from the southeast there is some ambiguity from the likes of MR4 at Boherlahan as to where one scheme ends and another begins due to the perceived close spacing between schemes along the ridgeline.

As outlined above, the proposed Upperchurch and Milestone Wind Farms will appear as a singular development due to the shared location and similarity in design. In terms of wind farm proliferation this is considered preferable to closely associated, but clearly distinct developments. This is supported by the DoEHLG Wind Energy Guidelines, which state under section 6.5 – Cumulative Effect that; "*Similarity in siting and design approach is preferred where a number of wind energy developments are located in the same landscape character area*" and; "*Different wind energy developments can appear as a single collective unit if located near each other*".

Aesthetically, the combined view of the Upperchurch and Milestone proposals results in a slightly increased intensity of development. The Milestone turbines are also commonly seen at a slightly lower level than the majority of their Upperchurch counterparts. This is entirely due to their lower elevation or the relative viewing distance as they have the same dimensions as the proposed Upperchurch turbines. This apparent disparity in height along with the fact that the Milestone turbine blades are often seen to cut against the skyline results in some visual ambiguity for the combined developments. Overall, it is considered that these cumulative aesthetic effects are relatively minor. This is on the basis that if these schemes were assessed as a single development it is not likely to attract higher order visual impact judgements than have been attributed herein for the proposed Upperchurch Wind Farm in isolation.

Should the proposed development proceed to construction along with the proposed Milestone Windfarm and all of the other permitted or operating windfarms wind farms currently shown in the cumulative photomontages there would be an overall sense that the Slieve Felim uplands has become a strategic area for wind energy development. This would not be a unique situation within the country and given the robust and productive landscape character along with the generally low level of sensitivity of surrounding receptors it is not inappropriate either.

On the basis of the factors outlined above, the additional cumulative impact represented by the proposed development is deemed to be **medium**.

9.4 MITIGATION MEASURES

Given the highly visible nature of commercial wind energy developments it is not generally feasible to screen them from view using on-site measures as would be the primary form of mitigation for many other types of development. Instead, landscape and visual mitigation for wind farms must be incorporated into the early stage site selection and design phases. A principle consideration in this regard was the Department of Environment Heritage and Local Government's Wind Energy Development Guidelines (2006).

9.4.1 Department of Environment, Heritage and Local Government Wind Energy Development Guidelines (2006)

The Wind Energy Development Guidelines (2006) provide guidance on wind farm siting and design criteria for a number of different landscapes, including 'Hilly and Flat Farmland' similar to the context for the proposed Upperchurch Wind Farm. Recommendations in the guidelines for this landscape type include the following:

Location – "Although hilly and flat farmland type is usually not sensitive in terms of scenery, due regard must be given to houses, farmsteads and centres of population."
"Location on ridges and plateaux is preferred…"
"Elevated locations are also more likely to achieve optimum aesthetic effect."

Spatial extent - "This can be expected to be quite limited in response to the scale of fields and such topographic features as hills and knolls"

Spacing - "The optimum spacing pattern is likely to be regular, responding to field pattern…However … a balance will have to be struck between adequate spacing to achieve operability and a correspondence to field pattern."

Layout - "The optimum layout is linear, and staggered linear on ridges and hilltops but a clustered layout would also be appropriate on a hilltop"

Height - "Turbines will tend not to be tall … the more undulating the topography the greater the acceptability of an uneven profile."

The design of the proposed wind farm is in general accordance with all of the design criteria outlined above except that relating to spatial extent. However, in this instance there is clear direction from the North Tipperary County Development Plan that a broader extent of development will be sought in this landscape character area than is provided for in the guidelines for 'Hilly and Flat Farmland'. Furthermore, the fact that the development is relatively dispersed across four elevated areas reduces its intensity, particularly at local receptors where views of discreet clusters of turbines are more commonplace than of the full scheme.

A number of general mitigation measures are also included below:

- Matt non-reflective finishes will be used on all turbine components;
- Transmission lines between individual turbines and the substation will be placed underground;
- Counter rotation of blade sets will be avoided;
- The number and extent of new access tracks will be kept to a minimum and properly landscaped immediately following completion of works. Such landscaping will include reinstating original vegetation along verges and repairing any wheel ruts;
- Special care will be taken to preserve any features, which contribute to the landscape character of the study area. Any damage to existing hedgerows from transporting the turbines will be rectified; and
- Turbines will be the same size as existing turbines in the area

A high standard of design will be applied to all structures associated with the substation considering not only its function but also the aesthetic quality, in order to minimise
any sense of intrusion. The proposed development will provide colour harmony and adequate screening of the substation using berms covered with scrub and ground vegetation in order to mitigate its impact.

9.5 RESIDUAL IMPACTS

Landscape and visual mitigation measures have been incorporated into the design of the scheme from its early stages. Therefore, the proposed wind farm presented as the subject of this application already incorporates any substantial landscape and visual mitigation measures. Unlike for many of the other EIA topics, the residual impacts of the proposed wind farm are essentially the same as assessed in the predicted landscape and visual impacts section (9.3) above.

9.6 CONCLUSION

A summary table is provided below, which collates the assessments of landscape and visual impacts. A discussion of the results is provided thereafter.

Table 9-11: Summary Impact Assessment

Landscape Impact			
Landscape Sensitivity		**Landscape Impact**	**Landscape impact Significance**
Low		Low	**Minor-negligible**
Visual Impact			
VRP	**Visual Receptor Sensitivity**	**Magnitude of visual impact**	**Visual Impact Significance**
CP1	Low	Negligible	**Negligible**
CP2	Low	medium	**Minor**
CP3	Low	High	**Moderate-minor**
CP4	Low	Medium	**Minor**
CP5	Low	Low	**Minor-negligible**
LC1	Medium	Medium	**Moderate**
LC2	Medium	Low	**Minor**
MR1	Low	Negligible	**Negligible**
MR2	Low	Medium	**Minor**
MR3	Low	Low	**Minor-negligible**
MR4	Low	Medium	**Minor**
DR1	Medium	Medium	**Moderate**
DR2	Medium	Medium	**Moderate**
DR3	Medium	Medium	**Moderate**
DR4	Medium	Medium	**Moderate**
DR5	Medium	Medium	**Moderate**
DR6	Medium	low	**Minor**
AV1	Medium	High	**Major-moderate**
AV2	High	Medium	**Major-moderate**
AV3	Medium	Medium	**Moderate**
AV4	Medium	Medium	**Moderate**
Cumulative Impact			**Medium**

9.6.1 Landscape Impacts

The assessment of landscape impacts is based on a comparison of landscape sensitivity against the magnitude of effects on the physical landscape and on landscape character. In this instance the judgement of sensitivity is ‘low’. This is mainly due to the robust and productive rural character of the receiving landscape and the influence of existing wind energy developments on that character.

The magnitude of the landscape impact is also considered to be 'low' on the basis that the proposed wind farm represents a familiar form, scale and intensity of development in an area where the scale of the terrain and land use patterns is such that even this relatively extensive proposal will not be overly dominant. The wind farm is not considered to have a physical impact on the site in excess of that experienced for surrounding forestry operations and the prevailing site land uses will be maintained below the turbines. On the basis of the judgements relating to landscape sensitivity and the magnitude of the landscape impact expected from this proposal, the overall significance of impact on the landscape is deemed to be 'Minor-negligible'.

9.6.2 Visual Impacts

Visual impacts were assessed on the basis of visual receptor sensitivity versus the magnitude of the visual impact. The magnitude itself is the function of the visual presence of the proposal and its effect on visual amenity. Visual impacts were assessed at 22 visual receptors throughout the study area.

As can be seen from the summary table above, visual receptor sensitivity generally varied between medium and low with these judgements being relatively evenly shared. Only one of the VRP's was attributed High sensitivity. The High sensitivity rating occurred at AV2 which is a local signposted lookout point that affords vast panoramic views over both the Slieve Felim uplands to the west and the lowland plains to the east.

Notably, none of the designated scenic routes is attributed a sensitivity judgement of higher than medium. This is on the basis that the sensitivity of a receptor is not wholly synonymous with the scenic quality of the view on offer, but also many other factors such as the likely mind set of the viewer and the popularity of the location. Many of the designated scenic routes relate to the provision of elevated or broadly panoramic vistas over the landscape. The value of such vistas relates directly to the vast nature of the view as opposed to the naturalistic or unique qualities of the scene, elements of the picturesque or a strong sense of place. Therefore, such views are most sensitive to visual obstruction (Blocking of the view) and not necessarily visual intrusion (an additional element within the view).

In terms of the magnitude of visual impacts, the relative visual dominance of the scheme from each VRP is strongly related to viewing distance in this instance. It also tends to relate to whether the view of the scheme is uphill or downhill and how vast the overall vista is. Where other wind farms are in view the proposed scheme is also generally considered to be less of a distinctive feature in the landscape. Notably, there are very few locations that afford views of all 22 of the proposed turbines at once due to the steeply rolling nature of the terrain surrounding the site. The view of only a limited number of turbines tended to moderate the visual presence of the scheme, especially in close proximity (<5km). Aesthetically speaking, the proposed development is well designed for this site with a sprawling layout and undulating profile that reflects the scale and form of the underlying terrain as well as the loosely structured land use patterns in the vicinity. For these reasons the magnitude of the visual impact is only considered to be higher than medium in two instances (AV2 and CP3), which are both less than 2km from the nearest turbines. This level of visual impact is almost unavoidable in such close proximity to commercial scale wind energy developments.

9.6.3 Cumulative Impacts

There is a reasonable accumulation of wind farms within the upland spine that runs through the centre of the study area. The proposed Milestone Wind Farm is contained within the southern cluster of the proposed Upperchurch Wind Farm and together these schemes will be read as a singular development. This scenario is generally considered preferable in cumulative impact terms to that of closely associated but separate developments as it limits the sense of wind farm proliferation. Views of multiple wind energy developments tend to be limited from within the steeply rolling terrain of this upland zone. Contrastingly, views of multiple developments are afforded from some locations within the plains to the southeast, where the turbines are seen to rise above the primary skyline ridge. In some instances the extent of wind farm development along the ridge is beginning to dominate the extent of undeveloped ridgeline creating an effect referred to as 'skylining' in the Scottish Natural Heritage Guidelines relating to the Cumulative Effects of Wind Farms (2005). The proposed Upperchurch and Milestone developments are considered to contribute noticeably to this effect at one of the VRP's (MR4), but this is a worst case scenario within the lowland area where unimpeded views of long sections of the skyline ridge are otherwise uncommon between hedgerows. The intervening peak of Knockalough also breaks up the line of turbines when viewed from much of the lowland area to the southeast. On balance of these factors the additional cumulative effect generated by the proposed Upperchurch Wind Farm is deemed to be of a medium level.

9.6.4 Overall Significance of Impact

In terms of the significance of impact, the majority of judgements across all assessment categories are in the mid to lower order of magnitude (Moderate to negligible). Only at two of the visual receptors that are both in very close proximity to the proposal is the significance of the visual impact judged to be major-moderate. This is on the basis of a medium sensitivity rating coupled with a high visual impact magnitude and vice versa. Whilst this represents the highest level of impact in this assessment it is only in the mid to high order of magnitude in terms of the visual impact significance matrix (table 9-7). On the basis of these reasons it is considered that the proposed Upperchurch Wind Farm represents an acceptable level of landscape and visual impact across the study area. It also complies with all of the relevant policies and guidelines for the receiving landscape in relation to wind energy development.

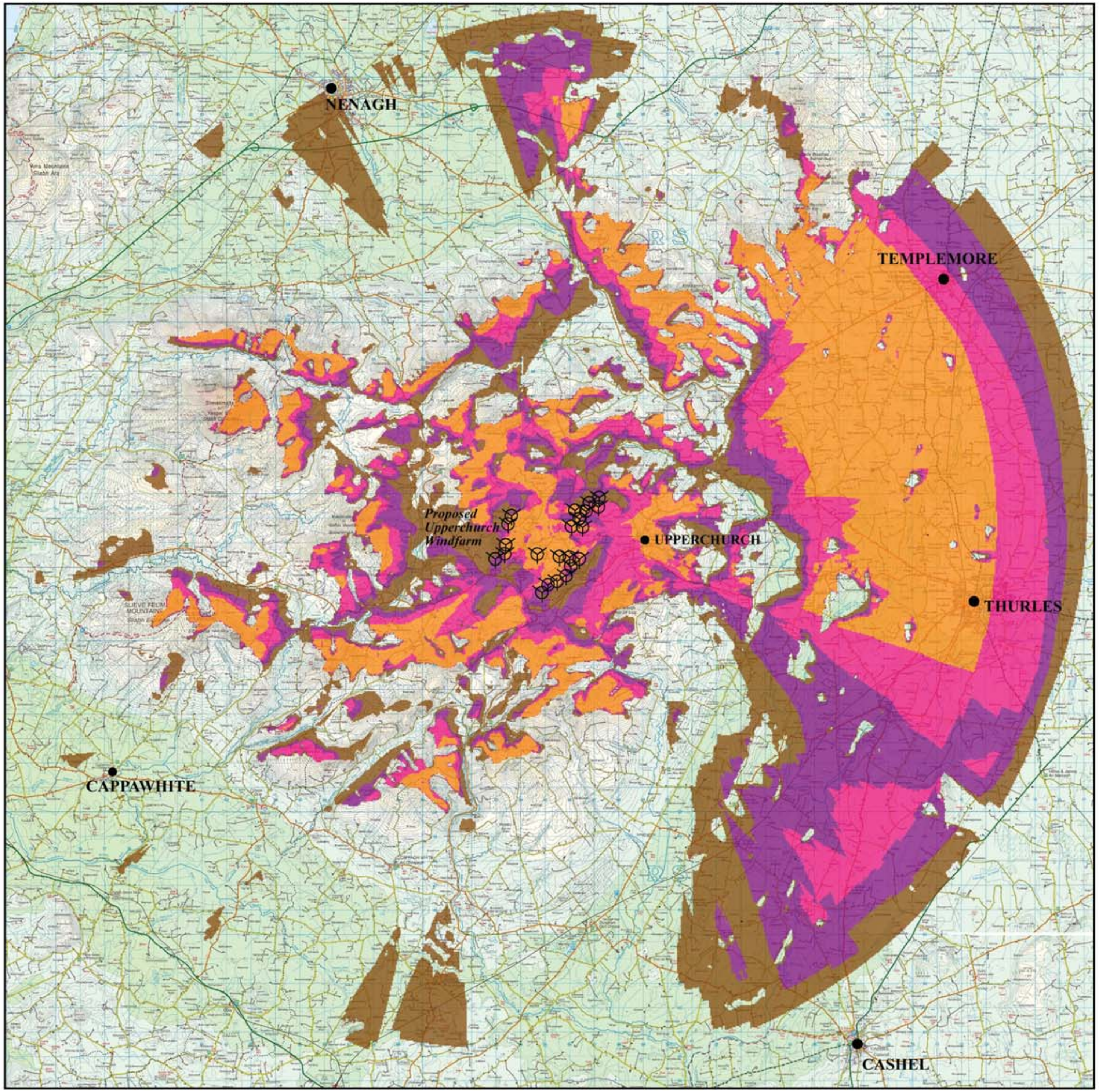


Figure 9.1

Zone of Theoretical Visibility (ZTV) of the proposed Upperchurch turbines.

Proposed Upperchurch turbines

Colour Code:

Brown Shading: Areas where 1 - 6 Upperchurch turbines are visible (to uppermost blade tip height)

Purple Shading: Areas where 7 - 12 Upperchurch turbines are visible (to uppermost blade tip height)

Pink Shading: Areas where 13 - 18 Upperchurch turbines are visible (to uppermost blade tip height)

Orange Shading: Areas where 19 -22 Upperchurch turbines are visible (to uppermost blade tip height)

Uppermost Blade Tip Height

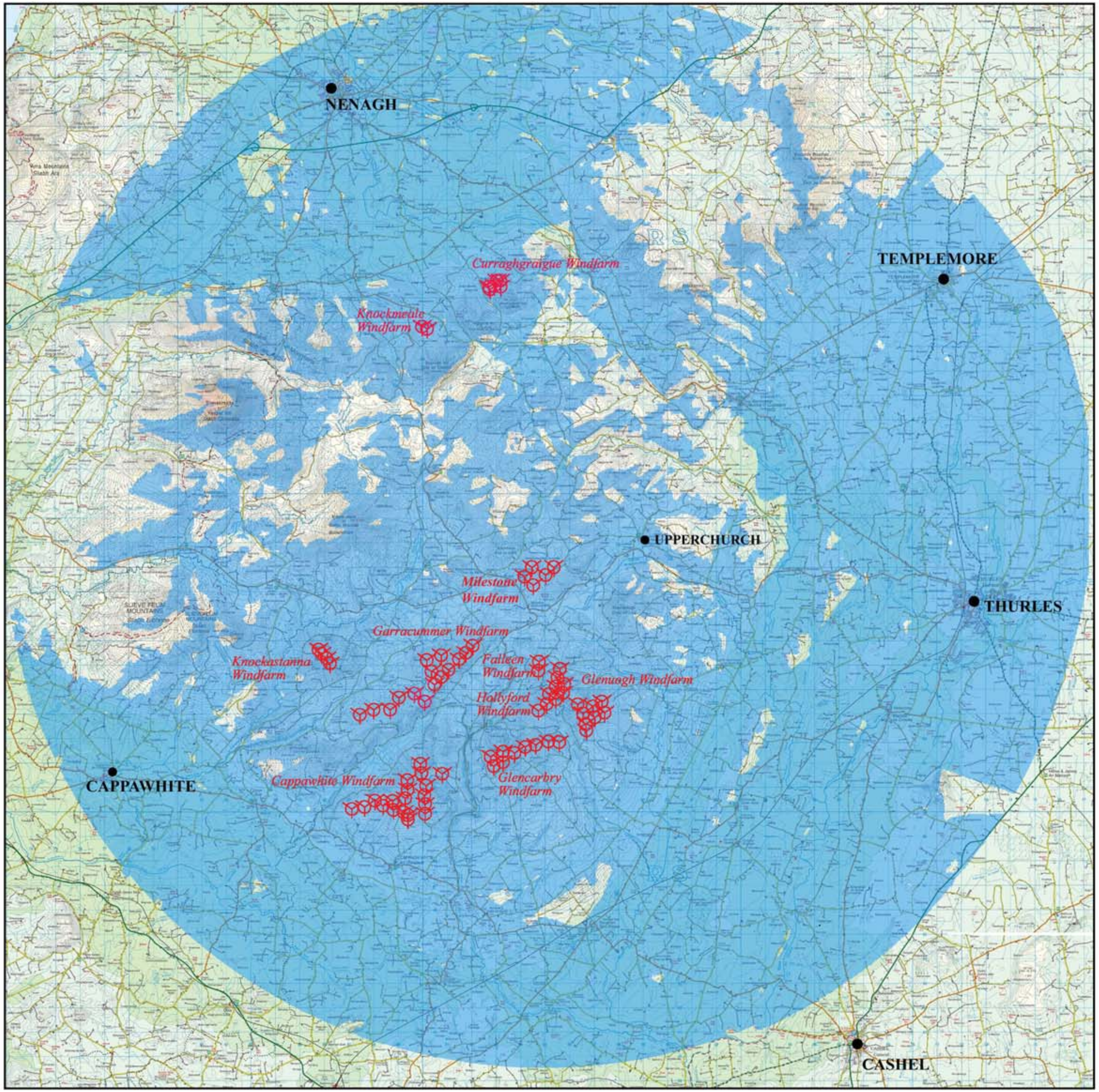


Figure 9.2 (Cumulative Study)

Zone of Theoretical Visibility (ZTV) of the existing, permitted and proposed turbines in the area.

Existing, permitted or proposed turbines as identified on the map

Colour Code:

Blue Shading: Areas where turbines from the existing and/or permitted and/or proposed windfarms in the area are visible to uppermost blade tip height.

Uppermost Blade Tip Height

Refer to Figure 10.3 for Cumulative ZTV

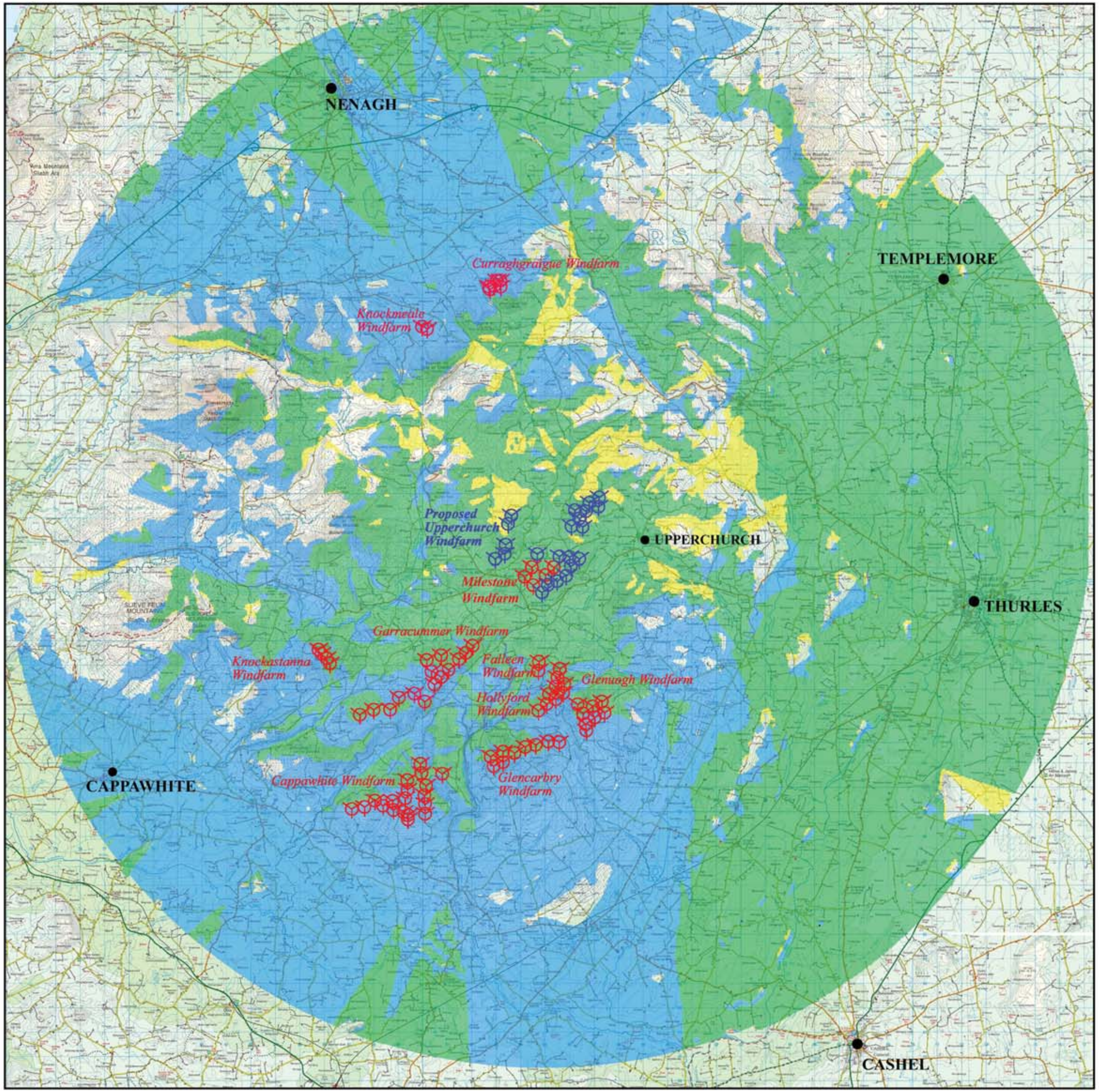


Figure 9.3 (Cumulative Study)

Zone of Theoretical Visibility (ZTV) of the proposed Upperchurch turbines along with the existing, permitted and proposed turbines in the area.


Proposed Upperchurch turbines


Existing, permitted or proposed turbines as identified on the map

Colour Code:

Blue Shading: Areas where turbines from the existing and/or permitted and/or permitted windfarms in the area are visible.

Green Shading: Areas where the proposed Upperchurch turbines along with turbines from the existing and/or permitted and/or proposed windfarms in the area are visible.

Yellow Shading: Additional areas of visibility due to the proposed Upperchurch turbines.

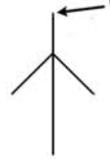
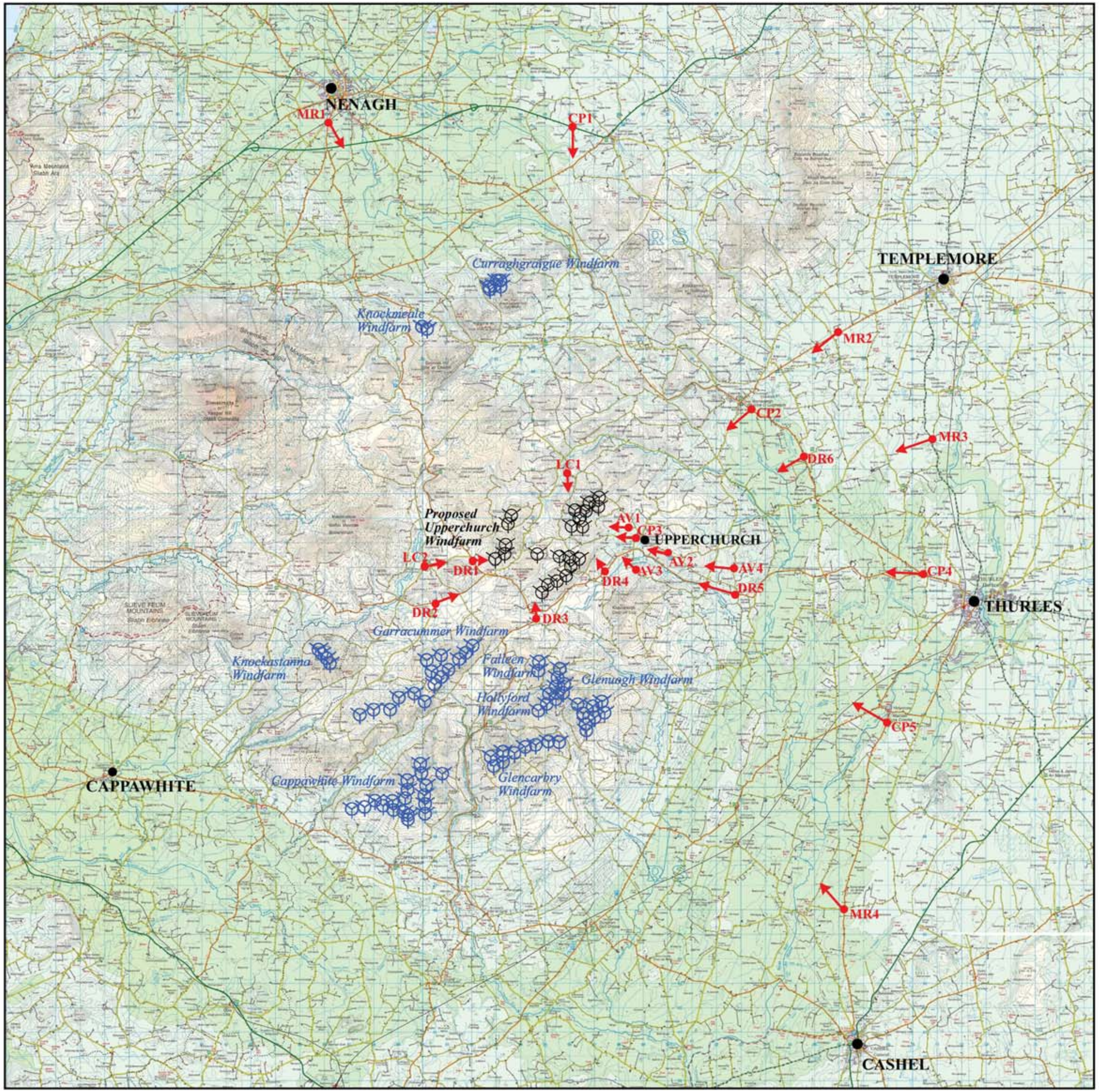


Figure 9.4

Map showing the location of the Viewpoint Reference Points (VRP's)



Proposed Upperchurch turbines

Existing or permitted turbines as identified on the map

CP1 Viewpoint code showing direction of the view towards the proposed Upperchurch Windfarm

REFERENCE DOCUMENTS

13 /51/0003 – response to RFI dated 28th February, 2013

Q10. *As set out in Section 10.13 of the County Development Plan 2010 in Table 10.9 Exclusion and Separation Zones the boundary setback distance for wind turbines is stated to be 1.5times the turbine height. In this regard you are advised that turbine T22 is less than the necessary distance from the boundary of the landholding and therefore the proposal should be revised to take account of this.*

A10. The proposal has been revised with regard to the position of T22. An agreement has been reached with the neighbouring landowner to oversailpart of his lands. T22 has been revised to a new position.

Revision shown in **Figure 10 (A)** revision to Location of T22 (over) and

Drawings No.s (in the accompanying FI Drawings Pack)

- Drg. No. UWF-PA1RFI – 07 (Site Location showing Revised Location of T22) 1:10560
- Drg. No. UWF-PA1RFI – 08 (Site Layout showing Revised Location of T22) 1:2500

See also **Appendix 10 (B) for** Agreement from the neighbouring landowner.

The revised position of T22 is illustratedin the Photomontages produced in answer to **Q.9** and in **Appendix 9.**

The revised position of T22 is examined in the context of the EIS in Table 10.1 below;
Table 10.1 Summary of T22 relocation in the context of the EIS

EIS Topic	Potential impact due to relocation	Impact of relocation	Ref. Document
Human Beings	Construction Traffic	No additional impact	Chapter 7 - EIS
	Construction and Operational H & S	No additional impact	Chapter 7 - EIS
	Increased economic activity in the area/region	No additional impact	Chapter 7- EIS
	Interaction with existing land use	No change – same habitat (conifer)	Chapter 13 – EIS Figure 13-4 Habitat Map 1 & 2
	Potential for shadow flicker at nearby dwellings	There are 4 properties (within 900m) where the values have changed from those listed in the EIS, due to the relocation of T22.	Chapter 10 Residential Amenity **See Table 10.2 below**

REFERENCE DOCUMENTS

13 /51/0003 – response to RFI dated 28th February, 2013

EIS Topic	Potential impact due to relocation	Impact of relocation	Ref. Document
Flora and Fauna	Habitat loss and/or alteration	750m^2 extra conifer felling	Response to FI Answer to Q5. – Ecological Management Plan EcMP Revised Natura Impact Statement – Answer to Q1 (b)
	Impacts on Fauna	No additional impact	
	Collision risk of Bird and bats	No additional impact	
Nature 2000/Ramsar Sites	Habitat damage, loss and/or alteration	No additional impact	Revised Natura Impact Statement – Answer to Q1 (b)
	Impact on species of qualifying interest	No additional impact	
Soils and Geology	Loss of Peat and subsoil resources	No additional impact	Chapter 14 EIS - Geotechnical Impact Assessment
	Damage to peat and subsoils due to vehicle movement	No additional impact	
	Excavation works: peat erosion and ground stability	No additional impact	
	Implications on ground stability and water quality due to storage and stockpiling of waste soils and subsoils	No additional impact	
Peat Stability	Peat landslide	No additional impact	Chapter 14 EIS - Geotechnical Impact Assessment

REFERENCE DOCUMENTS

13 /51/0003 – response to RFI dated 28th February, 2013

EIS Topic	Potential impact due to relocation	Impact of relocation	Ref. Document
Water (i) Surface water regime	Interruption of existing drainage patterns	No additional impact	Chapter 15 EIS Hydrological Impact Assessment Revised Natura Impact Statement – Answer to Q1 (b)
	Impact on Surface water flows due to increased run-off and hydraulic loading	No additional impact	
(ii) Surface water quality	Reduction in water quality due to releases of suspended solids and nutrients and/or pollution by hydrocarbons/ cement	No additional impact	
(iii) Hydrogeology	Groundwater flows	No additional impact	
	Groundwater pollution	No additional impact	
Air	Construction activities atmospheric emissions	No additional impact	Chapter 8 EIS - Air & Climate
Noise	Potential for noise and nearby dwellings	No significant change	Response to FI - Answer to Q.4
			Response to FI - Answer to Q.10 Table 10.2
Radiation	Electromagnetic interference	No additional impact	Chapter 6 EIS Windfarm Planning Guidelines
Climate	GHG emission offsets	No additional impact	Chapter 8 Air & Climate Assessment
Landscape	Potential for unacceptable visual impact	No significant change	Response to FI - Answer to Q. 9
Material Assets	Impact on Residential Amenity	No significant impact	Response to FI - Answer to Q.4
			Response to FI - Answer to Q.10 Table 10.2
	Impact on grid capacity	No additional impact	Chapter 4 EIS - Site Selection

EIS Topic	Potential impact due to relocation	Impact of relocation	Ref. Document
	Cultural Assets Potential for impact on existing archaeological sites	No additional impact	Chapter 12 EIS Cultural Heritage Table 12.1
	Cultural Assets Potential for impact on unknown archaeological material	No additional impact	Chapter 12 EIS Cultural Heritage
	Tourism	No additional impact	Chapter 9 EIS Socio-Economic Impact Assessment
Interaction of the Foregoing	interaction of noise, visual impact and effects on ecology	No additional impact	Chapter 4. Site Selection Process

All dwelling houses within 900m of a turbine were assessed in the EIA. The hr/annum of shadow flicker effect predicted will change at 4 of these houses due to the relocation of T22. Details listed in;

Table 10.2 – Change in Shadow Flicker Impact at properties within 900m

House No. (from EIS)	v.1 hr/annum	hr/annum change due to relocation of T22	Impact
House 2	11	25	+14 hr/annum. Now office at Site Compound No 2. See Answer to Q8 (b)
House 18	9	8	Decrease in 1 hr/annum. Insignificant
House 25	5	2	Decrease in 3 hr/annum. Insignificant
House 62	1	4	Increase in 3 hr/annum. Insignificant

In summary the repositioning of T22 will have no additional impact on any topics assessed in the EIA. The repositioning will bring some changes to the separation /residential impact values at the nearest houses and 3rd party land boundaries. These changes are listed in Table 10.2 above and Table 10 (3) below ;

13 /51/0003 – response to RFI dated 28th February, 2013

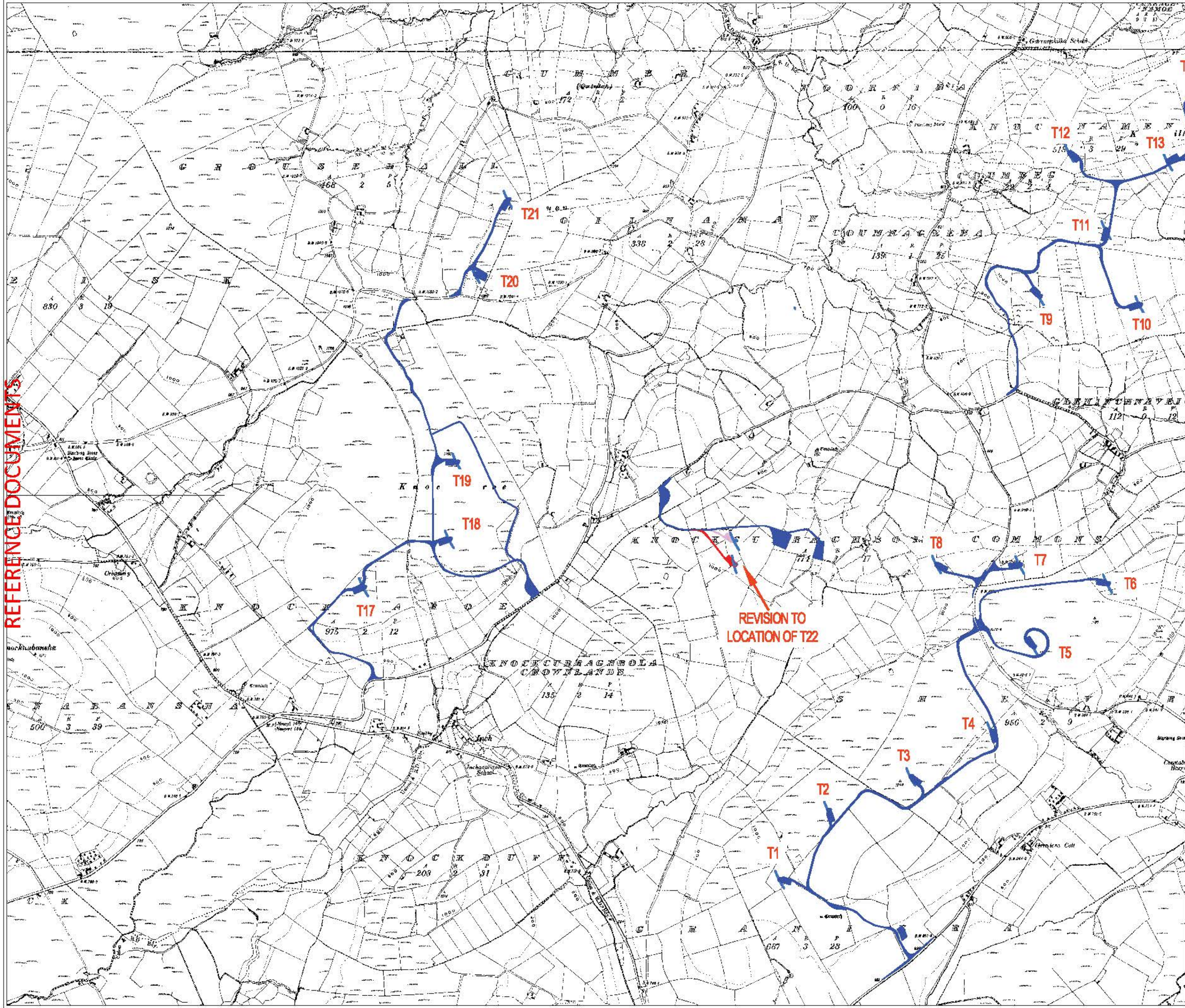
Table 10.3: Changes to the separation /residential impact values

Value affected	Before repositioning	After repositioning	Notes
Distance from the nearest site boundary	190m	113m to the neighbouring landowner's lands to the SE 159m to the same landowner's lands to the SW	Set back distance – 190m i.e. 1.5 times the turbine height.
			Relocated T22 will now oversail 3rd party lands to the southeast and the southwest (both parcels owned by the same landowner) by agreement with the landowner. Landowner consent and mapping details in Appendix 10 (B).
Distance from the nearest houses	House 2 - 380m	House 2 – 382m	Unoccupied house, proposed as windfarm site facility in Site Compound 2. See - Answer to Q.8 re Site Compounds.
	House 7 – 910m	House 7 – 844m	Unoccupied house, proposed as construction site offices for Milestone Windfarm 12/51/0385
	House 18 – 438m	House 18 – 527m	3rd party occupied house - separation distance increased by 89m due to relocation. Positive
Predicted noise levels from the proposed Upperchurch windfarm at nearest house	House 2 – 43db(A)	House 2 – 43db(A)	No change
	House 7 – 43db(A)	House 7 – 43db(A)	No change
	House 18 – 42db(A)	House 18 – 41db(A)	Predicted noise levels to decrease by 1db(A). Not significant. See Answer to Q4 – Revised Noise Impact Assessment
Predicted cumulative noise levels from the proposed Upperchurch and Milestone windfarms at the nearest houses	No cumulative calculation for v.1 layout	House 2 – 43db(A)	No change
		House 7 – 53db(A)	10db(A) additional noise attributable to nearest Milestone turbine (WTG 1) being 80m distant – house proposed as Milestone windfarm construction site offices.
		House 18 – 42db(A)	1db(A) additional noise attributable to Milestone windfarm. Not significant. See Answer to Q4 – Revised Noise Impact Assessment

13 /51/0003 – response to RFI dated 28th February, 2013

Value affected	Before repositioning	After repositioning	Notes
Distance from nearest watercourse	458m	419m	39m nearer. No significant impact, all works will be carried out in accordance with mitigation measures recommended in the EIS and in the Revised Natura Impact Statement – Answer to Q1 (b).
Distance from nearest SPA	2015m	2070m	55m further away. No significant impact, all works will be carried out in accordance with mitigation measures recommended in the EIS and in the Revised Natura Impact Statement – Answer to Q1 (b).

REFERENCE DOCUMENTS



Unchanged windfarm roadways shown in blue

Revision 2 layout and location of T22 shown in red

Original layout and location of T22 shown in pink

FIGURE 10 (A)

REVISION TO LOCATION OF T22

DRAWN BY: JACK BRETT
ECEOPOWER DEVELOPMENTS LTD
SION ROAD, KILKENNY
TELEPHONE: 056 7750140

APPENDIX 8(E)

Turbine Relocation Consent Letter

I Paddy Ryan of Knockcurraghbola Commons confirm that I am the owner of the lands comprised in Folios 12664F and 4688 of the Register of County Tipperary.

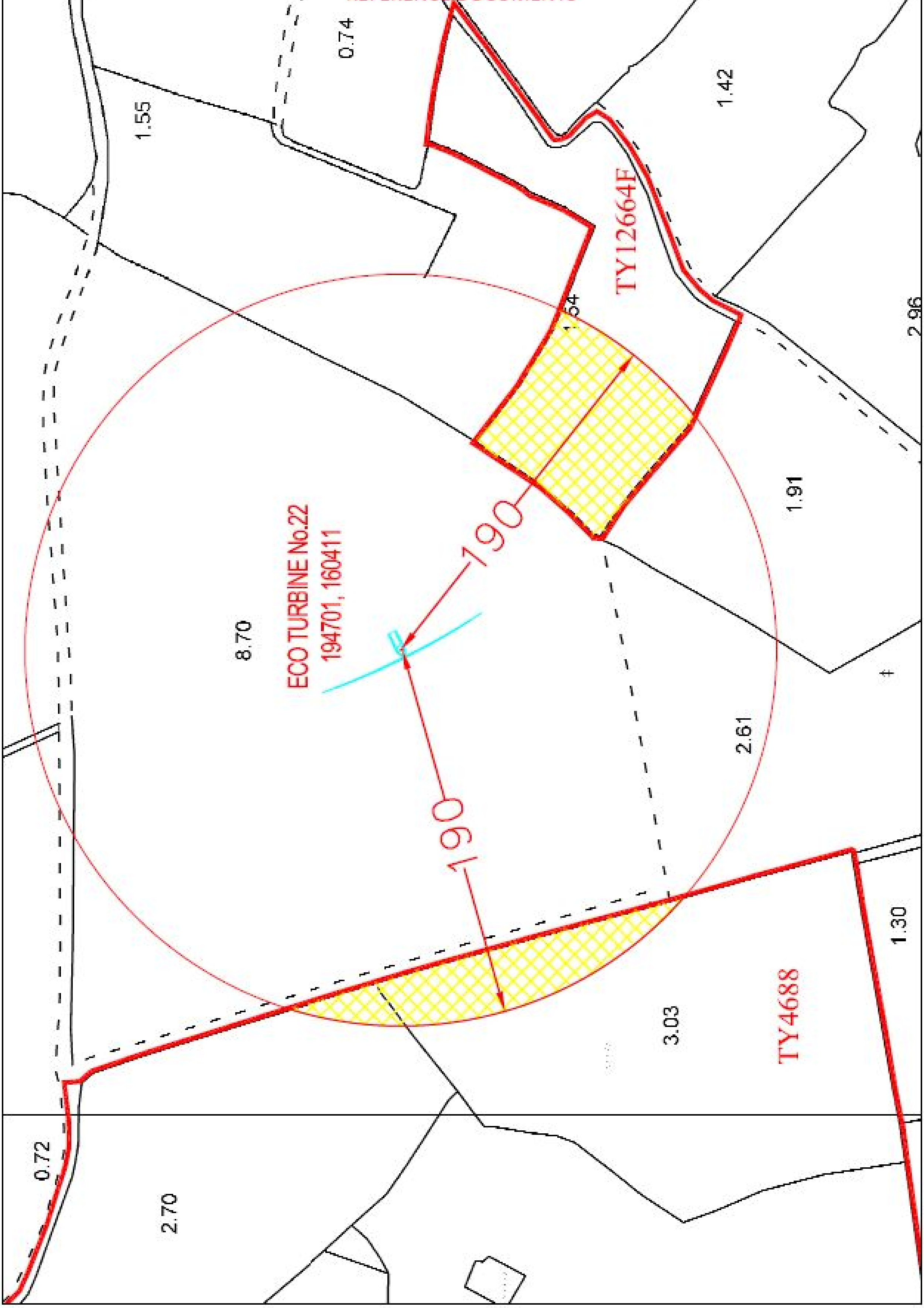
I hearby give my consent to the relocating of turbine no. 22 (T22) of the Upperchurch Windfarm (Planning ref 13510003) to the coordinates E 194701, N 160411and understand that the turbine will now be within an Exclusion Zone as per 10.13.2 of the North Tipperary County Development Plan; that being 1.5 times the tip height of the turbine (189.75m in this case).

I further consent to the turbine being located a maximum distance of 20m, in any direction, from the above coordinates in order to allow 'micro-siting' of that turbine.

Sincerely, Paddy Ryan 25/06/13.

Paddy Ryan

REFERENCE DOCUMENTS



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Q11. *With regard to wind farm development in general, it has been noted that an increasing number of [international] turbine installations have proved problematic in that under certain conditions, the structure can become unstable. Such conditions have, in general, been attributed to high winds, human (design) error, un-designed-for dynamic loads and those resulting from basically, taller and larger turbines. Taking such issues into consideration and their applicability to the current turbine proposed i.e. high turbines and large mass (345m3) of concrete foundations and notwithstanding the isolated locale of the development, suggests that the H&S aspect of the turbine installations, need to be considered. Accordingly, you are requested to submit a Turbine Design Assessment which shall address the structural design issues as outlined above and possible issues relating adverse conditions (eg. ice formation on the blades), in particular, you are requested to refer to quality control methodology utilised in order to ensure effective and consistent concrete strength in such [large] concrete placements.*

A11. The Health and Safety aspects of the proposed turbine installations are a primary concern of Ecopower Developments Limited. The promoter of a construction project is legally required to take account of the safety of all people who may be affected by the project. Health & Safety issues are examined during all stages of a windfarm design and operation – turbine assembly, construction, installation, commissioning, operation and maintenance and decommissioning. The promoter has statutory duties under Irish Health and Safety legislation to identify and eliminate hazards at every stage of the design process.

Specific issues arising from Q.11 include:

- Turbine structural integrity under prevailing site conditions
- Quality control during construction including strength requirements of foundations
- Quality control during operation including strategies for adverse weather conditions.

Turbine Design Assessment

Loading of wind turbines in a wind farm is determined by wind speeds and turbulence parameters of a particular site. The three wind classes for wind turbines are defined by an International Electrotechnical Commission standard (IEC), and correspond to high, medium and low wind as follows:

Turbine Class	IEC I High Wind	IEC II Medium Wind	IEC III Low Wind
Annual average wind speed	10 m/s	8.5 m/s	7.5 m/s
Extreme 50-year gust	70 m/s	59.5 m/s	52.5 m/s
Turbulence classes	A 18%	A 18%	A 18%
	B 16%	B 16%	B 16%

The Upperchurch windfarm site has been assessed as a Class 1 site, and therefore the highest turbine specification IEC Class 1A will be installed. Wind turbines are designed and type certified according to the latest international standards. The current internationally acknowledged IEC standards is the IEC-61400 series.

See **Appendix 11 (a)** for relevant British and European standards
See **Appendix 11 (b)** for typical Type Certification for Class 1A turbines.

In order to achieve Type Certification (in this case Wind Turbine Generator (WTG) Class 1A) the wind turbine is designed, type-tested and manufactured in conformity with the design assumptions and the relevant standards of the IEC 61400 series for Class 1A WTGs. It must be sufficiently demonstrated during testing that the turbine can be installed, operated and maintained in accordance with the design documentation. The Type Certification comprises all the mandatory modules namely design assessment, manufacturing evaluation and type testing.

Manufacturing evaluation comprises component manufacturing certification including but not limited to the major components - tower, gearbox, blades and generator.

Type testing includes full scale prototype testing. The safety and function tests on the prototype are performed according to IEC standards. The turbine behaviour during starts, stops, grid loss and other transient events are tested and measured. Rotor blades are subjected to full scale ultimate strength tests, fatigue strength tests and residual strength tests.

Type Certification directly related to the Classification of any particular windfarm site ensures that the turbine structures remain stable during the construction and operational life of the windfarm.

Quality control during construction of the concrete foundations

The construction of the turbine foundation starts with a soil survey/analysis and a geotechnical report of the foundation area. A geotechnical engineer prepares a soil investigation program, carries out the necessary works at the site and in the laboratory, analyses the results of the works, produces a report and gives a recommendation for the foundation. The foundation is then designed according to these recommendations and certified in a Foundation Designer's Compliance Declaration document.

See **Appendix 11 (c)** for a sample
- Foundation Compliance Declaration and
- Technical Specification for a Turbine Foundation.

The foundation comprises reinforced steel and concrete. The steel for reinforcement is supplied by a producer certified according to specified standards with regard to grade, designation, nominal diameter, surface geometry and strength characteristics and is delivered cut and bent according to the foundation drawings.

It is very important for the erection of the turbine tower that the concrete works are executed with the appropriate care and precision. The concrete is composed according to the demands stated on the design drawings and to the results of the soil survey.

In order to ensure effective and consistent concrete strength in the turbine foundations the following procedures will be adopted;

- The selected foundation contractor shall provide experienced staff during the foundation pours.
- The contractors method statement will be reviewed by a competent engineer in advance of the concrete pour to ensure its suitability.
- For quality control during the concrete pour, an independent company shall take concrete cube samples at regular intervals throughout the course of the concrete pours. The pour shall also be supervised by an independent engineer.
- For each set of cubes, one shall be tested at 7 days, two shall be tested at 28 days and one shall be held as a spare. These cube tests will be used to confirm the concrete in the foundation complies with the design strength requirements of the foundation.
- Concrete slump tests shall also be carried out on each concrete delivery prior to placement.

The design of the foundations will include the verification and the construction drawings of the foundation and will comply with the guidelines and standards of the technical documentation and in particular IEC 62079.

Quality control during operation (including strategies for adverse weather conditions)

The windfarm will be operated in accordance with the Irish Wind Energy Association (IWEA) **Health & Safety Guidelines for the Onshore Wind Industry on the island of Ireland 2011- Chapter 9: Construction, Commissioning and Demolition**and
Chapter 10: Operation and Maintenance. See**Appendix 11 (d).**

While recognising that the wind energy industry has statutory duties under Irish Health and Safety legislation, the stated purpose of the Guidelines is to offer advice on Health and Safety issues that are specific to the wind energy industry.Section 10 of the Guidelines details the considerations that should be given to Health and Safety in the operation and maintenance of wind farms. The operation and maintenance phase covers all aspects of normal routine operation, planned and breakdown maintenance, inspections and testing.

In the context of turbine integrity and the safety of the public it is noted in Section 10.3.1, that under the requirements of Safety, Health and Welfare at Work (Construction) Regulations 2006/ Construction (Design & Management) Regulations 2007 (Safety File), the EU Machinery Directive and CE Marking process, and the WTG Certification programme specified in IEC WT01, manufacturers of the wind farm hardware (including electrical infrastructure equipment and WTG) are required to supply the owners/operators with an operations and maintenance manual. This manual is required to explain how the equipment is to be safely operated, maintained and inspected. The manual also details the frequency of maintenance checks and appropriate maintenance activities (including recommendations for component replacements) to be performed to maintain the integrity and the on-going safety of the turbine.

The Upperchurch windfarm will be operated within Irish Health & Safety legislation and according to the IWEA Health & Safety Guidelines.

Contingencies for adverse events

Ice formation on the blades: Under certain weather conditions, ice, white frost or snow can build up on the rotor blades of turbines. This usually happens when there is high air humidity, rain, or snow while temperatures are around 0^{0}C. Ice formation occurs when water droplets freeze on the blade surface. White frost build-up occurs when the moisture particles in the air are already frozen; the rotor blades pick up these particles which then adhere to the blade surface. Ice and white frost build-up can reduce a turbine's efficiency and increase the strain on the material, particularly due to imbalance. In addition, ice deposits may represent a hazard to people in the vicinity of the turbine when they begin to melt and drop away.Ice build-up most frequently occurs at temperatures between – 1^{0}C and - 4^{0}C. It does not usually occur at temperatures above + 1^{0}C and below - 7^{0}C. The available air humidity is too low at temperatures below - 7^{0}C.

The presence of ice can be detected by the turbine control system and remedial action can be taken depending on the specific site requirements. Ice detector systems use sensors on top of the tower and/or at the base to measure the outside temperature and then to determine the presence of icy conditions. Then, because the presence of ice reduces the efficiency of the blades and thus the power output, the turbine control system can be set to detect a drop in production in conjunction with suitable icing conditions. Limit values of the control system can be set within defined parameters to further optimise the responsiveness of the ice detection system. The control system can be set to shut down the affected turbines within a narrow tolerance range i.e., before the thickness of the ice layer becomes a hazard to the dynamic loading of the rotor blade. The time required to de-ice the blades is then calculated based on the outside temperature. During this period, the turbine does not start up automatically. When the ice has melted and before manual start up, a visual inspection of the blades can be carried out to check that any ice that formed has fallen directly and safely to the ground.

Ice detection systems can be deployed at Upperchurch windfarm, which will protect the windfarm personnel, local landowners and the general public from any hazard of ice throw.

Lightning Protection System: The lightning protection system in a turbine helps to protect the wind turbine against physical damage caused by lightning strikes and usually consists of lightning receptors, a system to conduct the lightning current down through the wind turbine to help avoid or minimise damage to the turbine, protection against over-voltage and over-current, shielding against magnetic and electrical fields and an earthing system. There is no additional danger from lightning storms due to the presence of wind turbines in an area.

Storm Conditions: Class 1A turbines are designed to start up at windspeeds of c.3m/sec and to continue to operate until windspeeds rise to storm conditions of c.25m/sec or above, when they automatically shut down. They do not restart until the wind drops to 20m/sec. They do not operate outside of these parameters.

Class 1A turbine structures are designed to withstand extreme windspeeds of 50m/sec and extreme gusts of 70m/sec (hurricane force). The Class 1A turbine is designed for use at altitudes up to 1000m above sea level.

Conclusion:

Windfarm construction and operation is a highly regulated activity. The Upperchurch windfarm will be constructed and operated within strict Health & Safety legislation and in accordance with industry best practice.

At the end of 2012 there were 225,000 turbines operating in 79 countries worldwide. To date, there have been 1,500 turbines installed on the island of Ireland, since the first windfarm was built in 1992 at Bellacorrick, Co. Mayo. Wind energy has proven over time to be a safe technology and, properly installed and operated, presents no threat to local landowners and the general public.

13 /51/0003 – response to RFI dated 28th February, 2013

Further Information 13/51/0003 (2 No. wind Turbines at Upperchurch)

Appendix 11 (a) Relevant British and European standards

The following British and European Standards have been created specifically for use within the windenergy industry. The content of some may impact on Health and Safety. Whererelevant the BS ENnumber has been used as opposed to the applicable IEC reference.

PD IEC WT01:2001 – IEC System for Conformity Testing and Certification of Wind Turbines – Rules andprocedures

BS EN 61400-1:2005 – Wind turbines – Design requirements

BS EN 61400-2:2006 – Wind turbines – Design requirements for small wind turbines

BS EN 61400-11:2003 – Wind turbine generator systems – Acoustic noise measurement techniques(amended 2006)

DD IEC TS 61400-12: 2006 – Wind turbine generator systems – Power performance measurement ofelectricity producing wind turbines.

DD IEC TS 61400-13: 2001 – Wind turbine generator systems – Measurement of mechanical loads

IEC/TS 61400-14: 2005 – Wind turbine generator systems – Declaration of apparent sound power leveland tonality values

DD IEC TS 61400-22: 2011 – Wind turbine generator systems – Conformity testing and certification

IEC 61400-21:2008 – Wind turbine generator systems – Measurement and assessment of power qualitycharacteristics of grid connected wind turbines

IEC TS 61400-23:2002 – Wind turbine generator systems – Full-scale structural testing of rotor blades

PD IEC/TR 61400-24:2002 – Wind turbine generator systems – Lightning protection

BS EN 61400-25-1:2007 – Wind turbine generator systems – Communications for monitoring and controlof wind power plants – Overall description of principles and models

BS EN 61400-25-2:2007 – Wind turbine generator systems – Communications for monitoring and controlof wind power plants – Information models

BS EN 61400-25-3:2007 – Wind turbine generator systems – Communications for monitoring and controlof wind power plants – Information exchange models

BS EN 61400-25-4:2008 – Wind turbine generator systems – Communications for monitoring and controlof wind power plants – Mapping to communication profile

BS EN 61400-25-5:2007 – Wind turbine generator systems – Communications for monitoring and controlof wind power plants – Conformance testing

BS EN 61400-25-6:2008 – Wind turbine generator systems – Communications for monitoring and controlof wind power plants – Logical node classes and data classes for condition monitoring

BS EN 50308:2004 – Wind turbine generator systems – Protective measures – Requirements for design,operation and maintenance

PD CLC/TR 50373:2004 – Wind turbine generator systems – Electromagnetic compatibility

IEC 60050-415:1999 – Wind turbine generator systems – International electrotechnical vocabulary– Part 415

BS EN 61508-7:2002 – Functional safety of electrical/electronic/programmable electronic safety-relatedsystems
BS ISO 81400-4:2005 – Wind turbine generator systems – Design and specification of gearboxes

DD IEC/TS 62257-9-1:2008 – Recommendations for small renewable energy and hybrid systems for ruralelectrification – Micropower systems

Wind farm worker H&S standards include, but are not limited to:

BS EN ISO 14122-1:2001 – Safety of machinery – Permanent means of access to machinery – Part 1:Choice of fixed means of access between two levels

BS EN ISO 14122-2:2001 – Safety of machinery – Permanent means of access to machinery – Part 2:Working platforms and walkways

BS EN ISO 14122-3:2001 – Safety of machinery – Permanent means of access to machinery – Part 3:Stairs, stepladders and guard rails

BS EN ISO 14122-4:2004 – Safety of machinery – Permanent means of access to machinery – Part 4:Fixed ladders

BS EN 795:1997 – Protection against falls from a height – Anchor devices – Requirements and testing

BS 7883:2005 – Code of Practice for the design, selection, installation, use and maintenance of anchordevice

REFERENCE DOCUMENTS

APPENDIX 11(B):

TYPICAL TYPE CERTIFICATION FOR CLASS 1 A TURBINE

TÜV SÜD

Industrie Service

Type Certificate

Subject:	**Wind Turbine ENERCON E-82 E4 – 3.0MW** **Rotor Blade E82-2WK1a** **78.15 m and 83.8 m Hub Height** **WTC I_A**
Registration no.:	02.05.13.12.01
Applicant:	**ENERCON GmbH** **Dreekamp 5** **26605 Aurich** **Germany**
Confirmation:	It is hereby certified that the above mentioned subject has been assessed by TÜV SÜD Industrie Service GmbH concerning the design, the prototype testing, the manufacturing and the type characteristics measurements.
Assessment procedure:	The conformity evaluation was carried out according to IEC 61400-22:2010 'Wind turbines – Part 22: Conformity testing and certification' in combination with IEC 61400-1:2005 including amendment 1:2010 'Wind turbines – Part 1: Design requirements'.

The evaluation is based on the following reference documents:

Registration No.:	dated	Statements of Compliance / Reports
02.05.13.22.01	2013-05-15	Design Assessment E-82 E4 by TÜV SÜD
02.05.13.32.01	2013-05-15	Type Testing E-82 E4 by TÜV SÜD
02.05.13.42.01	2013-04-30	Manufacturing Evaluation E-82 E4 by TÜV SÜD
02.05.13.62.00	2013-03-04	Type Charact. Measurements E-82 E4 by TÜV SÜD
1874047-20-e Rev. 1	2013-05-15	Final Evaluation Report E-82 E4 by TÜV SÜD

This Certificate is valid until **2018-05-14**

if the validity of the certification of the quality management system is maintained.

Munich, 2013-05-15

Dr.-Ing. M. Webhofer
Head Certification Body Wind Turbines
TÜV SÜD Industrie Service GmbH

DAkkS Deutsche Akkreditierungsstelle D-ZE-14153-01-02

Certification Body for products according to DIN EN 45011, IEC/ISO Guide 65 accredited by DAkkS. The accreditation is only valid for the scope mentioned in the accreditation certificate.

Dipl.-Ing. M. Schmalstieg
Head of Department Wind Turbines
TÜV SÜD Industrie Service GmbH

ZERTIFIKAT ◆ CERTIFICATE ◆ 認証証書 ◆ СЕРТИФИКАТ ◆ CERTIFICADO ◆ CERTIFICAT

REFERENCE DOCUMENTS

APPENDIX 11(B):
TYPICAL TYPE CERTIFICATION
FOR CLASS 1 A TURBINE

DNV

DET NORSKE VERITAS

TYPE CERTIFICATE

Vestas V90 3MW

IEC TC-205703-7	**2010-05-17**
Type Certificate number	**Date of issue**

Manufacturer:
Vestas Wind Systems A/S
Alsvej 21
DK-8940 Randers SV

Valid until: 2014-06-07

This certificate attests compliance with IEC 61400-1 ed. 3: 2005 concerning the design and manufacture. The conformity evaluation was carried out according to IEC WT 01: 2001 "IEC system for conformity testing and certification of wind turbines - Rules and procedures."

Reference documents:

Design Evaluation Conformity Statement:	IEC DE-205703-7
Foundation Design Evaluation Conformity Statement:	IEC FE-205703-1
Type Test Conformity Statement:	IEC TT-205703-6
Manufacturing Conformity Statement:	IEC MC-205703-6
Type Characteristics Measurement Conformity Statement(s):	IEC TM-205703-5
Final Evaluation Report:	WTDK-2554 rev.3 and WTDK-3077 rev.1

Wind Turbine specification:

IEC WT class: S. For further information see Appendix 1 of this Certificate.

Date: 2010-05-17

Jorge Dahl

Jorge Dahl
Management Representative
Det Norske Veritas, Danmark A/S

PRODUCTS
RvA C257

Date: 2010-05-17

T. Søndergaard

Torben Søndergaard
Project Manager
Det Norske Veritas, Danmark A/S

DET NORSKE VERITAS, DANMARK A/S

T05 7958243 Ver 07 - Approved - Exported from DMS: 2013-02-01 by MR

PUBLIC

APPENDIX 1 - WIND TURBINE TYPE SPECIFICATION

General:

IEC WT class acc. to IEC 61400-1:2005:	S (IEC WT class 1A/2A except for temperature range)
Rotor diameter:	90 m
Rated power:	3000 kW
Rated wind speed V_r:	13.4 m/s
Hub heights	65m, 75m, 79.8m, 80m, 90m (IEC1A, 50Hz/60Hz) 105m (IEC 2A, 50Hz / 60Hz)
Operating wind speed range V_{in}-V_{out}:	4 – 25 m/s
Design life time:	20 years

Wind conditions:

	1A	2A
V_{ref} (hub height)	50 m/s	42.5 m/s
V_{e50} (hub height)	70 m/s	59.5 m/s
V_{ave} (hub height):	10 m/s	8.5 m/s
I_{ref} at V_{hub} = 15 m/s:	0.16	0.16

Electrical network conditions:

Normal supply voltage and range:	6-33 kV (50 Hz) 10-34.5 (60 Hz)
Normal supply frequency and converter types:	50 Hz VCS 60 Hz VCRS

Other environmental conditions (where taken into account):

Air density:	1.225 kg/m^3
Normal ambient temperature range:	Standard version: -20°C to 40°C LT version: -30°C to 40°C (however maximum air density according to IEC 61400-1 Ed.3 at wind speed above 10m/s: 1.34 kg/m^3)
Extreme ambient temperatures range:	Standard version: -40°C to 50°C LT version: -40°C to 50°C

Main components:

Blade type:	Vestas 44m blade
Gear box alternatives:	Hansen EF901EE55-K1, i=104.6 (50 Hz) Hansen EF901EE55-K1, i=109.0 (60 Hz)
Main bearing alternatives:	FAG: F-809597 FAG: F-807110 SKF: BT2-8125 C/HA1

Generator alternatives:	Leroy Somer G54-10/4P: MK61S (50 Hz VCS) Leroy Somer G54-9/4P: MK71S (60 Hz VCRS) VND DVSGM 560/4L: V5 (50 Hz VCS) VND DVSGM 560/4L: V6 (60 Hz VCRS)
Transformer alternatives:	Siemens AG 4GB6580-9KA SGB DTTHIL 2500/30 ABB DTE 3140/36
Yaw gear	SOM PG 1604 R=1391/1
Tower type:	Tubular steel towers: HH65m IEC 1A (Drawing no.: 960109.V05) HH75m IEC 1A (Drawing no.: 960904.V01) HH75m IEC 1A (Drawing no.: 962995.V03) HH79.8m IEC 1A (Drawing no.: 958412.V06) HH80m IEC 1A (Drawing no.: 75950000.V00) HH80m IEC 1A (Drawing no.: 960558.V04) HH80m IEC 1A (Drawing no.: 75950001.V00) HH90m IEC 1A (Drawing no.: 75950028.V02) HH105m IEC 2A (Drawing no.: 75950010.V00) HH105m IEC 2A (Drawing no.: 75950009.V00) HH105m IEC 2A (Drawing no.: 960567.V04) HH105m IEC 2A (Drawing no.: 960121.V08)
Foundation	Gravity Base Slab HH80 IEC1A, GWL at terrain level (75959509.R2) Gravity Base Slab HH80 IEC1A, GWL at foundation level (75959508.R3) Gravity Base Slab HH105 IEC2A, GWL at terrain level (75959511.R2) Gravity Base Slab HH105 IEC2A, GWL at foundation level (75959510.R2)
Crane and service load	Integrated, 800kg
Service Lift	Avanti, type Shark, max working load 240 kg
Controller	VMP 6000

REFERENCE DOCUMENTS

TÜV SÜD Industrie Service GmbH
Certification Body Wind Turbines

Industrie Service

Statement of Compliance

for the Prototype Testing

Registration No.: **02.05.13.32.01**

This statement of compliance is issued to:

ENERCON GmbH
Dreekamp 5
26605 Aurich
Germany

For the wind turbine:

E-82 E4 – 3.0MW
Rotor Blade E82-2WK1a
WTC I_A

This conformity statement attests compliance of the prototype tests of the above mentioned wind turbine with the standards

IEC 61400-22:2010 Annex D, 'Requirements for Safety and Function Tests',

IEC 61400-12-1:2005, 'Wind turbines – Part 12-1: Power performance measurements of electricity producing wind turbines',

IEC TS 61400-13:2001, 'Wind turbine generator systems – Part 13: Measurements of mechanical loads' and

IEC TS 61400-23:2001, 'Wind turbine generator systems – Part 23: Full-scale structural testing of rotor blades'.

The associated prototype testing reports are listed in the annex.

The conformity evaluation was carried out according to IEC 61400-22:2010, 'Wind turbines – Part 22: Conformity testing and certification'. Changes in the design unless being approved by TÜV SÜD Industrie Service GmbH render this statement invalid.

Munich, 2013-05-15

Martin Webhofer

Dr.-Ing. M. Webhofer
Head Certification Body Wind Turbines
TÜV SÜD Industrie Service GmbH

DAkkS
Deutsche Akkreditierungsstelle
D-ZE-14153-01-02

Certification Body for products according to DIN EN 45011, IEC/ISO Guide 65 accredited by DAkkS. The accreditation is only valid for the scope mentioned in the accreditation certificate.

Dipl.-Ing. M. Schmalstieg
Head of Department Wind Turbines
TÜV SÜD Industrie Service GmbH

TÜV SÜD Industrie Service GmbH
Certification Body Wind Turbines

TÜV SÜD Industrie Service

Statement of Compliance
for the Prototype Testing

Registration No.: **02.05.13.32.01**

Annex

Safety and Function Test

The safety and function test according to IEC 61400-22:2010, Annex D was performed in the presence of TÜV SÜD Industrie Service GmbH. The turbine behavior during starts, stops, grid loss and other transient events has been tested and measured.The results of the safety and function test are reported in:

- "Report on Witness of Safety and Function Test for a Type-Certification Project: Wind Turbine Enercon E-82 E4 Normative Reference IEC 61400-22:2010", report no. 1874047-8-e rev. 1, dated 2013-04-25, issued by TÜV SÜD Industrie Service GmbH

Power Performance Measurement

The electrical power output during production was measured according to IEC 61400-12-1:2005 by the accredited test laboratory Deutsche WindGuard Consulting GmbH. The results of the measurements including the power curve are reported in:

- "Power Curve Test of a Wind Turbine of Type Enercon E-82E3 Location: Simonswolde, Germany", report no. MP12028, dated 2012-07-19.

Load Measurement

The load measurement equipment was installed and calibrated and the mechanical loads were measured according to IEC TS 61400-13:2001 by the manufacturer ENERCON GmbH. The measurement results are reported in document

- "Bestimmung der Betriebslasten an der E-82 E4", document-no. D0257442-0, 227 pages, version 1, dated 2013-04-30

The accomplishment of load measurements was witnessed and the results were reviewed by the accredited Ingenieurbüro Dr.-Ing. Dieter Frey. The comparison of the measurement results with the simulation results was assessed by TÜV SÜD Industrie Service GmbH and reported in:

- "Report on Assessment of Load Measurements for a Type Certification Project: Wind Turbine ENERCON E-82 E4 Rotor Blade Type E82-2WK1a Load Measurements and Comparison with the Results of the Load Simulation Normative Reference IEC TS 61400-13:2001 in combination with IEC 61400-22", report no. 1970959-1-e, dated 2013-05-15.

TÜV SÜD Industrie Service GmbH
Certification Body Wind Turbines

Industrie Service

Statement of Compliance
for the Prototype Testing

Registration No.: **02.05.13.32.01**

Full Scale Rotor Blade Tests

The rotor blade of type E82-2 WK1a was subjected to full scale ultimate strength tests, fatigue strength tests and residual strength tests. The static tests were performed by ENERCON and witnessed by TÜV SÜD Industrie Service GmbH. The fatigue strength tests were perfomed by NAREC, Northumberland, UK, an accredited test institute for full scale rotor blade tests.

The measurement results were reported by the manufacturer ENERCON GmbH in documents

- 'Auswertung Statischer Belastungstest des E82-2WK1a Rotorblattes", dated 2012-07-09, 82 pages, document-no. RW822.120.021|0|1|DE, revision 1.0.
- 'Auswertung Betriebsfestigkeitstest Rotorblatt E82-2WK1a', dated 2013-02-18, 9 pages, document-no. D0246224, revision 0
- 'Auswertung Rotorblatt E82-2 WK1a Statischer Restfestigkeitstest', dated 2013-03-08, 48 pages, document-no. D0245667, revision 0

The related reports from the accredited body/test institute are

- 'Report on Witness Rotor Blade Testing for a Type-Certification', report no. 1832860-2-e, dated 2012-09-28', issued by TÜV SÜD,
- 'Fatigue Test Report Fatigue Testing of Enercon E82-2 Blade ND01133', dated 2013-02-05, 52 pages, project no. 000347, revision 2, issued by NAREC,
- 'Report on Assessment of a Rotor Blade for a Type-Certification', report no. 1832860-3-e Rev. 1, dated 2013-04-08, issued by TÜV SÜD,
- 'Report on Witness Rotor Blade Testing for a Type-Certification', report no. 1969569-1-e, dated 2013-04-05, issued by TÜV SÜD.

The requirements of IEC 61400-23:2001 for full scale blade testing are met.

Comments: The safety and function test and the load measurement were performed at wind turbines of type E-82 E3. Due to the similarity of this type of wind turbine with the type E-82 E4 the results can be accepted for a statement of compliance for the wind turbine type E-82 E4.

end of annex

REFERENCE DOCUMENTS

NORDEX	Form	PM-XEUCON-0063 Version 2.0 Confidentiality: IP Status: Released

Declaration

|0x63d8d800
|0x63d8d800

Foundation Designer's Compliance Declaration

Asthe responsible foundation designer,I hereby declare that the foundation design provided for the following project:

Project Name (Country)

which isequipped with wind turbine generatorsof the following model reference:

Nordex Nxx Rxx MT(R) IEC xx

is in accordance with but not limited to the following laws, standards, specifications and documents:

- Nordex – Site specific foundation design specification F302_148
- Nordex – Foundation design loads XXXX, rev. XX
- Germanischer Lloyd IV-1 Guideline for the certification of wind turbines
- IEC 61400-1
- CEB-FIB Model Code 1990
- National and local applicable building laws and standards.

In particular,as the designer,the following considerations, requirements, checks and verifications have been carried out and fulfilled accordingly:

- Application of correct loads and load safety factors;
- Consideration of the correct anchoring system and correct bolt pretension;
- Clearly structured and complete design report;
- Coherence between structural calculation and design drawings;
- Material selection in accordance with site specific requirements (e.g. material availability, aggressive ambiance);

- Design drawings are clear, concise, easy to understand and consider all relevant construction information (e.g. cable ducts, earthing, dimensions, materials, backfill, groundwater, site topography);
- Simple and risk assessed ease of construction (e.g. construction workflow/method statement);
- Consistency between geotechnical recommendations and design;
- Interaction between the ground, sub-soils and thefoundations (static/dynamic stiffness requirements);
- Checks against overturning, sliding and lift-off (no gap condition);
- Check against shear failure of the soil;
- Check of allowable soil pressures/ground bearing capacity;
- Calculation of ultimate limit state for all reinforcement bars;
- Calculation of fatigue life of all reinforcement bars;
- Calculation of ultimate limit state of all relevant concrete sections (e.g. punching, shearing, bending);
- Calculation of fatigue life of all relevant concrete sections;
- Calculation of ultimate limit state at the load entrance points of the anchor cage (grout, concrete underneath load spreading and anchor plate);
- Calculation of fatigue life at the load entrance points of the anchor cage (grout, concrete underneath load spreading and anchor plate);
- Calculation of the pile loads and head connection - if applicable;
- Site specific requirements – as applicable.
- Crack width limitations.

Designer (Name, Address, Phone) / Stamp

Date & Signature

Technical Specification

Design

Site specific foundation

Document number:
F302_148_EN

Revision: **1**	Created: **R.Wederhake**
Date: **2006-11-23**	
Department responsible: **Central Engineering/FAS**	Checked: **M.Marburger**
Classification: **SC – Partner confidential**	
Status: **FI - Final**	Released: **J.Nitzpon**

AST: 2630

Replacement for:

Document published in electronic form. Original at Central Engineering/ENS.

Revision index

Rev.	Date	Author	Modification (Section)	AST
1	23.11.2006	Wederhake	General revision	2630
0	08.01.2004	Marburger	Created	

Table of contents

1 General

1.1 Scope

This specification serves as a requirement specification for the design of site specific foundations for Nordex wind turbines.

The design of a foundation includes the verification and the construction drawings of the foundation.

1.2 References

Document No., Revision/Edition	Description
	Standards/Guidelines
EN 1990	Eurocode 0: Basis of structural design
EN 1992	Eurocode 2: Design of concrete structures
EN 1997	Eurocode 7. Geotechnical design
CEB-FIP Model Code 1990	Comité Euro-International du Béton, Bulletin d'Information No 203, CEB-FIP Model Code 1990; Final Draft, July 1991
EN 206-1	Concrete – Part 1: Specification, performance, production and conformity
IEC 62079:2001-02	Preparation of instructions – Structuring, content and presentation
GL IV-1:2003 + Suppl. 2004	Guideline for the certification of wind turbines. Hamburg : Germanischer Lloyd WindEnergie, 2004
DIN 1045, Part 1-3:2001-07	Reinforced concrete structures; design and construction
DIN 1054-1:2003-01	Subsoil – Verification of the safety of earthworks and foundations

The edition/revision stated was used in preparation of this document. If not stated otherwise, the newest edition/revision of a document or guideline shall be used.

1.3 Documents to be submitted by Nordex

The input information acc. to chapter 2 shall be content of the following documents

- Load Specification - Foundation
- Drawing of tubular tower
- Drawing of anchor cage
- Drawing of earthing
- Drawing of ductwork

Any documents (appendices/enclosures, drawings, and Nordex specifications) not available to the supplier in the revision stated or higher shall be ordered from Nordex before any work is started.

1.4 General proceeding

The complete documentation according to chapter 6 shall be submitted at least 2 weeks before the agreed date if not stated otherwise. Nordex will review and comment the complete documentation with the objective of a release of the construction drawings to the agreed date. The author of the foundation design has to submit the revised documentation by the agreed date.

Nordex will release the drawings for construction. This release does not imply that Nordex is responsible for the correctness of the content of the documents. The responsibility for the correct content of the documents exclusively remains at the supplier. Nordex informs the supplier immediately if errors in the documents are found.

All changes and/or corrections in the design, verification or the drawings after the release must be immediately announced to Nordex by written.

1.5 Abbreviations, definitions, symbols

Fx: vertical Force

Fy, Fz, Fyz, Fres: horizontal Forces

Mx: torsional Moment

My, Mz, Myz, Mres: bending Moments

TB: Tower Bottom, bottom edge of the base flange of the tower, upper edge of the load spreading plate

ULS: Ultimate Limit state

SLS: Service Limit State

γ: safety factor

foundation: foundation of the wind turbine including concrete body and soil

ductwork: cable ducts

ground gap: theoretic tension in sole level resp. soil under foundation

elastic modulus: Young's modulus

N_{tot}: total mass of wind turbine (nacelle, tower, foundation)

2 Input Information

The necessary input for the design of a foundation is defined below. The entire input information has to be defined by Nordex with the order; missing input information has to be demanded before start of work by the supplier.

2.1. Type of turbine

2.2. Weights and centres of gravity of nacelle

2.3. Stiffness for foundation-soil interaction, Eigenfrequency of the system turbine/foundation

2.4. Loads (extreme loads incl./excl. γ, fatigue loads, permanent loads, earthquake loads with γ=1,0)

2.5. Design of tower, position of tower bottom, anchor bolts

2.6. Design and description of the connection between tower and foundation (anchor cage)

2.7. Specification of standard earthing and standard ductwork

3 Requirements for foundation design

3.1 General requirements

In order to achieve the necessary hub height the position of the tower bottom (TB) must be taken from the drawing of the tubular tower.

3.1.1 Eigenfrequencies

For the foundation design the soil properties have to be taken into consideration in order to ensure that the eigenfrequencies of the entire system wind turbine-foundation meet the requirements of the load calculation.

In general therefore a minimum dynamic stiffness of the foundation, defined by a minimum rotating spring rate $k\varphi_{dyn}$ is specified.

These Specifications result into a definition of the soils elastic modulus. Either the required soils elastic modulus has to comply with the soil conditions or the rotating spring rate $k_{\varphi dyn}$ is to be confirmed by a soil engineer.

For pile foundations a horizontal spring rate $k_{h,dyn}$ depending of the total mass of the wind turbine incl. foundation is defined (see table 1). Intermediate values can be interpolated.

Turbine	$k_{h,dyn}$ approx. N_{tot} = 100 t	$k_{h,dyn}$ approx. N_{tot} = 3000 t
All turbines	$4 \cdot 10^7$ N/m	$1 \cdot 10^9$ N/m

Table 1

3.1.2 Inclination

A maximum inclination of 3mm/m resulting from the characteristic extreme load must be kept strictly.

An unequal settlement of the foundation including load spreading plate of max. 1mm/m can be accepted.

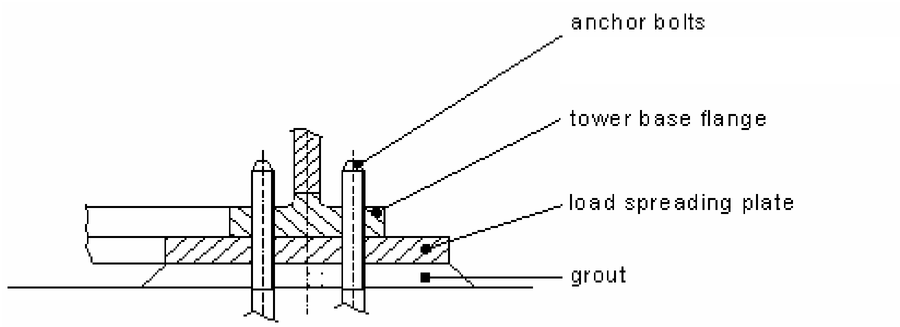
3.2 Materials

For the design of the foundation materials shall be used which are state of the art and of common use in the respective country. Nordex reserves the right to define materials and standards to be used with the order.

3.3 Connection Tower-Foundation

The tubular tower is screw connected to the foundation by a set in concrete anchor cage and a T-flange on the lower end of the tower (see sketch).

The anchor cage consist of anchor bolts M36 or M42 a load spreading plate and an anchor plate. The unbonded anchor bolts are pre-tensioned after adequate curing of the concrete to increase the fatigue resistance of the connection.



sketch – connection of tubular tower to foundation

The pretension F_v of one anchor bolt may be assumed according to table 2.

Anchor bolt	F_v
M36 – 8.8	355kN
M42 – 8.8	500kN
M42 – 10.9	550kN

Table 2

3.4 Loads

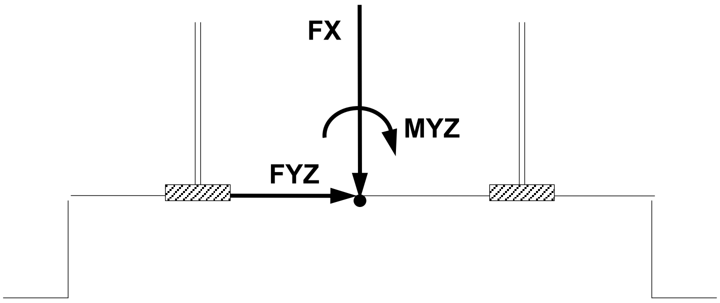
The calculation of the loads is based on accepted standards for wind turbines, e.g. IEC, GL, NVN, DS.

In general the wind turbine model includes wind turbulences, earthquake loads and dynamic behaviour of the entire structure (blades, nacelle, tower, foundation).

The loads loose their validity if a higher wind class is considered or the required eigenfrequencies are not met.

3.4.1 Definitions

All loads are given respective to the intersection tower axis - TB (see sketch). Loads may appear in all directions.



sketch - reference point for effect of loads

The tower is connected to the foundation by an anchor cage. Pressure is lead to the foundation through the load spreading plate while tension is submitted via the anchor bolts to the anchor plate.

The safety factors are defined by the basis standard for the load calculation. If different safety factors are applied for the verification this must be explained and Nordex has to be informed immediately.

3.4.2 Extreme loads

The extreme loads are given for ULS and SLS. ULS loads include a safety factor γ according to the respective standard. As γ is varying the load cases given for ULS and SLS do not have to be identical.

For the verification of the foundation design Myz and Fyz are to be superimposed in a conservative manner.

3.4.3 Fatigue loads

The fatigue loads are given as load collectives for $n = 10^7$ cycles with different gradients and as Rain-Flow-Counts. The fatigue loads implement a safety of γ=1,0. Based on conservative verification procedures only Fx, Fz, Mx and My have to be considered for the fatigue resistance.

The maximum load ranges can be calculated with their related mean loads.

Minimum: mean – 0.5 * range

Maximum: mean + 0.5 * range

Thus the load range of fatigue loads is defined as 2 x amplitude.

3.4.4 Permanent Loads

Permanent loads are defined by GL-Guideline IV Table 6.7.1 see row “Load case 1 according to DIN 1054” to DLC 1.0, 3.1 and 4.1.

Under permanent loads (γ=1,0) no ground gap (tension in the sole level) may occur, see GL-Guideline IV 6.7.6.3 (3).

3.4.5 Earthquake loads

In general the foundation verification has to include earthquake loads.

An abandonment of a verification for earthquake loads has to be specified with the order.

4 Verification of the foundation

Verification shall be provided in accordance with accepted standards, state of the art and existing law in the respective country and also shall comply with the requirements of the *Guideline for the Certification of Wind Turbines* of Germanischer Lloyd (GL-Guideline IV). The foundation must be designed for a lifetime of minimum 20 years.

4.1 Minimum Content of the verification

4.1.1 Revision Index

4.1.2 Description of the wind turbine generator

- turbine and foundation
- dimensions of the foundation
- used materials with information about material characteristics
- used safety factors for the materials
- assumptions for soil conditions
- used loads and their safety factors
- used literature and standards

4.1.3 Sketch of the foundation with main measures

4.1.4 Static proofs

All Proofs must include the verification for fatigue and extreme loads and serviceability.

4.1.4.1 Inner resistance

- main reinforcement top and bottom
- horizontal shear reinforcement
- shear reinforcement / punching
- crack width
- load concentrations at the load spreading plate
- load concentrations at the anchor plate
- load spreading plate[1]
- anchor plate[1]
- anchor bolts[1]
- summary of the results

4.1.4.2 External resistance

- soil shear failure ⇒ soil requirements
- soil pressures, divided up in edge and mean pressure ⇒ soil requirements
- avoidance of ground gap under permanent loads
- tilting (overturning)
- sliding (horizontal shifting)
- buoyancy
- settlement
- summary of the results

[1] Verification model can be provided by Nordex

4.1.5 Soil requirements

- Max. soil pressure
- Min. elastic modulus (static, dynamic)

4.2 Formal aspects

- all pages must be clearly numbered
- all used models must be indicated; extraordinary models must be explained and references be attached
- all used formulas must be indicated completely at their first use, e.g. $f_{cd} = \gamma_c * f_{ck}$
- references in the calculation must be clearly indicated and marked
- the calculation shall be easy to follow and check
- program prints or input lists which don't give final results shall be in the appendix
- results shall be edited graphically whenever possible

5 Verification by a third party

A verification of the foundation design by a third party can be requested by Nordex or local legislation. The author can be responsible for the arrangement of the verification by a third party. This must be defined with the order.

The verifying third party and the extent of this verification will be specified by Nordex.

The author of the foundation design supervises the verification by a third party. This can include the verification processes for a *Design Assessment* or *Statement of Compliance*.

6 Documentation

6.1 General requirements

All documentation shall be provided in English.

Documents intended for use by the end user or on site, such as construction drawings, shall be provided in English and in the language of the country of the installation site.

The documents shall be supplied on paper and in electronic form and comply with the respective guidelines and standards of technical documentation (in particular IEC 62079).

Amendments to any part of the documentation shall be submitted in writing, agreed with Nordex, and all amended documents shall be provided.

All documentation shall be archived in electronic form by the supplier for at least 10 years or in accordance with ISO 9000.

6.2 Extent of Documentation

- Verification of the foundation design acc. to chapter 4
- Construction drawings
- List of reinforcement bars (standard, material, diameter, length, weight)
- Work instruction for the installation of the reinforcement

6.3 Construction drawings

Drawings must be designed according to accepted standards and state of the art. All information on the construction drawings must be indicated in English and the language of the respective country.

The drawings must indicate the quantity and quality of steel and concrete.

The building contractor must be able to fabricate the foundation with these drawings without any further information.

The integration of general drawings for earthing and cable tubes in the foundation drawings must be agreed with Nordex.

6.4 Electronic document formats

- 3D models and drawings: Pro/Engineer compatible (alternative: *.iges or *.step format)
- 2D drawings: MegaCAD, *.dxf, Adobe Acrobat Document (PDF)
- FEM: Ansys, Pro/Mechanica
- Calculations: Excel, Mathcad, Adobe Acrobat Document (PDF)
- Lists: Excel, Access, Adobe Acrobat Document (PDF)
- Text documents: Word, Adobe Acrobat Document (PDF)

Deviations are to be agreed with Nordex before delivery.

7 Scope of supply

A development of a site specific foundation shall include:

- the documentation according to chapter 6
- the arrangement and supervision of a verification by a third party if requested

8 Quality requirements

8.1 Requirements to the supplier

The supplier should be certified according to ISO 9000 pp; at least an effective quality assurance system shall be in operation. Nordex reserves the right to audit the quality assurance system in the design and production processes after prior notification. The supplier agrees, without restriction, to be audited by Nordex customers after prior notification.

9 Protection notice

REFERENCE DOCUMENTS

REFERENCE DOCUMENTS

IWEA
Irish Wind Energy Association

Health and Safety Guidelines for the Onshore Wind Industry on the Island of Ireland 2011

APPENDIX 11(D)

CHAPTER 9: CONSTRUCTION, COMMISSIONING AND DEMOLITION

CHAPTER 10: OPERATION AND MAINTENANCE

www.iwea.com

Issue/Version
Issue Draft 2 (For Consultation): September 2011

Acknowledgements

IWEA acknowledges the time, effort, experience and expertise of all those who contributed to this document. Details of the organisations and indwividuals who participated in the consultation and editorial of this document are available on request from IWEA.

Foreword

Health and Safety Authority

[To be finalised]

IWEA Foreword

These Guidelines for Health & Safety in the Wind Energy Industry Sector on the island of Ireland reflects our commitment to keeping IWEA members and the industry up to date with Health and Safety developments, new legislation, guidance and best practice. The Guidelines are intended for information, general guidance and as an aide-mémoire for senior and operational managers within the industry sector. We will include minor changes reflecting any revised information in further versions of the document and by updates to members. As such, we welcome and encourage any comments on the format, quality and accuracy of this publication.

We acknowledge that improvements can always be made, and whilst the Guidelines do not constitute advice, or indicate any specific course of action, we wish to support and promote the sharing of good practices within the industry, so please contact IWEA if you have any enquiry on these Guidelines or the supporting Health and Safety issues they aim to promote.

Johanna Cafferkey, Chairperson IWEA Health and Safety Strategy Group

Disclaimer

The contents of these Guidelines are intended for information and general guidance only, do not constitute advice, are not exhaustive and do not indicate any specific course of action. Detailed professional advice should be obtained before taking or refraining from taking action in relation to any of the contents of these Guidelines or the relevance or applicability of the information herein.

Glossary

Note: entries are primarily limited to those terms not explained in the text.

AC	Alternating Current
ACOP	Approved Code of Practice
APS	Association of Project Safety
CAA	Civil Aviation Authority
CDM	Construction (Design & Management) Regulations 2007
CIAT	Chartered Institute of Architectural Technologists
CIBSE	Chartered Institute of Building Services Engineers
CIOB	Chartered Institute of Builders
CITB	Construction Industry Training Board
Client	The organisation which carries out a project or for which a project is carried out
Commoners	Persons who have rights over land
COSHH	Control of Substances Hazardous to Health
CPHSP	Construction Phase Health & Safety Plan
CSSHP	Construction Stage Safety and Health Plan
DC	Direct Current
Distribution Code	Regulations governing the connection and operation of generating plant to the distribution network
DNO	Distribution Network Operators
DRA	Design Risk Analysis (as used by designers under the SHWW Construction Regulation or CDM)
DSEA	Dangerous Substances and Explosive Atmospheres
EAW	Electricity at Work Regulations
EMAS	Employee Medical Advisory Service
ERP	Emergency Response Plan
ETCI	Electro-Technical Council of Ireland
FLO	Fisheries Liaison Office
HASWA	Health & Safety at Work etc.Act 1974 UK
HASWNIO	Health & Safety at Work (Northern Ireland) Order 1978
HAV	Hand Arm Vibration
H&S	Health & Safety
HIAB	Truck or lorry mounted crane (proprietary name)
HSA	Health and Safety Authority
HSE	Health & Safety Executive (UK)
HSENI	Health & Safety Executive of Northern Ireland
HSF	Health & Safety File (as defined under CDM)
HV	High Voltage – a voltage exceeding 1000V AC or 1500V DC measured between conductors, or 600V AC or 900V DC measured between conductors and earth

ICE	Institute of Civil Engineering
IEC	International Electrotechnical Commission
IEI	Engineers Ireland
IMechE	Institute of Mechanical Engineers
IRATA	International Rope Access Trade Association
IOSH	Institution of Occupational Safety & Health
ISM	International Safety Management Code
IStructE	Institute of Structural Engineers
IVB	Independent Verification Body
KPI	Key performance indicator
kV	kilovolt
LV	Low Voltage – a voltage exceeding 50V AC or 120V DC, whether measured between conductors or to earth, but not exceeding 1000V AC or 1500V DC measured between conductors, or 600V AC or 900V DC measured between conductors and earth
MHSWRNI	Management of Health & Safety at Work Regulations (Northern Ireland) 2000
NATS	National Air Traffic Services
NLB	Northern Lighthouse Board
NOK	Next of Kin
O&M	Operations and Maintenance
PPE	Personal Protective Equipment
PSDP	Project Supervisor Design Process
PSHP	Preliminary Safety & Health Plan
PSCS	Project Supervisor for the Construction Stage
PPM	Planned Preventive Maintenance
PTW	Permit to Work
RIDDOR	Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (Northern Ireland) 1995
RNLI	Royal National Lifeboat Institution
ROV	Remotely Operated Vehicle
RSPB	Royal Society for the Protection of Birds
SCADA	Supervisory Control and Data Acquisition
SHWW	Safety, Health and Welfare at Work
SHWWA	Safety, Health and Welfare at Work Act 2005
SHWWCR	Safety, Health and Welfare at Work (Construction) Regulations 2006
SHWWGAR	Safety, Health and Welfare at Work (General Application) Regulations 2007
SMS	Safety Management System
TSO	Transmission System Operator
UXO	Unexploded Ordnance
WTG	Wind Turbine Generator
WTSR	Wind Turbine Safety Rules (developed by RenewableUK and now commonly used within the industry)

REFERENCE DOCUMENTS

Contents

Appendices

BEST PRACTICE GUIDELINES FOR WIND ENERGY HEALTH AND SAFETY

1. Introduction

1.1 The Irish Wind Energy Association (IWEA) was established to promote the use of wind power on the island of Ireland. IWEA acts as a central point for information for our membership as well as a lobbying group to promote wind energy to government. IWEA researches and proposes solutions to current issues and generally acts as the forum for the Irish wind industry. IWEA is committed to promoting the use of wind energy in Ireland and beyond as an economically viable and environmentally sound alternative to thermal or nuclear generation. In September 2010 IWEA established a group dedicated to Health & Safety in the Wind Industry in Ireland. The goals of the Health & Safety Strategy Group are:

- To act as an information sharing forum for IWEA members
- To communicate safety best practice and to highlight safety issues to the IWEA membership
- To facilitate the development of safety best practice
- To safeguard the industry through the use of safety alerts, lessons learnt documents and contact information.

1.2 Members are expected to adhere to the highest standards and ensure that contracts for design, procurement, construction, commissioning and operation are written so as to promote safe practices and avoid clauses that may compromise Health and Safety. This is fundamental to the development and maintenance of a strong safety-first culture within the industry.

1.3 IWEA recognises the importance of the Client in establishing high standards for Health and Safety at every stage of a renewable energy project. Clients and developers should promote high standards through the selection and management of the whole of their supply chain, including designers, manufacturers, contractors and operators. Clients also have enhanced legal responsibilities for project safety under the SHWW Construction Regulations (ROI) and CDM Regulations (NI), as explained later in this document, which include ensuring that sufficient resources, including time, are allocated to a project. It is further recognised by the regulations that designers and manufacturers will have significant impact on Health and Safety throughout the life of the project. Designers have an obligation to eliminate, or, if impractical, reduce the severity of hazards. As such they have a major influence in promoting improvements in Health and Safety within the industry.

1.4 It is also accepted that a commitment to good practice requires that throughout the life cycle of a wind farm,steps are in place to ensure that the workforce are involved in improving Health and Safety standards as far as reasonably practicable through appropriate consultation, suitable training, competence assessments and by ensuring adequate supervision.

1.5 IWEA wishes to promote experience transfer between members so that good and best practices can be disseminated through learning from accidents, incidents, near events and operating experience. It is recognised that significant costs to operators, designers, manufacturers and suppliers can occur as a result of workplace accidents. Investment in safety to reduce accidents makes sound commercial sense. IWEA is in the process of setting up a "Best Practice and Lessons Learned" area in the Health and Safety section of the IWEA website which is open to all.

1.6 Recognising the advantages of having a common standard for safeguarding persons from the inherent dangers that exist from electrical and mechanical plant IWEA recommends the adoption of a safe system of work for operational turbines. One such system of work is the Wind Turbine Safety Rules ('the Rules'). The Rules do not replace legislation or other regulatory requirements, however, they have been welcomed by owners, operators and service organisations and are in widespread use on operational turbines in ROI and the UK. More detailed information on the Rules and guidance on their application can be found in Section 10.3 at iwea.com and at www.renewable-uk.com.

1.7 These Guidelines have been drawn up with the aim of enhancing Health and Safety on wind energy developments on the island of Ireland incorporating both ROI and NI. The guidelines are based almost exclusively on the Guidelines published by Renewable UK in September 2010. Specific changes in this Irish version of the guidance include the following:

- Inclusion of the applicable legislation references from ROI and NI
- Inclusion of relevant guidance from the Health and Safety Authority in Ireland and the Health and Safety Executive of Northern Ireland
- Deletion of all references and guidance relating to the offshore wind industry (It is planned to update this guidance to include offshore wind and renewables in the future)

1.8 While the majority of these Guidelines are applicable to any geographic location, the document assumes that Irish (ROI or NI) mainland legislation applies. Where this is not the case, reference to the appropriate regulatory requirements will need to be made.

1.9 IWEA welcomes feedback on its published material and readers are encouraged to forward comments and suggestions for future revisions to health&safety@iwea.com

REFERENCE DOCUMENTS

9. Construction, Commissioning and Demolition

9.1 Introduction

As part of the IWEA safety strategy a construction safety sub-group has been established with the aim of helping to develop best practice in the area of wind farm construction in Ireland.

The installation and commissioning phases of the project will represent one of the highest risk phases with respect to Health and Safety considerations. As discussed in Section 8, much can and should be done in the design phase to remove or reduce construction phase risks, and Section 9 now addresses key steps to further mitigate risks during this phase of the project.

The term 'construction' includes commissioning, dismantling and demolition, and the term 'Contractor' includes all persons/organisations undertaking such work.

9.2 Legislative requirements

9.2.1 A table of the various legislative requirements and their applicability to each stage of the project is included in Section 6. A list of further guidance on the application of the legislation in ROI and NI is given in Appendix 1.

9.2.2 During the construction phase of a project, the works will be under the control of the PSCS or Principal Contractor appointed by the Client under SHWWCR or CDMNI respectively. All persons and organisations working on the project site (including persons working for the Client) come under the control of the PSCS/Principal Contractor and must comply with the site rules. Only one PSCS/ Principal Contractor may be appointed for a single site at any time.

However, it may be appropriate, where different work packages are being carried out in parallel, for these to be defined as separate projects, each with its own PSCS/Principal Contractor, provided each has a separate delineated site and access to it. The interfaces between each project would need to be explained in the Preliminary Safety and Health Plan (ROI) or Pre-Construction Health and Safety Information (NI). In this situation, the Health and Safety plan prepared by the PSCS/ Principal Contractor must recognise the interfaces involved and contain measures to manage those interfaces. Duties of the PSCS/ Principal Contractor and other contractors on site are listed in Section 6.

9.3 Notification

9.3.1 The SHWW Construction Regulations requires the HSA to be notified of any project that will last more than 30 days (of construction) or involve more than 500 man days. The Client is responsible for notifying the HSA of the construction project by means of completion of Form AF1 as soon as the design process begins.

If construction work on a project is planned to last longer than 30 working days or exceed 500 person-days, the Client must promptly notify the Health and Safety Authority of the project, the details of the Project Supervisor Design Process, and the Project Supervisor Construction Stage where this is known, as set out in Approved Form AF.1This Notification should be made at the earliest possible point after the making of the appointment of the PSDP. The notice should be sent by registered post to the Authority or as may be directed by the Authority. The Project Supervisor Construction Stage is also required to notify the Authority of a construction project before construction commences on site (AF2 Form)

Prior to erection or use of tall structures and equipment, whether temporary or permanent, e.g. cranes, turbine towers or tall met masts, the following authorities and organisations should be informed:

- Irish Aviation Authority
- local airfields; and
- parachutist, paraglider, microlight and ballooning organisations.

Request confirmation from all parties informed, to ensure all information provided has been made available to all potential air users

9.3.2 CDMNI requires the HSENI to be notified of any project that will last more than 30 days (of construction) or involve more than 500 man days. The CDMC is responsible for notifying HSENI of the construction project (usually by means of completion of Form F10) shortly after their appointment. If information is missing from the form (e.g. this is before the Principal Contractor is appointed) then an additional notification may be sent in.

Prior to erection or use of tall structures and equipment, whether temporary or permanent, e.g. cranes, turbine towers or tall met masts, the following authorities and organisations should be informed:

- MOD, CAA, NATS (the minimum information required is OS/GPS location and tip-height above existing ground level);
- local airfields; and
- parachutist, paraglider, microlight and ballooning organisations.

Request confirmation from all parties informed, to ensure all information provided has been made available to all potential air users.

9.4 Document control and record keeping

Requirements for compiling and retaining Health and Safety records are defined in the specific legislation contained within Section 6. It is recommended from the outset that a document control and record keeping procedure is established, and arrangements made for the storage, retrieval and maintenance of the records for their required retention period.

Typical project documentation will include:

- Health & Safety management system procedures and documentation;
- pre-construction information;
- preliminary and construction stage plans;
- drawings and specifications;
- Electrical systems status records
- minutes of project meetings;
- project reports;
- method statements;
- risk assessments;
- Work permits and associated documentation.
- safety incident records including Near Misses, Good Catches, Dangerous Occurrences and Injuries
- chemical agent risk assessments (ROI) or COSHH assessments (NI) and health surveillance records;
- test and commissioning reports;
- training records and certification;
- equipment certification;
- daily personnel attendance records; and
- post-construction surveys.

In addition to the above both the SHWW Construction Regulations and CDMNI requires the Client to ensure that a Safety File is created and maintained for the lifetime of the structure. This file is required to contain all relevant information relating to the structure.

9.5 Planning, communication and coordination

Maintaining high standards of planning, communication and coordination of project Health and Safety goals, rules and requirements throughout the construction phase can go a long way in preventing accidents.

9.5.1 Planning

9.5.1.1 In ROI the PSCS must develop a suitable Safety and Health Plan for the project, prior to the commencement of construction work. The plan provides the blueprint for managing and co-ordinating safety and health during construction. The plan needs to explain how the key safety and health issues will be managed. It must be relevant to the particular project and should be built on the Safety and Health Plan prepared on a preliminary basis by the PSDP.

The PSCS should develop this Safety and Health Plan so that it:

- incorporates the approach to be adopted for managing safety and health during the construction stage;
- takes account of the relevant sections of the Safety Statements prepared by the different contractors under Safety, Health and Welfare at Work Act 2005. (The PSCS should check the safety statements prepared by the contractors to ensure that they relate to the site in question and the work activities to be carried out);
- includes the specific control measures for dealing with Particular Risks;
- takes account of other work activities taking place on the site (e.g. where the construction work overlaps with non-construction activities);
- incorporates the common arrangements (including emergency procedures and welfare as well as details regarding control, co-ordination, and management of shared equipment, such as scaffolding and lifting appliances);
- document the arrangements for ensuring effective co-operation and co-ordination;
- includes arrangements for monitoring compliance with the Safety and Health Plan and with safe working procedures;
- includes arrangements for checking that persons on site have received appropriate safety and health information and training, e.g. Safe Pass and CSCS, and that consultation arrangements are in place;
- includes arrangements for ensuring effective communications between all parties, and the arrangements for appointing a site safety representative (this may include matters such as frequency of project or site meetings and how safety and health is to be dealt with at these meetings, frequency of site safety representative inspections, etc);
- includes information and arrangements for the welfare of workers (effective washing, welfare and changing facilities are a vital part of health precautions, for example, against cement contact dermatitis and contamination by other hazardous substances);
- is modified as necessary as work progresses and as changes occur.

REFERENCE DOCUMENTS

As much of the Safety and Health Plan as possible should be developed before construction work starts, particularly the procedures and arrangements which are applicable to the generality of the construction stage and early work packages, the Safety and Health Plan must be kept up to date, modified, and altered in the light of changing circumstances and standards achieved on site and as the construction work progresses. If the contracting arrangements are such that design and preparation for many of the work packages is not complete at the start of the construction stage, the parts of the Safety and Health Plan relating to those packages need to be developed. Safety statements and information from contractors starting work during the different work stages of a project will invariably mean that parts of the Safety and Health Plan have to be amended and updated before construction of such work packages commences.

Reviews of parts of the Safety and Health Plan may also need to be made if there are design changes or alterations, unforeseen circumstances or if variations to planned circumstances arise. It is vital that such changes are notified to all parties working on site who will be affected.

As an integral part of developing the Safety and Health Plan, the PSCS must check that a hazard identification and risk assessment has been carried out for each of the main stages during construction. To do this properly, information, including method statements and safety statements, will generally be needed from the contractors who will be working at the site. If risks arise because a number of contractors are exposed to a common hazard (e.g. from site transport, shared scaffolding, unguarded openings or lifting operations), the PSCS needs to ensure that the risks are avoided, or if this is not reasonably practicable, effectively controlled and managed.

9.4.1.2 In NI a Construction Phase Plan is required to be completed by the Principal Contractor under CDM. In addition to this plan, the Principal Contractor is required to define a timetable for project completion. Sufficient time must be built into the project timetable to allow for Health and Safety to be effectively managed. Consideration should be given to:

- project organisational structure and clearly defined Health and Safety roles and responsibilities of all appointees under CDM, responsible persons and site personnel;
- setting of clear objectives and goals for Health and Safety throughout the project;
- setting of clear Health and Safety site rules and performance requirements;
- defining systems, procedures and documentation to be used to manage Health and Safety;
- interfaces between contractors and overlapping work;
- the construction methods to be used, including the preparation of method statements, risk assessments and safe systems of work;
- the order of construction activities/events required to complete the work safely;
- the equipment, facilities and personnel to be utilised throughout the construction phase;
- safety precautions to be implemented;
- allocation of appropriate resources to ensure all necessary information, instruction and training is provided;
- allowing sufficient time for employee consultation;
- working times and limitations on personnel, shift rotation and handover;
- project programming to define timescales of work completion and project milestones; and
- review of planning and plan arrangements, frequency, responsibility and actions.

9.5.2 Communication and coordination

Both the SHWW Construction Regulations and CDMNI require employers who share a workplace to cooperate and coordinate their activities in the interest of Health and Safety. Arrangements for maintaining communication and coordination throughout the construction phase should consider:

- the frequency and methods of communication between the duty holders
- site personnel;
- third parties and other site users;
- the public;
- arrangements for shared workplaces;
- arrangements for emergency response;
- provision of information, instruction and training;
- equipment to be used to post or deliver communication information; and
- audit and review to measure performance and make sure ‘the message is getting through’, and everyone at all levels understands their role within the project.

REFERENCE DOCUMENTS

9.5.3 Communication on site

Maintaining good communication on site is crucial to help maintain Health and Safety standards, and to respond effectively to requests for support and emergency assistance. Arrangements should ensure:

- contact can be maintained with key personnel, e.g. by mobile phones or radios, at all times;
- procedures are established for persons working alone or in small groups (lone access to towers and remote places should be avoided);
- rules and procedures are understood and followed,
- site risks are communicated and control measures are understood
- all workers understand instructions and information whatever their native language;

Methods of communications on site may include:

- Site inductions
- Safety workshops
- Safety briefings
- Toolbox talks
- Safe system of work plans (SSWP)
- Coaching audits
- Safety notice boards.
- Safety signs

9.6 Competence

9.6.1 SHWW Construction Regulations 2006 (ROI)

When making the appointments of Project Supervisors, it is essential that the Client is as satisfied as he or she can reasonably be that those appointed are competent to carry out the duties set out for them in these Regulations.

The Client is obliged to make reasonable enquires regarding the competence of those proposed to be appointed. Assessment of the responses to any enquiries made needs to be guided by common sense and, where appropriate, professional advice. The professional bodies in the construction industry may be in a position to offer advice as regards the essential qualifications and training required.

In large scale projects, or where panels of contractors are used, a prequalification procedure might be an integral part of the enquiry into competence of certain potential appointees.

When assessing competence, the following general guidelines should be considered:
- Only those competencies and resources that relate to the duties of the person being assessed need to be considered;

- The matter to be considered is the capacity of the person being assessed to comply with the duties that they would carry under the Regulations;
- The assessment should relate to the project under consideration but may also focus on previous projects executed and experience gained elsewhere;
- The assessment should be proportionate and should concentrate on the main issues, rather than being generic;
- It follows that a relatively minimal assessment should suffice for what will clearly be a relatively low-risk project;
- An extensive assessment should not be necessary when dealing with a person whom you have recently subjected to the process on a similar project;
- Past performance on safety and health, including accidents reported to the Health and Safety Authority, enforcement record, and previous remedial actions should inform the assessment;
- A good guide should be a proven track record of competence within the duty-holder's field.

Clients also have a duty to ensure that those appointed as PSDP, designers, PSCS, or contractors have adequate resources to carry out their functions under the Regulations. Resources as they relate to the PSDP (and designers) include staff with the requisite expertise and competence to assist in the execution of the role of PSDP (or designer) for a project or part of a project. The regulations require that assurance is sought by the Client that the PSDP or Designer will deploy resources to the project at a suitable time and in an appropriate manner to allow the role of PSDP/Designer be executed in accordance with the Regulations. Resources may also include infrastructure within or available to a company, such as information technology, communication systems, in-house safety management systems, and other items of infrastructure which facilitate the execution of the role of PSDP/Designer in accordance with the Regulations.

The assessment of resources is an important aspect of the Regulations. To reasonably assure himself or herself of the resources that will be deployed to a project by the successful appointees, the client is expected to make reasonable enquiries in relation to potential appointees. These reasonable enquiries might take the form of enquiries to the potential appointees themselves and/or of others who are familiar with the competence and capabilities of the proposed appointee or members of the proposed appointee's team.

Further detail on competence assessment of project supervisors, designers and contractors is available in two HSA publications "Best Practice Guide for Clients in Construction" (HSA, 2009) and "A Guide to the design and management sections of the Safety, Health and Welfare at Work Construction Regulations 2006" (HSA, 2006)

9.6.2 CDM (Northern Ireland)

A key stage in the successful delivery of any project is ensuring that only competent organisations and individuals are appointed. The HSE states that for an organisation or individual to be deemed competent they must possess sufficient knowledge of the specific tasks to be undertaken and the risks that the work will entail; have sufficient experience and ability to carry out their duties in relation to the project;

and be able to recognise their limitations and take appropriate action in order to prevent harm to those carrying out construction work, or those affected by the work. (Source: HSE CDM ACOP)

In addition, ACOP L144 also states that 'no-one should undertake any work which they themselves are not competent to perform'.

The Association of Project Safety (APS) holds registers of both corporate and individual members who have demonstrated levels of competence in their particular construction discipline. It is recommended that those organisations and personnel appointed under CDM are, as a minimum, registered with APS.

It is recommended that a two-stage assessment is performed. An example for a technical or managerial level role would involve:

- Stage 1 would include task knowledge appropriate for the tasks to be undertaken. This would include knowledge and experience of the design and construction process. Typically, individuals would be professionally qualified to a chartered level (e.g. CIBSE; ICE; IEE; IMechE; IStructE; RIBA; CIAT; CIOB, etc.). In addition, evidence of Health and Safety knowledge would be expected. This could include relevant CPD qualifications (e.g. IOSH Managing Safely, NEBOSH National General Certificate in Construction Occupational Safety and Health) and registers (e.g. ICE), and membership (e.g. IOSH, APS).

- Stage 2 would be to gather evidence to determine if the individual has the experience and ability to perform the task. This would specifically include evidence that they have experience of projects with comparable hazards and complexity. This will be particularly important for wind farm projects. It should be noted that a similar approach is recommended when assessing the competence of organisations.

9.7 Risk assessments and method statements

9.7.1 Risk assessments have been covered in Section 5.7 above. However, the risk assessment process should remain 'live' throughout the construction phase, so that appropriate reviews, modifications and updates may be made to reflect actual events during the work. Changes in work methods and practices, and subsequent risk assessment should be controlled in accordance with Section 5.8 – Management of Change.

9.7.2 Method statements should be prepared for all activities in sufficient detail to:

- provide a clear understanding of the work to be performed;
- provide an understanding of the appropriate control measures and precautions to be used;
- provide an understanding of residual risks that cannot be otherwise controlled;
- provide an understanding of roles and responsibilities related to the work to be undertaken;
- allow the Principal Contractor to develop the Health and Safety plan; and
- allow high-risk activities to be properly monitored and controlled.

9.8 Safe systems of work

Apply a safe system of work such as the Wind Turbine Safety Rules when the turbines become energised. See Section 10.9 below for further information.

9.8.1 Permit-to-work systems should be considered for:

- activities in which it is not practical to remove significant hazards;
- high-risk activities, e.g. excavations, hot work (the application of heat, including welding, burning or grinding on plant containing flammable materials) and entry into confined spaces;
- managing the connection of newly constructed plant and equipment to an electrical and
- working on installed equipment that has been put into service, i.e. post-energisation.

Further information may be found in HSE Guidance document HSG 250 – Guidance on permit-to-work systems (see Appendix 1).

9.8.2 Procedures should be established:

- for access and egress to the site
- for the control and management of traffic on the site particularly during high volume periods
- for high-risk activities, e.g. working at height, working over water and heavy lifting;
- for equipment to be 'handed over' or 'energised';
- to keep all contractors, and their employees, informed of equipment status;
- to ensure that the work of one contractor does not adversely affect others;
- for connection of equipment to 'live' services;
- to control access to equipment that is automatically or remotely controlled;
- to assess the requirements for first aid training and the provision of equipment;
- for lone and remote workers;
- to ensure adequate response to emergency situations

9.9 First Aid

IN ROI under the SHWW General Application Regulations 2007 employers have a duty to provide first-aid equipment at all places of work where working conditions require it. Depending on the size or specific hazards (or both) of the place of work, trained occupational first-aiders must also be provided. Further guidance on first aid rooms and recommended first number of first aiders is provided in HSA Guidance (Ref Appendix 1)

IN NI the Health and Safety (First-Aid) Regulations (Northern Ireland) 1982 apply. They require that suitable risk assessments should be conducted to ensure that adequate and appropriate equipment, facilities and personnel are provided to ensure employees receive immediate attention if they are injured or taken ill at work. Further Guidance is provided in an approved NI code of practice (Ref Appendix 1)

Specific examples that may require further attention for wind related projects include consideration of:

- Adequate eye wash, defibrillators, emergency showers, stretchers and other specific items of equipment relevant to the project
- Suitable measures to ensure first aid provisions are properly maintained;
- The provision of Automated External Defibrillators (AEDs) at appropriate locations and suitable trained operators
- Additional training with respect to electric shock/burns, hypothermia, suspension syncope. (Note: Only following advice from a suitable competent person)
- The need to communicate to everyone on site what first aid provisions there are and where to find/summon them including the equipment and first-aiders
- Recording of first aid treatment in accordance with the statutory and company specific requirements

Note: Principles and practice apply to operations and maintenance activities as well.

9.10 Emergency arrangements (Onshore Windfarms Only)

9.10.1 A site Emergency Response Plan (Project ERP) must be in place during the construction phase, with appropriate additions or adjustments for specific or 'one-off' operations. Where contractors are involved, the plan must detail 'bridging' arrangements between the Emergency Response Plans of individual contractors.

When developing the ERP, consideration should be given to the remoteness of the site location and response times of emergency services, and appropriate arrangements provided, i.e. equipment and trained personnel (e.g. first aid / rescue training), to ensure self sufficiency and preservation of life until emergency services are in attendance.

Emergency Response Plans must include (as a minimum):

- the roles and responsibilities of all key personnel appointed to effectively manage the organisation's emergency response arrangements, including those in overall control and those appointed to control each site;
- contact details for organisation's legal advisers to be used in the event of serious incidents;
- emergency contact details for all internal and external parties involved in the works;
- third-party emergency service contact details;
- the location of all site access points and site plans;
- details of potential hazards and emergency situations that the emergency services may encounter;
- details and locations of significant hazards, e.g. high-voltage equipment;
- details and locations of nearby installations that may provide assistance in an emergency;
- emergency communications procedures;
- emergency response procedures for initial actions in emergencies that could be anticipated, including:

- evacuation of nacelle and WTG,
- emergency shutdown of energised equipment,
- failed lifting operations,
- fire,
- sickness,
- injury,
- pollution,
- bomb threat / sabotage,
- extreme weather,
- peat ground movement
- engulfment / drowning

• procedures for personnel tracking;
• procedures for the notification of next of kin;
• public relations procedures for dealing with the press;
• statutory reporting requirements;
• training and drills requirements;
• procedures for liaising with the emergency services and regulatory authorities; and
• procedures for calling-off assistance to represent employees during interviews with regulatory authorities (note: work colleagues may be prevented from assisting as nominated persons)

It is recommended that exercises are regularly undertaken to validate the ERP and to ensure that operations staff are familiar with it. It is particularly important to engage local emergency services, including medical facilities, in understanding the potential needs of the project and the environmental conditions under which they may be asked to assist.

9.10.2 The following procedures should be established in line with the ERP, based on suitable and sufficient risk assessments and following consultation with local emergency services:

• all foreseeable emergency situations relevant to onshore sites, including evacuation and escape;
• safe transportation and storage of hazardous materials, e.g. flammable substances;
• hazardous activities, such as hot work (the application of heat, including welding, burning or grinding on plant containing flammable materials), potentially including cable jointing/terminating;
• abnormal weather conditions, e.g. extreme cold, floods and lightning; and

9.10.3 Based on a suitable and sufficient fire risk assessment, working areas should be provided with:

• means of raising the alarm;
• clear and accessible evacuation instructions;
• suitable means of escape, including signage, emergency lighting and designated assembly areas;
• portable fire-fighting equipment;
• means of disposing of scrap and waste materials safely;
• fixed fire detection and extinguishing systems, where appropriate;
• additional precautions/devices as recommended by the fire risk assessment (e.g. places of safety, r

refuges etc.)

9. 10.4 Ensure that persons working on site:

• are familiar with all relevant emergency arrangements;
• are trained, well versed and practised with the arrangements, and know what to do; and
• know who will take charge in emergency situations.

9.11 Information, consultation, training and supervision

9.11.1 Ensure that:

• persons appointed to work on site possess the necessary level of skills and competence;
• statutory notices and posters are clearly displayed;
• Safety awareness training as required by legislation has been provided to relevant persons (safe pass ROI) a site safety representative chosen by the workers where possible has been appointed where required by legislation (SHAWCR ROI)
• employees are able freely and openly to express their views about Health and Safety;
• employees are provided with information about Health and Safety, e.g. toolbox talks;
• site induction training is provided, registered and enforced, so that no person may access the works without having been inducted;
• information is displayed on site-specific hazards, e.g. warning notices;
• sufficient supervision of appropriate experience is provided;
• training takes account of potential language barriers of workers; and
• any additional training to be confirmed via risk assessment and training-needs analysis.

9.11.2 Before and during work on site it is necessary to:

• establish the level of competence of persons as they arrive on site;
• make an assessment of any necessary further specialist training or refresher training to be provided;
• ensure details of all training are recorded;
• provide Health and Safety information regarding the site to all contractors;
• provide training on working at height techniques;

9.12 Weather conditions

An adverse-weather policy should be established to cover:

• effects of high winds, e.g. specify permissible wind speeds governing lifting operations;
• effects on workers of inclement weather, e.g. when working at height, on steep slopes and in bad ground conditions;

- risk of being snowed in or cut off, e.g. due to flooding;
- lack of visibility, e.g. fog and low cloud;
- work on, or in close proximity to, metal structures when there is a risk of lightning strike;
- dry weather increasing the risk of heath/moorland fires;
- hot sunny weather increasing risk of sunstroke, sunburn and dehydration;
- cold weather increasing the risk of frostbite/hypothermia;
- additional weather-related PPE;

9.13 Temporary facilities

9.13.1 Provision should be made for:

- location of temporary structures, e.g. on firm ground, secured/anchored against high winds;
- safe access to working areas, which might include pedestrian and site transport;
- first aid facilities and trained first-aiders;
- communication links on and off site, e.g. temporary landlines, mobile phones and radios;
- safe unloading, storage and laydown of materials;
- preventing unauthorised access to quarrying activity or borrow pits;
- washout areas for concrete delivery vehicles
- adequate and safe installation of temporary services, e.g. electricity, LPG supplies and fuel supplies;
- recording of the location of temporary services e.g gas lines, electricity cables etc.
- adequate maintenance and servicing of any gas appliances (and associated flue systems) that are provided for the use of workers, e.g. water heaters, cookers or heaters; and

9.13.2 Temporary facilities should be:

- kept clean and regularly maintained;
- securely fenced and contained against vandalism or leaks to the environment, e.g. fuel oil; and
- waste should be regularly removed from the site.

9.13.3 Welfare arrangements for workers should include:

- protection against extremes of climate;
- toilets and washing facilities, including hot water;
- mess and first aid facilities;
- storage for personal protective equipment;
- changing/drying rooms;
- adequate heating / ventilation of facilities for office work

9.14 Site access

9.14.1 Liaison with public highway authorities will be required to plan delivery of materials, plant and equipment to ensure safe passage and ensure that associated risks are managed, as far as other road users are concerned. This often involves the development and agreement of transport plans.

Temporary access roads should be established which:

- allow safe transition of vehicles from the public highway, which avoids the need for reversing;
- are subject to a speed limit;
- should be marked with warning signs and notices;
- are constructed to support anticipated loads, e.g. mark soft verges;
- identify specific hazards, e.g. steep inclines;
- provide properly designed and constructed crossings, e.g. at watercourses, underground services;
- avoid or warn against the presence of overhead services, e.g. electricity cables;
- take account of the risks to pedestrians and livestock from site vehicles and segregate pedestrians from vehicles;
- allow sufficient space for long/heavy vehicles to manoeuvre.

Where the site is traversed by public right of ways (bridal paths, roads, walking tracks) provision should be made for the effective management of these crossings during the construction phase. Arrangements to protect members of the public and the workers should be included in the Health & Safety Plan / Construction Phase Plan and managed by the PSCS/PC with the co-operation of all the contractors on the site. These arrangements may include:

- Gates with locking facilities.
- Splayed openings to afford a good view of oncoming traffic.
- Traffic control systems
- Warning signage.
- Convex mirrors.
- Lighting after dark.
- Manned during periods of high traffic volume.

These arrangements should included in the site induction information be briefed to all concerned.

9.14.2 Areas of ‘hard standing’ should be established:

- allowing vehicles to be parked off the public highway;
- which are reinforced and marked, sufficient to withstand the weight of heavy vehicles;
- to support crane outriggers without settlement; and
- for adequate laydown or storage areas.

If the need for reversing vehicles cannot be eliminated, provide and keep clear adequate turning areas, and provide effective systems to control it.

9.14.3 Transport on site should be:

- assessed and selected for suitability, so as to be safe and right for the job, to deal with site conditions, e.g. rough terrain, enforced speed limits;
- subject to proper maintenance, repair and inspection; and
- only driven or operated by suitably trained persons with banksmen and supervisors as required (following risk assessment).

Note: particular consideration should be given to ensuring that visiting drivers understand what they have to do to ensure safe working on the site. This is likely to require vehicle control measures at entrances to the site.

9.14.4 Temporary fences and/or barriers may be required to:

- segregate vehicles from pedestrians;
- restrict or control access to members of the public;
- restrict access to areas containing crops or livestock; and
- indicate rights of way or landowners' boundaries.

9.14.7 Working at height

Part 4 of the SHWW General Application Regulations 2007 as amended (ROI) and The Work at Height Regulations (Northern Ireland) 2005 (NI)) are similar in their requirements relating to work at height. The Regulations require employers to:

- avoid the need to work at height wherever possible;
- ensure the work is properly planned;
- carry out a suitable and sufficient risk assessment;
- ensure the work is appropriately supervised throughout;
- ensure the work is carried out in a safe manner;
- provide suitable and sufficient measures to prevent anyone falling; and where necessary to mitigate the effects of a fall should it occur
- not start work until appropriate emergency and rescue arrangements are in place;
- ensure work is only undertaken when weather conditions do not jeopardise safety;
- ensure no person engages in any activity, including organisation, planning and supervision, in relation to work at height or work equipment for use, unless they are competent to do so, or if being trained, are supervised; and
- ensure all places of work at height and all equipment used are inspected prior to use and on an ongoing basis throughout the work.

Organisations involved with performing work at height during the construction phase should ensure they

develop and implement appropriate procedures and documentation to ensure all effective controls are in place, are being maintained and are compliant to the requirements of the regulations. Further information on specific aspects of working at height are given below.

Selection of work equipment for work at height

The following requirements must be considered when selecting equipment:

- give collective protection measures priority over personal protection measures;
- take account of:
  - the working conditions and the risks to the safety of persons at the place where the work equipment is to be used,
  - the distance and consequences of a potential fall,
  - the duration and frequency of use,
  - the need for easy and timely evacuation and rescue in an emergency,
  - any additional risks posed by the use, installation or removal of that work equipment, or by evacuation and rescue;
- ensure its characteristics and dimensions are appropriate to the nature of the work to be performed and the foreseeable loadings, and allow passage without risk;
- ensure all purchased equipment is supplied with a CE Mark and relevant certification.

Where work platforms are used for access and egress the potential falling distance must be negotiated.

Existing places of work and means of access or egress at height should:

- be stable and of sufficient strength and rigidity for the purpose for which it is intended to be, or is being used;
- where applicable, rest on a stable, sufficiently strong surface;
- be of sufficient dimensions to permit the safe passage of persons and the safe use of any plant or materials required to be used, and to provide a safe working area having regard to the work to be carried out there;
- possess suitable and sufficient means for preventing a fall;
- possess a surface which has no gap:
  - through which a person could fall,
  - through which any material or object could fall and injure a person,
  - giving rise to other risks of injury to any person, unless measures have been taken to protect persons against such risk;
- be so constructed and used, and maintained in such condition, as to prevent, so far as is reasonably practicable:
  - the risk of slipping or tripping,
  - any person being caught between it and any adjacent structure; and
- where it has moving parts, be prevented by appropriate devices from moving inadvertently during work at height.

Fragile surfaces

Ensure that:

- no person passes across or near, or works on, from or near, a fragile surface when not required to do so;
- where this cannot be prevented, suitable and sufficient platforms, coverings, guard rails or similar means of support or protection are provided and used;
- where a risk of falling remains, suitable and sufficient measures to minimise the distances and consequences of a fall are provided, e.g. fall arrest;
- warning notices are fixed at the approach; and
- where this is not practicable, persons are made aware of it by other means.

Falling objects

Employers must:

- take suitable and sufficient steps to prevent the fall of any material or object;
- take suitable and sufficient steps to prevent any person being struck by any falling material or object;
- ensure that no material or object is thrown or tipped from a height; and
- ensure that materials and objects are stored in such a way as to prevent risk from collapse, overturning or unintended movement.

Danger areas

All work areas that present a risk of falling or being struck by a falling object must be fitted with equipment and signage that prevents unauthorised access.

Use of personal fall protection systems

A personal fall protection system shall be used only if:

- a risk assessment has demonstrated that:
  - the work can be performed safely while using that system and
  - the use of other, safer work equipment is not reasonably practicable;
- the user and a sufficient number of available persons have received adequate training specific to the operations envisaged, including rescue procedures.

A personal fall protection system shall:

- be suitable and of sufficient strength for the purposes for which it is being used;
- where necessary, fit the user;
- be correctly fitted;

- be designed to minimise injury to the user and, where necessary, be adjusted to prevent the user falling, or slipping from it, should a fall occur; and
- be so designed, installed and used as to prevent unplanned or uncontrolled movement of the user.

A personal fall protection system designed for use with an anchor shall be securely attached to at least one anchor, and each anchor and the means of attachment shall be suitable and of sufficient strength and stability for the purpose of supporting the load.

A work positioning system shall be used only if:

- the system includes a suitable backup system for preventing or arresting a fall;
- the user is connected to it; and
- where it is not reasonably practicable, all practicable measures are taken to ensure that the work positioning system does not fail.

A rope access or positioning technique shall be used only if:

- it involves a system comprising at least two separately anchored lines, of which one ('the working line') is used as a means of access, egress and support, and the other is the safety line;
- the user is provided with a suitable harness and is connected by it to the working line and the safety line;
- the working line is equipped with safe means of ascent and descent, and has a self-locking system to prevent the user falling should they lose control of their movements; and
- the safety line is equipped with a mobile fall protection system, which is connected to and travels with the user of the system.

Taking the risk assessment into account, and depending in particular on the duration of the job and the ergonomic constraints, provision must be made for a seat with appropriate accessories.

The system may comprise a single rope where:
- a risk assessment has demonstrated that the use of a second line would entail higher risk to persons and
- appropriate measures have been taken to ensure safety.

A fall arrest system shall incorporate a suitable means of absorbing energy and limiting the forces applied to the user's body.

A fall arrest system shall not be used in a manner:
- that involves the risk of a line being cut;
- where its safe use requires a clear zone (allowing for any pendulum effect), that does not afford such a zone;
- that otherwise inhibits its performance or renders its use unsafe.

A work restraint system shall be so designed that, if used correctly, it prevents the user from getting into a position in which a fall can occur.

Use of ladders

- Ladders may only be used when the result of a risk assessment has demonstrated that the use of more suitable work equipment is not justified because of the low risk, because the duration of required use is short, or because of existing features on site which cannot be altered.
- Any surface upon which a ladder rests should be stable, firm, of sufficient strength and of suitable composition to support the ladder safely, so that its rungs or steps remain horizontal with any loading intended to be placed on it.
- A ladder should be positioned to ensure its stability during use.
- A suspended ladder should be attached in a secure manner so it cannot be displaced and swinging is prevented.
- A portable ladder should be prevented from slipping during use by:
  - securing the stiles at or near their upper or lower ends and
  - an effective anti-slip or other effective stability device.
- A ladder used for access should be long enough to protrude sufficiently above the place of landing to which it provides access.
- No interlocking or extension ladder shall be used unless its sections are prevented from moving relative to each other while in use.
- Where a ladder or run of ladders rises a vertical distance of 9 metres or more above its base, there should, where reasonably practicable, be provided at suitable intervals sufficient safe landing areas or rest platforms.
- Every ladder should be used in such a way that:
  - a secure handhold and secure support are always available to the user and
  - the user can maintain a safe handhold when carrying a load.

Inspection – This means visual or more rigorous inspection by a competent person as is appropriate for safety

Inspection of places of work at height
Ensure that the surface and every parapet, permanent rail or other such fall protection measure are checked prior to use.

Inspection of work equipment

Employers must ensure that:

- all installed work equipment is not used unless it has been inspected;
- work equipment exposed to conditions causing deterioration is inspected at suitable intervals and after extreme events;
- no work equipment leaves its site unless it is accompanied by physical evidence that it has been inspected and is within its retest date; and
- the results of an inspection are recorded and kept until the next inspection.

Inspection of working platforms – scaffolding

Employers must ensure that:

- platforms above 2m are not used unless inspected;
- the person carrying out an inspection prepares a and submits it to the person requesting the inspection within 24 hours; and
- reports are kept on site until the construction work is completed.

Inspection reports
Inspection reports must contain the following information:

- the name and address of the person for whom the inspection was carried out;
- the location of the work equipment inspected;
- a description of the work equipment inspected;
- the date and time of the inspection;
- details of any matter identified that could give rise to a risk to the health or safety of any person;
- details of any action taken as a result of any matter found;
- details of any further action considered necessary; and
- the name and position of the person making the report.

In ROI details of inspections must be recorded in the Statutory Form GA3 available with other guidance in the HSA Code of Practice for Access and Working Platforms (HSA, 2009)

Duties of persons at work

Every person must:

- report any activity or defect that is likely to endanger themselves or others;
- use any work equipment or safety device provided to them by their employer; and
- use the work equipment or device in accordance with the training and information provided to them.

9.15 Security

During construction the PSCS / PC must take reasonable measures to ensure that no unauthorised person enters the work area, and this should be documented in the Safety and Health Plan. Only people who are explicitly authorised, either individually or collectively, by the PSCS/PC or designated person should be allowed on site.

The PSCS will need to have measures in place so that only authorised people are allowed into any area where construction work is taking place.

Typical authorised people might include:
- contractors or employees carrying out construction work;
- those who need to enter the work area for purposes connected with the work (e.g. architects, engineers and representatives of the client);
- individuals or organisations who have a statutory right to enter the work area (e.g. Health and Safety Inspectors, Building Control Inspectors and others who have statutory powers to enter the site);
- employee representatives.

Authorised people should have the relevant site rules explained to them and undertake any necessary induction training. Some authorised visitors may need to be supervised while on site or visiting specific areas. How access is controlled depends on the nature of the project, the risks and the location. The boundaries of all sites should be physically defined, where practical, by suitable barriers .The type of barriers should reflect the nature of the site and its surroundings.

Security measures should be sufficient to prevent access by any unlawful visitors without causing them harm.

All security measures should be put into effect prior to construction work starting and should be updated as necessary throughout occupation of the site. The measures should:

- ensure provision to prevent unauthorised access to the site;
- ensure materials are stored without risk to Health and Safety;
- ensure construction plant is secured against unauthorised operation;
- establish procedures for control of visitors;
- establish procedures for visiting workers; and
- ensure provision to monitor the effectiveness of the security arrangements.

In practice it may be very difficult to fully secure a large wind farm site against unauthorised access. While the PSCS/PC must take reasonable measures in this area, each contractor should make arrangements on the site to ensure, based on a suitable risk assessment, that their work area, tools, equipment, plant and machinery are secure and do not pose a risk to un-authorised visitors or children. These procedures may include:

- The control of keys in machinery
- The locking and securing of construction plant.
- The movement of plant to a secure area on the site.
- The control of keys for buildings and structures
- A procedure for ensuring that buildings and structures are locked and secure.
- The prevention of access to heights e.g. scaffolding, ladders, cranes etc.
- The prevention of access to materials and substances.

A public safety risk assessment and site security plan should be included as part of the Health & Safety Plan / Construction Phase Plan by the PSCS/PC.

9.16 Existing services / previous land usage

9.16.1 The Preliminary Safety and Health plan prepared by the PSDP (ROI) or the Pre-construction information provided by the Client to the Principal Contractor under CDM (NI) should identify all existing services on site. Before work starts on site a physical check by the PSCS / Principal Contractor should be performed to confirm the location of all key services and signs of previous land use. This would typically involve:

- contacting all public utilities;
- identifying existing services and marking on drawings or charts;
- obtaining suitable detection equipment, e.g. cable locators;
- land is not contaminated from previous dumping or tipping;*
- checking that no old mine workings exist;*
- checking for previous military use, e.g. unexploded ordnance.*

*Obtain specialist advice if potential for such conditions exists.

9.16.2 Before and during construction the following practices should be observed:

- check for, identify and mark buried services before excavation takes place (see HSA Code of Practice for Avoiding Danger from Underground Services (HSA, 2010) or HSG47)
- identify and place ‘goalposts’ to warn of overhead electricity lines (see HSA approved Code of Practice For Avoiding Danger from Overhead Electricity Lines (ESB, 2008)
- treat all services as live;
- determine whether live services can be temporarily de-energised or diverted;
- expose buried services by appropriate means, e.g. hand digging;
- place ‘goalposts’ to warn of overhead services

9.17 Excavations

Specific requirements in relation to safety of excavations are detailed in Part 5 of the SHWW Construction Regulations 2006 (ROI) and Regulation 31 of CDM 2007 (NI)

9.17.1 Prior to excavations being undertaken ensure:

- a proper assessment is made of local ground conditions;
- that the proposed excavation will not cause any premature collapse of, or damage to, surrounding structures;

- the excavation is located away from traffic routes, or traffic routes are relocated;
- the excavation is prevented from collapsing;
- people, work equipment and materials are prevented from falling into the excavation; and
- no buried services (e.g. gas, electricity, water) exist in the locality.

9.17.2 As excavations are carried out:

- the sides should be supported or ‘battered’ back;
- it should be kept free of water;
- it should not be allowed to deteriorate as a result of bad weather;
- any deterioration should be made good;
- adequate barriers should be kept in place to prevent unauthorised access;
- the condition of the excavation is required to be inspected at the start of a shift, after any event that may have affected the strength of the excavation and after any unintentional fall or material is dislodged; and
- inspections should be recorded as evidence they were performed, and by a competent person.

9.18 Lifting and handling

9.18.1 Before carrying out any manual handling operation, ensure:

- compliance with Part 2, Chapter 4 of the SHWWGA Regulations 2007 Manual Handling of Loads (ROI) or the Manual Handling Operations Regulations (Northern Ireland) 1992 as appropriate.
- a relevant risk assessment has been carried out; and
- persons are trained on and adopt the correct manual lifting techniques and practices;

9.18.2 Where reasonably practicable the elimination of manual handling risks should be considered by means of supply to site of machine-handled loads e.g. pre-fabrication off-site, palletised loads etc. General good practice principles that should be considered include:

- Tasks which are carried out most frequently and that involve stooping, twisting, travelling or climbing with loads should be prioritised for improvement
- Every individual’s capability and competence should be considered before manual handling is undertaken. Training should be provided for all those carrying out manual handling tasks
- Wherever possible loads should be marked with their weight and presented with suitable hand holds
- Wind farms present an environment with challenges such as restricted work spaces, complex travel routes and exposure to the elements.

9.18.2 Before any lifting devices, including cranes, are used on site, ensure:

- appointment of a competent person to be in control of lifting operations;

- valid test certificates exist, including those for slings, lifting chains, shackles and lifting points on structures;
- only competent personnel trained in the use of the lifting equipment and accessories are involved;
- proper risk assessments are made on the lifting operation to be undertaken;
- account is taken of ground conditions and uneven terrain;
- precautions are taken to avoid contact with site services, e.g. overhead electrical cables;
- any restrictions on operations in poor weather conditions are clearly identified;
- all operations involving the use of elevated access platforms or man riding platforms are properly risk assessed, and control measures identified and implemented;
- all lifting operations are properly planned with all staff fully briefed, and lifting devices are of adequate capacity;
- cranes and HIABs are derigged and booms lowered before moving off;

9.19 Electrical Safety

Safe system of work procedures and in some cases permit-to-work procedures will be necessary to control work activities on or near live electrical systems. The Wind Turbine Safety Rules provide instruction to control post-installation and energisation operations.

Special attention should be given to boundary point between the wind farm electrical system and grid electrical system during the construction phase to ensure the safety of workers on both sides of this system boundary point from the risk of electrocution. Ideally this boundary point (e.g. switch, disconnect, cable or busbar) should be identified as early as possible after its construction and it’s operation or final construction controlled using a permit to work system.

Special attention should be given to the first connection and energisation of newly constructed windfarm electrical apparatus. Safe work procedures must ensure that.

- All persons are clear of the apparatus and have been warned that the apparatus is about to be made live.
- The apparatus has been declared, by a competent person, fit to be connected and made live.
- Apparatus that will not be connected to the system and on which further work is to be completed cannot be inadvertently connected and made live

WTG/infrastructure electrical assembly work completed during the construction phase should be performed by an appropriately qualified and competent electrical assembly engineer, and work completed in accordance with the relevant ETCI (ROI), IEE and IEC standards for electrical installation.

The integrity of the electrical infrastructure of all site facilities should be assessed at the time of completion and thereafter at prescribed intervals in accordance with Part 3 of the SHWW General Application Regulations 2007 (ROI) or the Electricity at Work Regulations (Northern Ireland) 1991 as appropriate.

Signage should be installed on all electrical generating equipment, junction boxes, switchgear panels and doors to identify the Health and Safety risks that personnel may be exposed to should they open covers, doors or panels. All covers, doors and panels should be locked, or otherwise prevented from being opened without a mechanical device/tool, to restrict access and prevent exposure to live electrical components and systems.

The configuration and status of installed electrical systems on the site should be recorded and this record should be updated as additions and changes occur. This record may take the form of a electrical schematic diagrams, line diagrams and an associated log sheet. This approach should be applied to the temporary electrical system put in place at the start of the construction phase (e.g. supplies to site accommodation and site lighting) and updated right through the commissioning, energisation and handover of the completed wind farm electrical system.

Portable appliance testing (PAT) should be performed on all electrical equipment used by employees to perform their work, to ensure the equipment is safe to use.

All portable electrical tools should be 110 volt and connected to a double wound, center tapped 110 volt step down (yellow) transformer. All electrical plugs should be properly rated. Electrical tools and their plugs and supply leads of should be inspected before use and removed from service or repaired if defects are found. All 230/400 volt electrical cables supplying 110volt supply transformers must have suitable mechanical protection and have suitable earth fault protection at the point of supply.

Further advice on electrical safety is listed in Appendix 1

9.20 Chemicals and substances

9.20.1 A suitable Chemical Agents Risk Assessment (ROI) or COSHH assessment (NI) should be made, utilising materials safety data sheets (from the supplier) and other sources of information for:

- all chemicals and other substances used on site, e.g. epoxy-based materials, oils, lubricants and fuels;
- processes causing dust and fumes, e.g. welding, grinding, etc.; and
- biological hazards that may be present on site from previous and/or existing animal inhabitants, e.g. Weil's disease (rats), anthrax (cattle), brucellosis (cattle), bovine tuberculosis (cattle), and cystic echinococcosis or hydatid disease (sheep).

9.20.2 Ensure that proper arrangements are made for:

- reviewing the need to use the substance, substitution with a safer alternative, or reduction of quantities used and stored on site;
- correct handling of chemicals/substances including disposal;

- correct storage of chemicals/substances, including bunding/ventilation;
- correct transport arrangements;
- provision of suitable first aid;
- welfare facilities;
- containment, clean-up and reporting of spillages;
- detection and management of vapours and fumes where necessary;
- environmental monitoring; and
- employee health surveillance.

Employers and contractors should be aware of the new REACH regulations that place additional duties on the downstream users of chemicals. REACH (Registration, Evaluation, Authorisation and Restriction of Chemicals) is a European regulation that has direct application in all EU member states. The regulations should lead to an improved level of Health and Safety information being passed down the supply chain. Further details are available via the HSA / HSENI.

The Code of Practice for the Safety, Health and Welfare at Work (Chemical Agents) Regulations 2001 provides guidance for use of chemicals in ROI.

ACOP L5 – Control of Substances Hazardous to Health (Fifth Edition) provides additional advice and guidance to the COSHH (Northern Ireland) Regulations 2003 (Ref Appendix 1).

9.21 Dangerous substances and explosive atmospheres

In ROI Requirements in relation to Explosive Atmospheres at Places of Work are detailed in Part 8 of the SHWW General Application Regulations and guidance is provided on its application by the HSA (Appendix 1) Employers must carry out a risk assessment of any work activities involving flammable substances and record the findings of the risk assessment in a document called the "explosion protection document."

In NI an assessment of the risks posed by substances that are flammable, highly flammable, extremely flammable, oxidising or explosive, and any dusts which when mixed with air may form an explosive mixture (classified as 'Dangerous Substances' under the Dangerous Substances and Explosive Atmospheres (Northern Ireland) Regulations 2003), needs to be performed to assess their potential for the creation of an explosive atmosphere within the workplace.

Sites that use and store Liquid Petroleum Gas (LPG) canisters, fuels or substances that are classified in any of the above categories, are required to carry out an assessment.

The assessment should identify the potential for an explosive atmosphere to occur within the workplace. Areas of significant risk require zonal classification and additional controls to prevent sources of ignition and accidental release of dangerous substances.

The following should be considered to reduce risk:

- reducing the quantity of dangerous substance;
- avoiding or minimising release;
- controlling any release at source;
- preventing the formation of an explosive atmosphere;
- collecting and containing releases;
- avoiding ignition sources;
- avoiding adverse conditions, e.g. high temperature; and
- segregating incompatible substances.

Areas which contain dangerous substances should be categorised into the following zonal classifications:

Zone 0 – an explosive atmosphere is present continuously;
Zone 1 – an explosive atmosphere is present occasionally; and
Zone 2 – an explosive atmosphere is not likely to occur in normal operation, but if it does, persists for a short period only .

All zonal areas are required to be identified with an EX warning sign and additional control measures are dependent on the zonal area classifications.

Further information is provided in Guide to the General Application Regulations Part 8: Explosive Atmospheres at Places of Work (ROI) or HSE ACOP L138 – Dangerous Substances and Explosive Atmospheres (NI) as appropriate (Ref Appendix 1).

9.22 Noise

Chapter 1 of Part 5 of the SHWW General Application Regulations – Control of Noise at Work (ROI) and the Control of Noise at Work Regulations (Northern Ireland) 2006 set limitations on the levels of noise employees may be exposed to whilst at work.

- Action values – the level at which employers must take action to reduce noise
- Exposure limits – the level of which must not be exceeded

Employers who perform work that is liable to expose any employees to noise at or above the action level must carry out a risk assessment. When performing the assessment consideration should be given to:

- the level, type and duration of exposure;
- the effect on employees or groups of employees;
- indirect effects from audible alarm systems;
- information provided by manufacturers;

- the availability of alternative equipment designed to reduce the emission of noise;
- noise levels beyond normal working hours;
- exposure in rest facilities;
- information obtained from health surveillance; and
- availability of hearing protectors.

Risk assessments must be performed by a competent person.

Further information may be found in Guide to the General Application Regulations Part 5 Chapter 2: Control of Noise at Work (ROI) or HSE Guidelines L108 – Controlling Noise at Work as appropriate (Ref Appendix 1).

9.23 Vibration

Chapter 2 of Part 5 of the SHWW General Application Regulations – Control of Vibration at Work (ROI) and the Control of Vibration at Work Regulations (Northern Ireland) 2005 set limitations on the levels of vibration employees may be exposed to whilst at work.

9.23.1 There are two types of physical effect from exposure to vibration at work:

Hand–arm vibration – vibration that is transmitted into the hands and arms during work activity, e.g. from pneumatic drills/hammers, electrical power tools; and

Whole body vibration – mechanical vibration that is transmitted into the body when seated or standing, through the supporting surface during work activity, e.g from ride-on plant or plant equipment, vehicles and helicopters.

9.23.2 The Regulations set limitations on the levels of vibration employees may be exposed to whilst at work.

Daily exposure action limit – the level at which employers must take action to reduce exposure to vibration
Daily exposure limit value – the level which must not be exceeded; if exceeded or likely to be exceeded, employees must be provided with health surveillance

9.23.3 Employers performing work liable to expose any employees to vibration levels at or above the daily exposure action limit must carry out a risk assessment, which should address:

- the magnitude, type and duration of exposure;
- employees whose health is at particular risk from such exposure;
- the condition of equipment and maintenance records;
- information provided by the manufacturers;
- the availability of replacement equipment designed to reduce exposure to vibration;

- any extension of exposure at the workplace to whole body vibration beyond normal working hours;
- specific working conditions, such as low temperatures; and
- previous health surveillance records.

The following should be considered when assessing appropriate prevention and control measures:
- alternative working methods that eliminate or reduce exposure;
- work equipment that produces the least possible vibration;
- the use of auxiliary equipment that reduces the risk of injuries caused by vibration;
- maintenance programmes for work equipment, the workplace and workplace systems;
- the design and layout of workplaces, work stations and rest facilities;
- suitable and sufficient information and training for employees, to ensure the work equipment is used correctly and safely;
- limitation of the duration and magnitude of exposure to vibration;
- appropriate work schedules with adequate rest periods; and
- the provision of clothing to protect employees from cold and damp.

9.23.4 Vibration exposure calculations

THE HSE in the UK has created a ready reckoner table to provide a visual guide to the levels of vibration exposure that are thought to be safe and those that may start to initiate vibration-related injuries. This can be downloaded from the HSE website (www.hse.gov.uk). This table provides those planning work with a guide to exposure times and can indicate from the outset those who may be at risk before work commences, allowing employers to take action at the earliest opportunity. The duration and magnitude of vibration exposure is required to be recorded for each individual daily, and reviewed to ensure personnel have not exceeded the daily exposure limit value.

The HSE has also created a vibration calculator, which can be downloaded from the HSE website (www.hse.gov.uk). The calculator allows employers to work out how much exposure over an 8-hour period employees have actually been exposed to. The calculator is designed to allow for multiple entries of vibration values (durations and magnitudes) from multiple tasks performed throughout the day by an employee. This provides the employer with accurate data of actual exposure and as stated in 9.22.2, if this value is exceeded, employees must be provided with health surveillance.
Additional information may be found in HSA document to the General Application Regulations Part 5 Chapter 2: Control of Vibration at Work (ROI) or HSE documents L140 – Hand–Arm Vibration and L141 – Whole Body Vibration (see Appendix 1).

9.24 Personal protective equipment (PPE)

Employers need to comply with the requirements of Part 2 Chapter 3 – Personal Protective of the SHWW (General Application) Regulations 2007 in ROI and the Personal Protective Equipment Regulations (Northern Ireland) 1993 in NI.

9.24.1 Persons working on site must be provided with appropriate PPE to protect against risks identified within a risk assessment that cannot be controlled by other means.

The PPE must be suitable for the individual and sufficient to provide adequate protection. When selecting appropriate PPE, consideration of the individual's physical size, make up and personal characteristics (such as facial hair), existing health conditions and whether or not the introduction of the PPE will increase risk to the individual's Health and Safety, needs to be given.

Accommodation for the PPE is required to be provided to allow the individual to store it in a clean and protected environment, which prevents contamination and deterioration.

Appropriate information, instruction and training (and, where necessary, supervision) is required to be provided to the individuals supplied with PPE, covering the reasons why the PPE is required to be worn (including risks and potential health effects of exposure) and on the correct use, storage and maintenance of the PPE.

The condition of the PPE should be monitored and it should be replaced when necessary.

9.24.2 When assessing the requirements for PPE to be used within the workplace, consideration should be given to:

- the risk assessment for the work required to be performed and the residual risks which cannot be controlled;
- the remoteness of the site and climatic conditions (both winter and summer);
- the need to work outside, e.g. exposure to ultraviolet light;
- the problems of access, e.g. the need to work at height;
- the need to work on, near or over water;
- the use of hazardous substances

9.25 Occupational health

All organisations should ensure that there is appropriate occupational health support and, where appropriate, there are specific health surveillance programmes. This would typically include policies and procedures that define:

- any requirements for a pre-employment medical;
- any legal requirements for health surveillance, e.g. vibration (HAVS), manual handling, hazardous substances, display screen equipment;
- requirements for health surveillance identified by a risk assessment, e.g. climbing;
- any local minimum standards, e.g. fitness, eyesight, hearing; and
- proper arrangements for managing health records, e.g. confidentiality.

Where a number of employees work together on the same site the owner/operator of that site should ensure the Occupational health arrangements are adequate, co-ordinated and consistent to the Occupational Health risks involved.

9.26 Reporting of accidents/dangerous occurrences and near events

9.26.1 ROI

In the case of an accident involving an employee at work in ROI, the employer is responsible for reporting the accident.

In any other case (if the injured person is self-employed or a member of the public), the person responsible for reporting the accident is the person having control of the place of work at which the accident occurred.

Accidents can be reported to the Health and Safety Authority in two ways; namely

(1) by hard copy, i.e. completing the Incident Report Form (IR1) and posting the completed form to the Workplace Contact Unit, Health and Safety Authority, The Metropolitan Building, James Joyce Street, Dublin 1, or

(2) online, via the Health and Safety Authority's website, www.hsa.ie.

Note: The HSA only accept the pre-printed forms published by the Authority photocopies are not acceptable Copies of the IR1 form are available from the Publications Section of the HSA by Telephoning 1890 289 389 or if calling from outside of the Republic of Ireland +353 1 6147000

Further details on what constitutes a reportable accident or dangerous occurrence is available on the HAS website at http://www.hsa.ie/eng/Topics/Accident_and_Dangerous_Occurrence_Reporting/

9.26.2 Northern Ireland

The Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (Northern Ireland) 1997, place a legal duty on Employers, Self-employed people and People in control of premises to report work-related deaths, major injuries or over-three-day injuries, work related diseases, and dangerous occurrences (near miss accidents).

The NI2508 forms should only be used to report work-related accidents and dangerous occurrences as defined in the RIDDOR regulations.

Please see http://www.hseni.gov.uk/hea71592_riddor_booklet.pdf for advice and guidance on these regulations. If you still need assistance please ring us HSENI on 0800 0320 121.

In accordance with good practice, for all workers:

- details of all 'near events' and incidents should be recorded and investigated;
- appropriate remedial action should be taken following all 'near events' and incidents to prevent any recurrence

9.27 Completion of works

9.27.1 Before leaving site;

- remove all unused materials, waste, plant and equipment;
- restore all temporary workings to a safe condition and to the satisfaction of the landowner; and
- carry out a thorough site inspection.

9.27.2 The Safety File

Both SHWW Construction Regulations (ROI) and CDM (NI) require the compilation of the Safety File for the installation on completion of the works. This is a very important document for the ongoing operation and maintenance of the site, since it includes specific information about the key hazards and risks associated with the installation that must be taken into account in any future works being planned. The Health and Safety File must be updated to reflect any changes to the installation during the project lifetime.

10. Operation and Maintenance

10.1 Introduction

10.1.1 This section highlights the consideration that should be given to Health and Safety in the operation and maintenance of wind farms. The operation and maintenance phase covers all aspects of normal routine operation, planned and breakdown maintenance, inspections and testing. Much of the guidance in Section 9, 'Construction, Commissioning and Demolition', is also relevant to operation and maintenance of wind farms and should also be consulted.

10.1.2 Persons with responsibilities will include the owner of the wind farm, the operator (if different), operation/maintenance crews and contractors. The ultimate responsibility invariably lies with the owner of the wind farm. However, reference should be made to the duties set out in specific legislation, which will deter mine the duty holder responsible for any particular aspect of a wind farm's activity.

10.1.3 A person should be appointed to be in charge of the site and responsible for all operations with a clear mandate for dealing with any eventualities. A site Health and Safety Adviser should also be appointed to support and advise the 'person in charge' on all matters of Health and Safety. It should be made clear to everyone on site who these persons are, along with an explanation of their roles and responsibilities.

10.1.4 Those appointed in respect of 10.1.3 above should take into consideration occurrences of incidents and near events as collated on the "Best Practice and Lessons Learned" area in the Health and Safety section of the IWEA website including any Safety Alerts issued.

10.1.5 Best practice is to provide on site controlled copies of relevant Health and Safety information for the site and the equipment installed, in addition to the controlled copies held by site management personnel.

10.2 Legislative requirements

10.2.1 A table of the various legislative requirements and their applicability to each stage of the project is included in Section 6.

10.2.2 In ROI the Safety Health and Welfare at Work Act 2005 and SHWW (General Application) Application Regulations 2007 require work equipment, plant and plant equipment to be maintained in an efficient state, in efficient working order and in good repair. In addition the SHWW Construction Regulations 2006 will apply to any maintenance works which come under the definition of "construction work". In addition to plant and equipment being maintained in an efficient state, there is also the requirement for a periodic inspection of all work equipment that maybe subject to deterioration. In addition to this, lifting equipment requires a periodic statutory thorough examination, and this must be carried out by a competent person

10.2.3 In NI the Health & Safety at Work (Northern Ireland) Order 1978 and the Provision and Use of Work Equipment Regulations (Northern Ireland) 1999 require all work equipment, plant and plant equipment to

be maintained in an efficient state, in efficient working order and in good repair.

Most maintenance activities fall under the CDM (Northern Ireland) Regulations 2007, however, the extent of compliance with these regulations depends upon whether or not the work to be performed is defined as construction work under the regulations, or the amount of time required to complete the work requires it to be classified as a notifiable project, e.g. 30 days or 500 man days. Further information is provided in Section 6 and in the CDM ACOP L144 but it is worth noting that the definition of construction work (pages 65–66 in the ACOP) includes waste resulting from the demolition or dismantling of a 'structure', and the definition of 'structure' includes masts, towers or parts of them.

10.2.4 A suitable Health and Safety management system should be identified and implemented to ensure that all activities are suitably planned, and all foreseeable risks assessed and mitigated. See Section 5 for further information.

10.2.5 Safe systems of work should be established and implemented regarding all work on all mechanical and electrical parts of the wind farm.

10.3 Operation

10.3.1 Operational instructions

Under the requirements of SHWWCR / CDM (Safety File), the EU Machinery Directive and CE Marking process, and the WTG Certification programme specified in IEC WT01, manufacturers of the wind farm hardware (including electrical infrastructure equipment and WTG) are required to supply to the owners/operators with an operations and maintenance manual. This manual is required to explain how the equipment is to be safely operated, maintained and inspected. The manual should also detail the frequency of maintenance checks and appropriate maintenance activities (including recommendations for component replacements) to be performed to maintain the integrity and the ongoing safety of the device.

Risk assessments for the operational instructions may also be required by the 2009 Machinery Directive (Directive 2006/42/EC, replacing Directive 98/37/EC, with effect from 29 December 2009).

10.3.2 Operational activities

Owners/operators shall commence the operational phase once handover of the hardware is complete. As covered in 10.2.4 and Section 5, a Health and Safety management system should be developed to ensure policies are established and appropriate arrangements are in place for Health and Safety throughout the operational wind farm site. To prevent knowledge gaps and increased Health and Safety risks to operational personnel, the Health and Safety management system should ideally be fully developed and operational before site handover is complete.

Owners/operators should ensure all operational monitoring activities are clearly defined for the operational phase. It is recommended that all routine operations performed during this phase are properly risk assessed and are controlled through standardised procedures, method statements and safe systems of work. Familiarity with standardised procedures and controls should increase operator awareness and reduce the potential for human error and frequency of accidents and incidents.

10.3.3 Condition monitoring

Condition monitoring (although a maintenance activity) is undertaken as part of the operational phase. Depending upon the level of condition monitoring equipment/systems installed, it may offer significant detailed feedback on the performance of components and WTG, and provide advanced warning of developing technical problems, such as component wear-out, whether premature or predicted. This will allow for early intervention, reduce the potential for a more serious failure event occurring and make the service life of the equipment more efficient.

Owners/operators should consider, at the earliest possible stage (design), the level and complexity of the condition monitoring required on their installed WTG and infrastructure. When defining the levels of condition monitoring required the following should be considered:

- any legal requirements relating to the equipment;
- the consequences of potential failure events;
- the criticality of equipment failure, and the need to identify and replace components quickly, e.g. to reduce the risk to public safety, the effects and cost of downtime, and penalty clauses;
- the availability of condition monitoring technology from the manufacturer or other organisations;
- any specific monitoring requirements required as a condition of planning consents;
- any historical data of similar component/equipment failures;
- the additional risks placed on individuals required to access the equipment, e.g. monitoring remotely to prevent the need for personnel to access turbine nacelles or visits to turbines offshore;
- the availability of spare components, e.g increased downtime waiting for replacement components/ equipment;
- the availability, logistics and cost issues relating to obtaining heavy installation equipment on site to install replacement parts, e.g. reactive failures may cause increases in downtime from a lack of available equipment / weather window; and
- data from the “Best Practice & Lessons Learned” area of the IWEA website and previous Safety Alerts.

10.4 Maintenance

10.4.1 Planned Preventive Maintenance Programme

A Planned preventative maintenance programme is required to be developed to ensure regular checks are made on critical components, and the likelihood of possible future component failures is identified (in conjunction with condition monitoring). Issues that need to be considered when developing a PPM

programme include:

- information provided by the manufacturers;
- frequency of maintenance activities;
- when the maintenance is to be performed, e.g. time of year, day/night, during peak or off-peak generation;
- maintenance activities to be performed (see 10.4.2 below);
- tools and equipment to be used, including calibration requirements;
- competent personnel, disciplines required, specialist knowledge, employed personnel or contractors;
- risk assessment and method statements;

Safe systems of work to be used;

- permits-to-work and locking-off, where there is significant risk to Health and Safety;
- records to be made, written scheme of examination, reports;
- information, instruction and training to be provided or obtained, specialist competencies, local site rules and task-specific hazards, and control measures;
- PPE to be worn;
- other safety precautions to be adopted and/or implemented; and
- emergency arrangements.

10.4.2 PPM procedures for maintenance, inspection and testing activities should be established for:

- installed safety devices, e.g. overspeed devices, electrical protection;
- safety features, e.g. attachment points for safety harnesses;
- installed lighting and emergency backup;
- portable electrical appliances;
- electrical earthing and lightning conductors;
- equipment installed with high integrity, e.g. blade fixings;
- lifting equipment (Including statutory inspections as required by Part 2 of the SHWW (General Application) Regulations 2007)
- access plant and equipment;
- mechanical handling equipment;
- cathodic protection and coating systems;
- foundation integrity;

10.4.3 Reactive maintenance (unplanned intervention)

The number of failures that require this will be reduced by planned maintenance, but many circumstances, such as severe weather conditions, can arise, which require workers to carry out tasks beyond their normal work experience and/or which are more than usually hazardous by their nature. Records of all breakdowns should be kept to influence future planned maintenance policy revisions, training and designs.

Arrangements should be considered to manage unknown and changeable situations as a result of breakdowns, major component failure and resultant damage. These should be considered and, where necessary, additional training provided to maintenance personnel in Health and Safety, situation management and management of change (see Section 5.8).

10.4.4 Review of performance and maintenance data

All condition monitoring data and maintenance records should be reviewed at regular and periodic intervals, to identify any repetitive patterns and trends relating to component reliability and breakdown. Both the condition monitoring and PPM programme should be reviewed, and where any patterns and trends of component failure arise, additional monitoring and maintenance activities should be introduced.

10.5 Long-term turbine integrity

It is recommended that owners/operators consider the following when addressing the long-term integrity of their WTG.

At all times adhere to the manufacturers' recommended preventive maintenance instructions, including:

- the frequency of examinations and maintenance activity;
- methods to be used to perform the maintenance;
- component replacement recommendations; and
- any guidance provided to ensure the work is performed safely.

Ensure all manufacturer-recommended modifications are completed within recommended timescales, or as soon as is reasonably practicable. Note: where routine maintenance is not carried out by the original equipment supplier, it is suggested that the turbine manufacturer be contacted for confirmation that all appropriate modifications have been implemented.

Periodically (but not less than every 12 months), contact the turbine manufacturer to share performance information and be appraised of any additional measures that they now recommend, following experience from other turbines of the same model, or similar design or components, installed elsewhere. Carry out these measures to provide assurance of the continuing integrity of the turbine.

Prior to purchasing turbines second hand, seek appropriate competent expertise on the suitability of the turbine(s) for the site. All second hand turbines purchased should be supplied with all historical maintenance records, including as a minimum, details of modifications made and results of thorough examinations performed. Ensure prior to commissioning, an appropriate technical assessment has been carried out and new integrity certifications obtained from a recognised competent body.

If the operational conditions of any turbines have changed significantly during their operational lives, e.g. machines being exposed to increased wind turbulence due to the erection of significantly sized buildings nearby or adjacent tree growth, ensure that appropriate advice is sought on the continued compatibility

of the turbine(s) for their location(s).

For any turbines approaching the end of their design lives and where operational lives are proposed to be extended, ensure that appropriate technical assessments are carried out and new integrity certifications obtained beforehand from a recognised competent body.

10.6 Record-keeping

10.6.1 Ensure that:

- a Health and Safety policy statement is written and available within the workplace (Safety Statement in ROI)
- employers' liability certificates for subcontractors are capable of being displayed/viewed on site;
- the Health and Safety management system is documented;
- all drawings, specifications, and operation and maintenance manuals are made available to relevant personnel;
- all risk assessments, method statements and safe systems of work are made available to relevant personnel;
- the Health and Safety file is made available and updated when necessary, including drawings, following any modification to the wind farm;
- all EC Declaration of Conformity Certificates and WTG Certifications are readily available;
- written schemes of examination are available for relevant pressure systems, lifting equipment and lifting accessories;
- any health records are properly maintained, available for at least forty years and secured to prevent unauthorised access;
- all training records and competency assessments are retained and made readily available; and
- an accident book is available to workers and its location is known.

10.6.2 Establish appropriate records, such as those for:

- maintenance/inspection of PPE, e.g. safety harnesses;
- testing of fire alarms and drills;
- maintenance/inspection of fixed and portable firefighting equipment;
- written risk assessments, e.g. vibration, chemicals, manual handling, foreseeable significant risks;
- training;
- auditing, monitoring, checks or inspections carried out, and actions taken;
- tests on any installed safety features, e.g. overspeed devices, emergency lighting;
- maintenance reports and maintenance logs, e.g. to record when maintenance activities were performed on the WTG, by whom and any actions taken;
- calibration of inspection, measuring and test equipment;
- portable electrical appliance testing; and
- significant events, such as high-voltage switching.

10.7 Competence

10.7.1 Contractors

Competence of contractors and those appointed under the SHWW Construction Regulations (ROI) and CDM (NI) has been covered in Section 9.6 above. It is recommended that owners/operators of wind farms who engage contractors to perform works on their site, utilise the same principles stated under Section 9.6 and refer to guidance provided in HSA publication Guidelines on the Procurement, Design and Management Requirements of the SHWW Construction Regulations 2006 or CDM ACOP L144 as appropriate.

10.7.2 Operation and maintenance personnel

Owners/operators who select and appoint key personnel should adopt the principles set out in Section 9.6.2 above. In addition, they should establish for the site a comprehensive training and competency development programme for all personnel, taking into account:

- the level of competence they already possess;
- the level of competence they require to enable them to complete their work safely and/or unsupervised;
- the type and nature of the work they will undertake;
- industry standards for minimum training requirements,
- legislative requirements, e.g. high-voltage switchgear;
- identification of training and development needs;
- scheduling of training and development activities;
- review frequencies;
- performance review by managers and supervisors; and
- review and appraisal with individuals.

10.8 Risk assessments and method statements

10.8.1 Risk assessments have been covered within Sections 5.7 and 9.7. It is recommended that owners/operators use the principles set out within these sections and the supporting Guidelines in Appendix 1

Operational and routine maintenance operations are unlikely to change significantly throughout the operation and maintenance phase. This allows owners/operators to develop appropriate risks assessments and method statements more efficiently. Wherever possible, these operations and the control measures identified should be standardised so personnel become familiar with common hazards and the precautions required.

Reactive maintenance activities as a result of a breakdown pose significantly greater Health and Safety risks to personnel, e.g exposure to unfamiliar situations as a result of damage created during component failure. In these circumstances consideration should be given to the following:

- the additional hazards posed as a result of component failure, e.g. falling debris, damaged/unstable work platforms, damaged lighting restricting visibility;
- the actions required to make the area safe, de-energised; removal of debris, damaged components, etc.;
- the hazards, and precautions required to make the area safe;
- seeking additional and expert advice from the appointed site Health and Safety Adviser;
- information from the Health and Safety File and Operations and Maintenance manual regarding replacement of components;
- additional emergency arrangements required for both the cleanup and replacement of components;
- the use of a Management of Change process (see Section 5.8) to cope with changing situations and events during the rectification work;
- additional training requirements; and
- incidents and near events as collated in the "Best Practice & Lessons Learned" area of the IWEA , together with all Safety Alerts issued.

10.8.2 Method statements have been covered in Section 9.7. It is recommended that owners/operators use the principles set out within this section to assist with the development of appropriate operation and maintenance method statements.

Method statements covering work on site must be prepared so that:

- high-risk activities can be identified, assessed, controlled and monitored;
- safe systems of work are devised;
- contractors can demonstrate adequate controls and compliance with their legal responsibilities; and
- lessons learned from incidents and near events should be used where appropriate to modify work procedures.

10.8.3 Consideration should be given to conditions associated with remoteness and climate:

- the risk of lightning;
- extremes of temperature, e.g. ice, snow, heat, risk of exposure;
- exposure to ultraviolet radiation;
- working at height;
- access at height;
- lone working;

10.9 Safe systems of work

10.9.1 A safe system of work for operational wind turbines has been developed known as the Wind Turbine Safety Rules (WTSR). The WTSR clearly specify actions and procedures that have to be followed in order that persons working on wind turbines are safeguarded from inherent dangers that exist from the installed electrical and mechanical equipment. These rules have set a common standard for maintaining turbines.

IWEA plans to form a sub group of the IWEA Health and Safety Strategy Group in 2012 to develop and communicate a common understanding and approach on the application of the WTSR for IWEA members on the island of Ireland. It is envisaged that this group will work closely with the Operational Safety Rules (OSR) sub-group in Renewable UK.

For more detailed information please refer to the RenewableUK website (www.renewable-uk.com), where the 'Wind energy' area of the Health and Safety section contains links to the following documents, available for download:

- the Wind Turbine Safety Rules;
- Introduction to WTSR;
- Guidance: How to use the WTSR documentation;
- a model implementation plan (a list of chronological activities to achieve successful implementation);
- a model WTSR training course (a set of slides for use in training staff);
- a model audit programme for WTSR (a guide to areas requiring audit following implementation of the WTSR);
- guidance on the application of the WTSR; and
- WTSR support procedures (example documents for use by individual companies to develop site- or company-specific support procedures).

10.9.2 The WTSR set down the procedures to be followed when undertaking work or testing on plant and low-voltage (LV) apparatus associated with a wind turbine generator (WTG). Any work or testing on the high-voltage (HV) infrastructure that forms part of the wind farm or WTG should only be permitted under a set of approved HV safety rules.

10.9.3 The RenewableUK OSR sub-group in the UK has identified a need to examine how the rules could be developed to encompass the HV equipment that provides the connection to the grid, and which is now becoming increasingly present inside wind turbines. The result of this work is a new set of rules that can be applied to the turbines alone, or to the whole wind farm. The progress and results of a set of new rules, currently under operational trials, are available on the RenewableUK website (www.renewable-uk.com).

10.9.4 In order to establish a safe system of work, consider:

- the need to establish safe working methods and written procedures;
- the need to establish permit-to-work procedures;
- any requirements for isolation, locking-off or tagging;
- cross boundary/interface safety, e.g. with Distribution Network Operators;
- how persons are set to work and supervised;
- access to the workplace, e.g. scaffolds, installed ladders, lighting; and
- monitoring and reviewing of requirements.

10.9.5 Permit-to-work systems should be considered for:
- activities where it is not practical to remove significant hazards; and
- high-risk activities, which may include
  - hot work (the application of heat, including welding, burning or grinding, on plant containing flammable materials),
  - work on or near to live electrical systems,
  - work on systems, components or devices that require locking off to prevent premature energisation,
  - entry into confined spaces and
  - access to dangerous work areas.

Further information may be found in Section 9.8.1 and in HSE Guidance document HSG 250 – Guidance on permit-to-work systems (see Appendix 1).

10.9.6 Special controls, including supervision, may be required in the following situations:

- visitors or contractors attend a site: make sure they understand what they have to do to ensure safe working;
- people are working at height;
- people are working alone;
- equipment can be operated remotely;
- working over water;
- organised shooting on or adjacent to a wind farm;
- public access, e.g. use of footpaths across work areas, etc.;
- where non- or poor-English-speaking workers are employed;

10.9.7 Some general site rules should be established, covering aspects such as:

- coordination of deliveries by various subcontractors;
- segregation of vehicles and pedestrians;
- vehicle movement on site, especially reversing, and the use of banksmen; where possible, the need for reversing should be eliminated;
- limiting the speed vehicles move around the site, ideally by fixed features that mean drivers cannot move too quickly; speed limits are not always appropriate or enforceable;
- the wearing of personal protective equipment, e.g. hard hats, safety footwear, high-visibility clothing, etc.;
- control of access to work areas;
- working in inclement weather;

10.9.8 Appropriate policies and procedures should be devised and implemented with respect to site visits offshore, distinguishing between planned maintenance visits and unplanned intervention visits in the event of a breakdown.

10.10 Communication

Section 9.5.2 identifies methods of communication that should be used within the construction phase of the wind farm. However, the same principles may be adopted for use during the operational phase of the wind farm. It is recommended that owners/operators establish a procedure for communication and ensure that communication is covered in all work instructions, method statements, safe systems of work procedures and permit-to-work systems. Issues that should be considered include:

- frequency and methods of communication to be used between:
  - site personnel and the management team,
  - functions within a wind farm,
  - third parties,
  - the public,
  - shared workplaces, and
  - emergency services;
- aids to assist communication, e.g. notice boards, provision of information;
- accessibility of key staff and management commitment;
- methods of feedback and dealing with requests for information;
- meetings including purpose, frequency, format, distribution of meeting minutes; and
- audit and review of communication performance.

10.11 Emergency arrangements

An Emergency Response Plan (ERP) for dealing with all foreseeable emergency situations on an operational wind farm site will need to be drawn up, with appropriate additions or adjustments for specific or 'one off' operations.

Section 9.9 explains how an ERP should be developed, and these Guidelines, along with those referenced at the end of this section, should be used to develop the ERP for an operational wind farm.

10.12 Information, consultation, training and supervision

10.12.1 Information to be provided to employees

- Relevant sections and requirements of the Health and Safety management system (Safety Statement in ROI)
- The Health and Safety policy
- Company and site Health and Safety induction
- Information on Health and Safety hazards and the control measures required to prevent risks to their Health and Safety
- Site Health and Safety rules and procedures

- Information on work procedures, risk assessment, method statements, and safe systems of work procedures
- Information on fire safety and fire prevention, including risks of and control measures to prevent fire outbreak, evacuation procedures and those responsible for their implementation, and the use of firefighting equipment
- Information on first aid arrangements, names of first-aiders, location of first aid equipment, and procedures for accidents and incidents
- Information on relevant sections of the Emergency Response Plan
- Information on the welfare facilities
- Information on all changes to the workplace and their effects on Health and Safety
- Requirements for health surveillance
- Guidance on who should be trained as a first aider
- Guidance on additional first aid, emergency and occupational health support available
- For further information on first aid see section 9.9

10.12.2 Information to be displayed in the workplace

- Statutory notices and posters, site Health and Safety policy, displayed within the workplace at a location accessible to all
- Appropriate signage to provide warning of workplace hazards, prohibitions, controls, measures such as PPE, evacuation routes and location of safety equipment
- Site maps, including the location of wind turbines and other wind farm equipment, safety equipment and emergency response equipment

10.12.3 Information for contractors

- Relevant safety file and pre-construction information required to be provided under SHWWCR / CDM
- Site safety rules and procedures
- Roles and responsibilities of key site personnel
- Health and Safety information regarding the site and hazards that exist within the workplace that they may be exposed to
- Interfaces between work activities and other contractors
- First aid and welfare facilities available on site
- Emergency Response Plan and arrangements

10.12.4 Information to third parties

- Provide information to landowners, e.g. location of buried cables
- Provide information for members of the public, e.g. designated rights of way
- Ensure statutory warning notices are in place

10.12.5 Consultation

A procedure should be established to ensure proper consultation with employees or their representatives on all matters of Health and Safety within the workplace. The procedure should consider:

- whether or not the company should consult all individuals or ask them to appoint a representative;
- election processes for representatives;
- equipment, facilities and resources to be made available to representatives;
- provision of information in due time to allow employees or their representatives to provide feedback and input to decisions made on Health and Safety;
- provision of information regarding changes within the workplace;
- encouragement to involve employees in the risk assessment process; and
- encouragement to develop an open workplace in which views are respected and opinions shared.

10.12.6 Training

Training and development programmes should be set up for all personnel, with the aim of identifying and providing all necessary training related to their work, and monitoring and developing competence. Training should include:

- site Health and Safety policy
- site Health and Safety induction;
- site rules and procedures;
- site personnel roles and responsibilities, including those of the individual being trained;
- relevant sections of the site's Health and Safety management system (Safety Statement in ROI)
- all technical aspects relating to their work;
- risk assessments, method statements, safe systems of work procedures, permit-to-work procedures, and emergency response arrangements and evacuation procedures relative to the work they shall undertake;
- additional training should be provided for additional roles, such as first aid and assigned responsibilities under the Emergency Response Plan; and
- Training provided should be in a common language to all; assistance should be provided where language barriers exist.

10.12.7 Supervision

Supervision and enforcement of Health and Safety instructions is a necessary requirement to ensure the successful implementation of the Health and Safety policy. Employers should ensure:

- adequate and appropriately experienced personnel are appointed to manage and supervise personnel;
- sufficient numbers are provided taking into account working hours, shifts and offshore restrictions; and
- supervisors are provided with appropriate and ongoing training and development to enable them to lead by example, manage personnel and situations effectively and without risk, ensure consistent

compliance to Health and Safety standards, be able to motivate and inspire others, and actively encourage a positive Health and Safety culture.

10.13 Security

Section 9.14 identifies legal requirements and suggests issues that must be considered when assessing security needs for a wind farm. It is recommended that owners/operators use this Guidance to establish appropriate procedures and measures unique to their site.

10.14 Site services

Due account must be taken of:

- overhead power lines and suitable safety clearances;
- underground services, e.g. gas, electricity, telephone, water;
- the need to inform landowners
- the location and depth of underground services and accuracy of installation drawings;
- the need to provide detection equipment, e.g. cable-location devices;
- the owners of the services;
- electrical hand tools: power supply is to be 110V centre tapped earth, and a favourable risk assessment is to be provided for other voltages; and

10.15 Safety equipment

10.15.1 The requirement for safety equipment should be identified within risk assessments. This may typically include:

- cable detectors;
- high-voltage measuring devices;
- portable earthing devices;
- temporary barriers, screens and notices;
- isolation devices for installed equipment, e.g. locks, chains, mechanical clamps; and

10.15.2 Ensure that when safety equipment is used:

- it is recorded on a register;
- persons are trained and competent in its use;
- it is properly stored, cleaned and maintained;
- it is periodically checked to ensure it remains in good working order and is safe to use; and
- all inspections and examinations are recorded, and records are retained.

10.16 Site safety

10.16.1 The legal requirements and issues to be considered when defining the appropriate measures required for the Health and Safety topics listed below have been covered in various parts of Section 9.

It is recommended that owners and operators use the guidance provided in Section 9 when developing appropriate procedures and arrangements for a wind farm. Additional information unique to the operations and maintenance of a wind farm are listed below.

10.16.2 Weather (see Section 9.11)

A procedure should be established to monitor weather and provide ongoing updates of changing conditions. Consideration should be given to:

- setting weather limitations on operational activities, and instructions should conditions change;
- scheduling of maintenance activities against favourable seasonable climates, e.g. if non-essential, arrange for the work to be completed in summer months; and
- establishing methods of monitoring weather conditions to obtain accurate forecasting to aid in planning work activities and personnel

10.16.3 Temporary facilities (see Section 9.12)

Temporary facilities may be required during:

- remote working on major maintenance activities;
- site refurbishment;
- replacement or refurbishment of existing buildings and infrastructure

10.16.4 Lifting and handling (see Section 9.17)

This includes daily manual handling activities and lifting operations on site, both routine and major lifts.

When establishing the procedures required for manual handling, and to control the use of mechanical lifting equipment and devices, consider the following issues:

- identification and risk assessment of manual handling operations;
- the provision and use of equipment that reduces the need for manual handling;
- the provision of information, instruction and training to increase awareness and improve techniques;
- the need for health surveillance;
- the periodic testing and thorough examination of lifting equipment and accessories;
- risk assessment for lifting operations;
- preparation of safe systems of work and use of competent personnel for lifting operations
- training of personnel, operators and banksmen; and

- retaining records of testing and thorough examination.

10.16.5 Electrical safety (see Section 9.18)

Procedures for the control of electrical safety throughout a wind farm site should be established, and should consider:

- maintenance activities and the use of method statements, safe system of work procedures, permits-to-work, lock-off and precautions to be used, including PPE;
- integrity testing of the electrical infrastructure
- periodic Portable Appliance Testing (PAT) of all hand-held or portable electrical equipment used on site;
- defining competency levels to perform work;
- providing ongoing training and awareness to all staff on site; and
- emergency response to accidents/incidents involving electricity.

10.16.6 Chemical substances (see Section 9.19)

This covers use, storage and transportation of lubricants, oils and fuels, epoxy resin systems, solvents and paints.

Procedures for the control of substances hazardous to health should include:

- development and updating of a hazardous substance register for the site;
- establishing minimum quantities of materials to be stored on site;
- justification for the use and/or introduction of a new substance into the workplace prior to its purchase;
- assessment of risk from hazardous substances;
- need for environmental monitoring;
- transportation of hazardous substances;
- storage arrangements for hazardous substances;
- provision of information, instruction and training; and
- need for health surveillance.

10.16.7 Dangerous substances and explosive atmospheres (see Section 9.20)

If storing dangerous substances, e.g. flammable, highly flammable, extremely flammable materials, on site, such as fuels for generators, a risk assessment is required.

If no flammable substances are stored on site, no action is required.

If required, procedures should consider:

- the carrying out of an appropriate risk assessment by a competent person;
- defining zonal classification requirements and areas to be zoned;

- introduction of explosion protection and devices, to plant, lighting and equipment in the area, and provision of Ex signage;
- emergency response procedures and equipment to deal with accidents and incidents;
- information, instruction and training; and
- monitoring and reporting on the effectiveness of controls.

10.16.8 Noise (see Section 9.21)

Noise may be a concern in areas around generators, compressors and vehicle movement.

Procedures for assessing and, where necessary, controlling noise levels at work should be established, considering:

- identification of all areas of the site where noise levels may exceed daily limits;
- performance of noise assessments in areas of concern, by a competent person;
- identification of areas of risk, areas of safety and actions required to reduce levels;
- provision of information, instruction, training and, if necessary, PPE; and
- provision of health surveillance.

10.16.9 Vibration (see Section 9.22)

This covers the use of hand-held power tools, vehicles and being located on vibrating staging or surfaces. Procedures for controlling vibration at work should include:

- identification of vibrating work equipment;
- performance of a risk assessment on each piece of vibrating equipment;
- establishing control measures;
- maintaining personal exposure records during operation;
- assessment of actual exposure against daily limits;
- provision of information, instruction and training; and
- the need for health surveillance.

10.17 Personal protective equipment (PPE)

Section 9.24 identifies principles to be used for the identification, selection and control of PPE. These principles should be adopted for all PPE requirements during the operational and maintenance phase. Routine operations and activities undertaken on an operational wind farm are unlikely to change significantly, allowing the owners/operators to, wherever possible, standardise the PPE requirements for use on most operations performed on site. Familiarity with the standardisation of PPE requirements will increase awareness and reduce the potential for non-compliance.

10.19 Occupational health (see Section 9.25)

Establish procedures that define:

- any requirements for a pre-employment medical, e.g. fitness to climb;
- any legal requirements for health surveillance; e.g. vibration, chemicals, manual handling, display screen equipment;
- any local minimum standards, e.g. fitness, eyesight, hearing;
- proper arrangements for health records, e.g. confidentiality and security of personal details;

10.20 Reporting of accidents/dangerous occurrences

Section 9.26 identifies the statutory requirements and suggests good practice to be adopted when reporting accidents, incidents and dangerous occurrences. It is recommended that owners/operators establish procedures for reporting accidents, incidents and dangerous occurrences, and investigating their root causes.

These procedures should be developed in line with the ERP and should identify:

- how accidents, incidents and dangerous occurrences are to be reported and who should be notified, including internal personnel, local authorities, Regulatory bodies;
- methods of recording;
- who should carry out the organisation's own investigation, alongside any enforcement authority;
- the process of investigation;
- how the findings are to be reviewed;
- how employees and their representatives are to be notified of the findings; and
- how improvements and preventive measures shall be identified, agreed and implemented.

REFERENCE DOCUMENTS

11. Developing Industry Best Practice and Emerging Risks

11.1 Introduction

It is not possible in the scope of these Guidelines to address every possible Health and Safety risk that may be encountered across the life cycle of a wind energy project. The dynamic nature of the industry is such that development and adoption of best practice is emerging very rapidly. Added to this, the scale and complexity of both planned and possible future projects will present many challenges in terms of Health and Safety risk management.

IWEA, on behalf of the industry on the island of Ireland, will take a lead in identifying, prioritising and communicating the most important issues relevant to the long-term safety and integrity of the industry. In developing a long-term Health and Safety strategy IWEA strongly advise that all duty holders take full account of the current and emerging state of knowledge of the risks and controls appropriate to a given project, technology or task involved. In particular, account should be paid to:

- the development of policies and procedures, including risk management arrangements, that are proportionate to the scale and complexity of the project;
- conducting robust risk assessment that takes account of the environmental constraints (e.g. extreme weather) that may be foreseeable;
- ensuring that product and operational safety checks pay particular attention to legal and safety standards when adopting new technologies;
- the training and competence standards that will be required; and
- developing an open safety culture that encourages the sharing and communication of Health and Safety best practice and lessons learned.

In addition to the direct operational Health and Safety risks across the life phases of a project, consideration should also be given to the:

- indirect and consequential Health and Safety impacts of projects and programmes;
- Health and Safety issues in contracts;
- emerging international dimensions of Health and Safety standards and best practice; and
- developing guidance in Ireland and overseas e.g. HSE via the Emerging Energy Technologies Programme (EET).

11.2 Specialist activities and support services

These Guidelines are intended to be relevant to all organisations contributing to the life cycle of wind farms (from initial feasibility studies through to decommissioning), and particularly relevant to senior and operational management within organisations developing, constructing or operating wind farms, or considering becoming involved in the sector.

These Guidelines therefore do not provide detailed advice on any specialist activities or support services that may be required to be carried out. Where these are provided, then, the basic principles in the selection, appointment and monitoring of those individual(s) will apply. In every situation and/or organisation an individual must have:

- sufficient knowledge of the specific tasks to be undertaken and the risks that the work will entail, and
- sufficient experience and ability to carry out their duties in relation to the project, to recognise their limitations and to take appropriate action in order to prevent harm to those carrying out the work, or those affected by the work.

[Insert information on IWEA H&S Sub-Groups. (Construction, Emergency Response, Transport)]

APPENDIX 1

References

The following publication references have been provided to allow readers who wish to understand more about the application and interpretation of specific areas of Health & Safety legislation, approved codes of practice and guidance to do so.

Guidance from the Health and Safety Authority

Health & Safety Authority (2006) Guide to the Safety, Health and Welfare at Work Act 2005, Dublin, HSA Publications.

Health & Safety Authority (2006) Workplace Safety and Health Management, Dublin, HSA Publications.

Health & Safety Authority (2006) Guidance on Risk Assessments and Safety Statements, Dublin, HSA Publications.

Health & Safety Authority (2006) Safety Representatives and Safety Consultation Guidelines, Dublin, HSA Publications.

Health & Safety Authority (2006) Guidelines on the Procurement, design and management Requirements of the Safety Health and Welfare at Work (Construction) Regulations 2006, Dublin, HSA Publications.

Health & Safety Authority (2007) Guidance for Directors and Senior Managers on their Responsibilities for Workplace Safety and Health, Dublin, HSA Publications

Health & Safety Authority (2007) 2007 Code of Practice for the Safety, Health and Welfare at Work (Chemical Agents) Regulations 2001, Dublin, HSA Publications

[Additional references pending]

Guidance from HSENI

Note: An updated list of Health and Safety legislation and guidance applicable to Northern Ireland is available o the HSENI website at http://www.hseni.gov.uk/resources/legislation.htm under the following headings:

- List of GB ACOPs approved for use in Northern Ireland
- List of guidance on regulations
- List of Northern Ireland ACOPs
- List of Primary Legislation
- List of subordinate health and safety legislation

Safe Work in Confined Spaces in Northern Ireland - Approved Code of Practice {Confined Spaces Regulations (Northern Ireland) 1999}

Workplace Health Safety and Welfare - Approved Code of Practice {Workplace, Health and Welfare Regulations (Northern Ireland) 1993}

First Aid at Work - Approved Code of Practice {Health and Safety (First Aid) Regulations (Northern Ireland)} 1982

Guidance from HSE UK

All publications are available from HSE Books, The Stationary Office (TSO) or most large book stores.

HSE Books catalogue – free from HSE Books

HSG65 – Successful Health and Safety Management – ISBN 978 0 7176 1276 5

L21 – Management of Health and Safety at Work – Management of Health and Safety at Work Regulations 1999 Approved Code of Practice and Guidance – ISBN 978 0 7176 2488 1

INDG275 – Managing Health and Safety – Five Steps to Success (HSE free leaflet) - ISBN 978 0 7176 2170 5

HSG48 – Reducing Error and Influencing Behaviour – ISBN 978 0 7176 2452 2

HSC13 (rev 1) – Health and Safety Regulation – A Short Guide (HSE free leaflet)

INDG417 – Leading Health and Safety at Work (HSE free leaflet) – ISBN 978 0 7176 6267 8

INDG420 – Getting Specialist Help With Health and Safety (HSE free leaflet) – ISBN 978 0 7176 6274 6

INDG163 – Five Steps to Risk Assessment (HSE free leaflet) – ISBN 978 0 7175 6189 3

Essentials of Health and Safety at Work – ISBN 978 0 7176 6179 4

L144 – Managing Health and Safety in Construction – Construction (Design and Management) Regulations 2007 Approved Code of Practice and Guidance – ISBN 978 0 7176 6223 4

HSG159 – Managing Contractors – A Guide for Employers – ISBN 978 0 7176 1196 6

HSG136 – Workplace Transport Safety – ISBN 978 0 7176 6154 1

HSG144 – The Safe Use of Vehicles on Construction Sites – ISBN 978 0 7176 6291 3

HSG151 – Protecting the Public – ISBN 978 0 7176 6294 4

L146 - Consulting workers on health and safety. Safety Representatives and Safety Committees Regulations 1977 (as amended) and Health and Safety (Consultation with Employees) Regulations 1996 (as amended). – ISBN 978 0 7176 6311 8

HSG263 – Involving Your Workforce in Health and Safety – ISBN 978 0 7176 6227 2

HSG256 – Managing Shift Work – ISBN 978 0 7176 6197 8

HSG222 – Effective Health and Safety Training – ISBN 978 0 7176 2109 5

L24 – Workplace (Health, Safety and Welfare) Regulations 1992 Approved Code of Practice and Guidance – ISBN 978 0 7176 0413 5

L138 – Dangerous Substances and Explosive Atmospheres – Dangerous Substances and Explosives Atmospheres Regulations Approved Code of Practice – ISBN 978 0 7176 2203 0

L64 – Safety Signs and Signals – The Health and Safety (Safety Signs and Signals) Regulations 1996 – Guidance on Regulations – ISBN 978 0 7176 6359 0

HSR25 – Memorandum of Guidance on the Electricity at Work Regulations 1989 – ISBN 978 0 7176 6228 9

HSG85 – Electricity at Work – Safe Working Practices – ISBN 978 0 7176 2164 4

BS7671:2008– Requirements for Electrical Installations. IEE Wiring Regulations. Institution of Electrical Engineers 17th Edition – ISBN 978 0 8634 1844 0

GS6– Avoidance of Danger from Overhead Electrical Power Lines – ISBN 978 0 7176 1348 9

HSG107 – Maintaining Portable and Transportable Electrical Equipment – ISBN 978 0 7176 2805 6

HSG230 – Keeping Electrical Switchgear Safe – ISBN 978 0 7176 2359 4

HSG253 – The Safe Isolation of Plant and Equipment – ISBN 978 0 7176 6171 8

L22 –Safe Use of Work Equipment – Provision and Use of Work Equipment Regulations 1998 Approved Code of Practice and Guidance – ISBN 978 0 7176 6295 1

INDG291 – Simple Guide to the Provision and Use of Work Equipment Regulations 1998 (HSE free leaflet) – ISBN 978 0 7176 2429 4

L113 – Safe Use of Lifting Equipment – Lifting Operations and Lifting Equipment Regulations 1998 Approved Code of Practice and Guidance – ISBN 978 0 7176 1628 2

INDG290 – Simple Guide to the Lifting Operations and Lifting Equipment Regulations 1998 (HSE free leaflet)

L122 – Safety of Pressure Systems – Pressure Systems Safety Regulations 2000 Approved Code of Practice – ISBN 978 0 7176 1767 8

L26 – Work with Display Screen Equipment. Health and Safety (Display Screen Equipment) Regulations 1992 As Amended – Guidance on the Regulations – ISBN 978 0 7176 2582 6

REFERENCE DOCUMENTS

HSG150 – Health & Safety in Construction – ISBN 978 0 7176 6182 4

L101 – Safe Work in Confined Spaces – Approved Code of Practice and Guidance on the Confined Space Regulations 1997 – ISBN 978 0 7176 5233 3

INDG258 – Safe Work in Confined Spaces (HSE free leaflet) - ISBN 978 0 7176 1442 4

L5 – Control of Substances Hazardous to Health (Fifth Edition) – The Control of Substances Hazardous to Health Regulations 2002 As Amended 2005 Approved Code of Practice and Guidance – ISBN 978 0 7176 2981 7

L108 – Controlling Noise at Work – The Control of Noise at Work Regulations 2005 – Guidance on Regulations – ISBN 978 0 7176 6164 0

L140 – Hand–Arm Vibration – The Control of Vibration at Work Regulations 2005 – Guidance on Regulations – ISBN 978 0 7176 6125 1

L141 – Whole Body Vibration – The Control of Vibration at Work Regulations 2005 – Guidance on Regulations – ISBN 978 0 7176 6126 8

L23 – Manual Handling – Manual Handling Operations Regulations 1992 –Guidance on Regulations – ISBN 978 0 7176 2823 0

L25 – Personal Protective Equipment at Work (Second Edition) – Guidance on Personal Protective Equipment at Work Regulations 1992 As Amended – ISBN 978 0 7176 6139 8

L102 – The Construction (Head Protection) Regulations 1989 – Guidance on Regulations – ISBN 978 0 7176 1478 3

HSG250 – Guidance on Permit-to-Work Systems – ISBN 978 0 7176 2943 5

HSG61 – Health Surveillance at Work – ISBN 978 0 7176 1705 0

HSG137 – Health Risk Management – ISBN 978 0 7176 0905 5

INDG355 Reduce Risks, Cut Costs - ISBN

L74 – First Aid at Work: Health and Safety (First Aid) Regulations 1981 Approved Code of Practice and Guidance –ISBN 978 0 7176 6260 9

L73 – Guide to the Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995 – ISBN 978 0 7176 6290 6

HSG245 – Investigating Accidents and Incidents – ISBN 978 0 7176 2827 8

HSE33 (rev 1) – RIDDOR Offshore (HSE free leaflet)

APPENDIX 2

Useful Contacts

IWEA
Sycamore House, Millennium Park, Osberstown, Naas, Co. Kildare

Health and Safety Authority
The Metropolitan Building, James Joyce Street, Dublin 1

Health and Safety Executive of Northern Ireland
33 Ladas Drive, Belfast BT6 9FR, Northern Ireland

Emergency Services within the Republic of Ireland
[To be confirmed]

Emergency Services within Northern Ireland
[To be confirmed]

Institute of Occupational Safety and Health (IOSH)
The Grange, Highfield Drive, Wigston, Leicestershire LE18 1NN
Tel: 0116 257 3100
Fax: 0116 257 3101
online: www.iosh.co.uk

IOSH practitioners can be contacted via the IOSH Register of Consultancy Services.

Association for Project Safety (APS)
Stanhope House, 12 Stanhope Place, Edinburgh EH12 5HH
Tel: 08456 121 290
Fax: 08456 121 291
online: www.associationforprojectsafety.co.uk

British Standards Institute (BSI)
389 Chiswick High Road, London W4 4AL
Tel: +44 (0)20 8996 9001
Fax: +44 (0)20 8996 7001
online: www.bsi-global.com

RenewableUK
Greencoat House, Francis Street, London SW1P 1DH
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